Market Orientation and Performance of Agro-Food Value Chains in Developing and Emerging Markets

The Case of Maize, Teff, and Beans Seed Supply Chains in Ethiopia



Shimelis Altaye Bogale

Propositions

1. Supply chains can deliver superior customer satisfaction by understanding customer satisfaction criteria of market offerings.
   (this thesis)

2. In value chains, lean on the strong links and work on the weak links.
   (this thesis)

3. Corporate social responsibility (CSR) is an overlooked perspective in corporate or company's policies.

4. Privatized farmland ownership is the shortest way to realize higher agricultural production and productivity.

5. In D&E markets food security is better served by local organic seeds than by GMO seeds.

6. Fake news on social media is the biggest enemy to a country's politics.

7. Corruption rather than lack of resources is the key hindrance for economic progress of developing countries

Propositions belonging to the thesis, entitled

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Shimelis Altaye Bogale

Thesis committee

Promotor

Prof. Dr J.C.M. van Trijp
Professor of Marketing and Consumer Behaviour
Wageningen University & Research

Co-promotor

Dr F.J.H.M. Verhees
Assistant professor, Marketing and Consumer Behaviour Group
Wageningen University & Research

Other members

Prof. Dr J.H. Trienekens, Wageningen University & Research
Dr CJM (Conny) Almekinders, Wageningen University & Research
Dr Melea Press**,** University of Glasgow, United Kingdom
Prof. Dr Belay Kassa, Pan African University, Addis Ababa, Ethiopia

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CHAPTER 1

General Introduction

1.1 Background and problem statement

“No poverty” and “zero hunger” are the first and second sustainable Millennium Development Goals (MDGs) of the United Nations (Sachs, 2012). Achieving these goals requires access – physical, social, and economic –to sufficient, safe and nutritious food for all people (FAO, 2009). However, food production systems face a three-fold challenge. First, the world population of 5.9 billion in 1997/98 will grow to 8.3 billion in 2030 and 9.3 billion in 2050 (Bruinsma, 2017; FAO, 2017b). Moreover, the population is getting more affluent, which increases the demand for food (Godfray et al., 2010). Second, food production systems need to reduce their impact on the environment to reduce global warming, pollution and environmental degradation (Godfray et al., 2010). Moreover, food production is competing for natural resources with other human needs for land, water, and energy. Third, the effects of climate change are a threat to food production systems. To respond to these challenges, food production systems need to increase agricultural output by 70 percent between 2006 and 2050 (FAO, 2009), reduce their impact on the environment, and become resilient, reliable and robust (3R) (Vlajic, Van der Vorst, & Haijema, 2012). Food production systems should produce more food, more efficient and equitable (Godfray et al., 2010). It requires changes in the way food is produced, stored, processed, distributed and accessed (Von Braun, 2007).

Despite globalization, food security in most of the developing world depends upon local food production (Funk & Brown, 2009). Most rural households in developing nations are involved in agriculture and most food is produced and consumed locally (Lamb, 2000). Thus, local agricultural production is critical to both food security and economic development among the rural poor, and increasing its productivity remains a central food security issue (Devereux, 2001; Schmidhuber & Tubiello, 2007).

1.1.1 Agriculture development in Africa

Zero hunger is the second of 17 Sustainable Development Goals adopted by the United Nations as part of its 2030 Agenda for Sustainable Development (Nations, 2015) but achieving this while reducing negative environmental impacts is one of the greatest challenges facing humanity.

Food security is about access to safe, nutritious and sufficient food all year round (FAO, 2009). While food insecurity—measured as not having access to at least 2,100 calories per day—has declined across all regions of the world, challenges remain. Food insecurity is still prevalent in parts of Sub-Saharan Africa, Asia, and Latin America and the Caribbean. The number of people considered food insecure (these regions) in 2020 is estimated at 761 million. Of those, about 50 percent live in Sub-Saharan African (SSA) countries, and 44 percent live in Asian countries (Baquedano, Christensen, Ajewole, & Beckman, 2020).

Global food security has improved over the past 15 years, because of two key drivers: increased agricultural production and trade (Baquedano et al., 2020). In countries where climate or lack of land or water resources limit the potential for local production, food imports have played an important complementary role. Since 1990, among the SSA, Asia, and Latin America and the Caribbean regions, production and imports of cereal grains and their equivalent has increased by 16 and 115 percent, respectively. Despite past success, challenges remain. Maintaining agricultural productivity growth as the global population rises will require investments to generate and deliver new technologies as well as efforts to broadly spread their adoption in food insecure countries (Baquedano et al., 2020).

The current food system (production, transport, processing, packaging, storage, retail, consumption, loss, and waste) feeds the great majority of world population and supports the livelihoods of over 1 billion people (Mbow et al., 2019). Since 1961, food supply per capita has increased more than 30%, accompanied by greater use of nitrogen fertilizers (increase of about 800%) and water resources for irrigation (increase of more than 100%). However, an estimated 821 million people are currently undernourished. The food system is under pressure from both climate change, and non-climate stressors such as population and income growth, and demand for animal-sourced products. These climate and non-climate stressors are impacting the four pillars of food security (availability, access, utilization, and stability). The current food system also threatens the health of people and the planet: agriculture accounts for 70 percent of water use and generates unsustainable levels of pollution and waste (WB, 2020). One-third of food produced globally is either lost or wasted (WB, 2020). Addressing food loss and waste is critical to improving food and nutrition security, as well as helping to meet climate goals and reduce stress on the environment. Risks associated with poor diets are also the leading cause of death worldwide (Mbow et al., 2019; WB, 2020).

Poverty and hunger, the biggest development challenges, remain concentrated throughout the less developed parts of the world. These parts of the world are often facing problems of food insecurity and undernutrition (Gassner et al., 2019; HLPE, 2017), despite the conclusion that

‘All developing countries except Sub-Saharan Africa (SSA) reached the Millennium Development Goal of halving poverty between 1990 and 2015’ (UN, 2010).

According to the World Bank, poverty is defined as a multidimensional concept encompassing low income and consumption, low educational achievement, poor health and nutritional outcomes, lack of access to basic services, and a hazardous living environment. It uses a poverty line of US$1.90 per day as an indicator of extreme poverty (WB, 2017).

Unlike most of the rest of the world, the total number of extremely poor people in SSA is increasing, from 278 million in 1990 to 413 million in 2015 (WB, 2017). In 2015, SSA was home to 27 of the world’s 28 poorest countries and had more extremely poor people than in the rest of the world combined. While the average poverty rate for other regions was below 13% as of 2015, it stood at about 41% in SSA (WB, 2017). Almost one in four people in SSA were estimated to be undernourished in 2017, representing about one-third of the 821 million people suffering from chronic hunger globally (FAO, IFAD, UNICEF, WFP, & WHO, 2018).

Sub-Saharan Africa region accounts for more than 950 million people, approximately 13% of the global population. By 2050, this share is projected to increase to almost 22% or 2.1 billion (OECD, 2016). Smallholder farms constitute approximately 80% of all farms in SSA (Gassner et al., 2019). In many of the countries, women comprise at least half of the labor force (FAO, 2015). However, food insecurity is increasingly concentrated in SSA. SSA remains the world’s most food-insecure region, with almost one-fourth of people – over 230 million – being undernourished (FAO, IFAD, & UNICEF, 2019). Among all the regions of the world, SSA is the only region that recorded a 10% (17.4–27.8%) increase in the number of hungry people between the periods of 1990–1992 and 2014–2016.

Globally, progress in fighting hunger has been steady with the prevalence of undernourishment falling from 14.7 to 10.6 percent between 2000 and 2015, while the number of undernourished declined from 900 million to 777 million over the same time (FAO, 2017a). A lot of factors accounting for the low level of food security in SSA, though vast regional differences remain: high population growth rates, low productivity of agricultural resources, political instability and civil strife (FAO et al., 2019; OECD, 2016). The success achieved (food security) in countries with stable political conditions, economic growth and expanding agricultural sectors suggests that appropriate governance systems, institutional capacities, and macroeconomic, structural and sectoral policies can work together to improve food security on a long-lasting and sustainable basis (FAO et al., 2019; OECD, 2016).

Agricultural development is one of the most powerful tools to end extreme poverty, boost shared prosperity and feed a projected 9.7 billion people by 2050 (WB, 2020). Growth in the agriculture sector is two to four times more effective in raising incomes among the poorest compared to other sectors. In 2016, 65 percent of poor working adults made a living through agriculture. Hence, agriculture can help reduce poverty, raise incomes, and improve food security for 80% of the world's poor, who live in rural areas and work mainly in farming (WB, 2020). Agriculture is also crucial to economic growth: in 2018, it accounted for 4 percent of global gross domestic product (GDP) and in some developing countries, it can account for more than 25% of GDP. But agriculture-driven growth, poverty reduction, and food security are at risk: Climate change could cut crop yields, especially in the world's most food-insecure regions. Agriculture, forestry, and land use change are responsible for about 25 percent of greenhouse gas emissions. Mitigation in the agriculture sector is part of the solution to climate change (WB, 2020).

Agriculture contributes around 25% of GDP in Africa (FAO, 2008; Tralac, 2017) and provides jobs for 70% of the labor force (FAO, 2008), as well as a livelihood for more than 65% of the population, most of whom are poor (AGRA, 2018; FAO, 2008). The sector accounts for 61% of employment, represents 9.16% of total exports, and 13.4% of total imports (Tralac, 2017). Agriculture remains the mainstay in most Sub-Saharan African economies, contributing 70% of employment, 33% of GDP, and 40% of export earnings (WB, 2014). However, African agriculture and/or African food production systems face huge challenges. First, the population of Africa is projected to grow from about 796 million in 2005 to 1.8 billion by 2050 (Nations, 2004). The countries with the fastest-growing populations will be mainly in sub-Saharan Africa (Nations, 2004). Despite urban migration, the number of rural dwellers will also continue to grow. Second, on the one hand the area under cultivation in Africa increased by more than 10% annually, between 1990 and 2006. On the other hand, Africa is critically threatened by land degradation (Garrity et al., 2010). Both put pressure on the natural environment. Third, the risks that come with climate change make agricultural development more daunting (Garrity et al., 2010). The high contribution of the agricultural sector to GDP also underlines the limited diversification of most African economies. On average, agriculture contributes 25% of total GDP (FAO, 2008; Tralac, 2017), however it ranges from below 3% in Botswana and South Africa to more than 50% in Chad (OECD, 2016), implying the need of a diverse range of economic structures in other sectors such as in industry, manufacturing and service. Further, both land productivity (output per unit of land—yields) and labor productivity (output per agricultural worker) remain low relative to other parts of the world (AGRA, 2018).

Despite a robust investment-to-GDP ratio of about 25%, GDP growth in Africa remains well below what is needed to reach many Sustainable Development Goals (SDGs) targets and keep pace with rapid population growth (Nations, 2019). Per capita income growth for the continent has modestly improved from the contraction in 2016; however, at only 0.6% in 2018 and 0.9% projected in 2019, it remains insufficient to significantly improve living standards of large segments of the population. Overall, Africa needs to at least double the current growth rate to make significant progress towards achieving the SDGs (Nations, 2019).

Agriculture is key to Africa's future. Yet, Africa is still producing too little food. Productivity has been broadly stagnant since the 1980s (AGRA, 2018; Gassner et al., 2019). Yields in Africa are among the lowest in the world. In the 1960s, the average cereal yield in Africa was only 57% of that of the world; by the 1980s and 1990s, the gap had widened with Africa achieving cereal yields of only 47% when compared to the rest of the world. It remains today at the 1990s level (Dzanku, Jirström, & Marstorp, 2015). Although the yields are increasing, it remains too far behind as compared to other parts of the world. Value addition through processing remains insignificant in many parts of the continent, though gradually increasing (AGRA, 2018). When compared to other regions of the world, the value of agricultural imports into Africa is significantly higher than that of exports from it (AGRA, 2018).

All regions of Africa have seen net agricultural production growth, with the largest increases in North and West Africa and the least in Middle and Southern regions (Pretty, Toulmin, & Williams, 2011). However, this is largely driven by the expansion of cultivated land rather than productivity gains (FAO, 2008; Van Ittersum et al., 2016).

Africa's agricultural productivity is very low, averaging 300-500 kg/ha, as compared with 2.5 tons/ha in the United States. The low yields are largely a result of poverty (UNDP, 2010). The average yields of grain crops in SSA have stayed below 1 ton/ha since the 1960s, compared with average cereal yields of 2.5 t/ha in South Asia and 4.5 t/ ha in East Asia (FAO, 2008; UNDP, 2010). Moreover, cereal yields in Africa are lower than half the world average. Thus, despite the improvements made in African agriculture, continued population growth means that the per capita availability of domestically grown food has not changed at the continent scale for 50 years and has fallen substantially in three regions. As a result, hunger and poverty remain widespread (FAO, 2009; Van Ittersum et al., 2016). Although global food demand is expected to increase 60% by 2050 compared with 2005/2007, the rise will be much greater in SSA. Indeed, SSA is the region at greatest food security risk because by 2050 its population will increase 2.5-fold and demand for cereals approximately triple, whereas current levels of cereal consumption already depend on substantial imports (Van Ittersum et al., 2016). For national and global food supply, it is of critical importance to significantly raise overall food production. Managing SSA's emerging food security crisis requires a 335% increase in cereal production over the next 40 years to meet the projected population and per capita food demand (Dzanku et al., 2015). These daunting numbers include both rural and urban consumers. To make the matter worse Africa may not be able to manage the existing food production system. That is, much of Africa's food is wasted. It is estimated that African farmers lose 15-25 percent of their crop in the fields and another 15-20 percent after harvest to rats, birds, locusts, and other pests. Again, this is a problem of poverty, because African farmers lack the means and skills to protect food through proper storage and rapid processing or transport of perishable produce (UNDP, 2010).

Land holdings have consistently shrunk in size due to rapid population growth rates. Eighty percent of the continent's farms now occupy less than 2 hectares. The dominance of smallholder agriculture means that short- and medium-term agricultural growth and poverty reduction prospects will be closely linked with the successful transformation of this sector (AGRA, 2018; FAO, 2008; Gassner et al., 2019). Most farmers in Africa typically grow the same food crops, year after year, on the same plot of land. This is mainly because of lack of adoption of existing (new) varieties on the one hand and the limited capacity of the research system in developing and making available to farmers varieties of improved seeds on the other hand (Gisselquist, Pray, Nagarajan, & Spielman, 2013). Moreover, most farmers grow food crops without adequate fertilization or soil replenishment measures. Fertilizer use by smallholder farmers has remained at the very low levels of about 8–10 kg of nutrients per hectare. Africa accounts for less than 1% of global fertilizer consumption (Jones & Thornton, 2003). The average fertilizer (N + P2O5) use is 16.24 kg/ha (FAOSTAT, 2010) which is 1/6th compared to the world use of 98.20 kg/ha. Overall, the entire African continent (including

North African countries and South Africa) accounts for only 2 to 3% of world fertilizer use; the share for SSA is generally less than 1%.

For economic development to succeed in Africa in the next 50 years, African agriculture will have to change so much. Production will have to increase massively, including labor productivity (AGRA, 2018; Bruinsma, 2017; FAO, 2017b; Gassner et al., 2019). Agricultural growth in Africa also requires a vast reduction in the proportion of the population engaged in agriculture and a large move out of rural areas (AGRA, 2018; Collier & Dercon, 2014; Gassner et al., 2019). Agricultural growth can reduce poverty and improve food consumption (Bruinsma, 2017; FAO, 2017b). It has been estimated that every 10 per cent increase in yields in Africa leads to a 7 per cent reduction in poverty (more than the 5 per cent in Asia) (Bruinsma, 2017; FAO, 2017b). Studies have shown that a one percent increase in agricultural yields can reduce the number of people living in poverty by 0.83 percent, and a one percent increase in per capita agricultural output can increase the incomes of the bottom quintile of the population by 1.61 percent (Development, 2005).

Farmers can increase food outputs by increasing yields per hectare, for example, by using new and improved varieties and making changes to agronomic and agro ecological management. Farmers can also increase food outputs by diversification of farms resulting in a range of new crops, livestock or fish that add to the existing staples or vegetables already being cultivated (Pretty et al., 2011).

Achieving Sustainable Development Goal 2: Zero Hunger requires enabling farmers to produce more food, particularly in regions of the world’s that lack food security (FAO et al., 2018). The majority of the food in SSA is produced by smallholder farmers (Herrero et al., 2017) while they are the most vulnerable to food insecurity and poverty (Sibhatu & Qaim, 2017). Hence, smallholder farmers are a crucial entry point for agricultural orientated interventions to improve food and nutrition security. Fulfilling the diverse needs and demands of smallholder farmers requires a market-based approach, but a challenge of this magnitude clearly cannot be solved by the private sector alone (FAO et al., 2018). Governments play a critical role in creating the right conditions for markets to flourish. Other actors, such as NGOs and farmer organizations must join forces with agricultural input companies to accelerate smallholder farmers’ capacity to gain knowledge and adopt new technologies that will enhance productivity. Further, governments need to put in place reforms necessary to unlock the agriculture’s potential of their country. These include access to land, new technologies, extension services, market access, access to finance, and private sector investment facilitation (AGRA, 2018).

Quality seeds

High-quality improved seed is essential to achieving higher yields. In addition, improved seed varieties can deliver better nutrition as well as offer greater resilience to the impacts of climate change. These contributions of seed demonstrate the critical importance of improved seed to achieve food security (McGuire, 2005).

The potential contribution of seed requires the development of strong seed systems capable of delivering new high-performing varieties to farmers - Not just once but a regular flow of new varieties, year after year. To match the yields found in other developing regions, farmers in Africa will need to adopt new varieties on 10-20 percent of the planted area each year, to match with an average of three to six new varieties released per crop per year found in other developing regions (Gisselquist et al., 2013). Across SSA, countries currently average less than one new variety released per year across all food crops (Gisselquist et al., 2013).

While policies operating at the macro scale, such as market regulation, seed policies, urban demand, and labor supply are important, it is also important to look at the micro level. Farmers' decisions determine the impact of improved seeds in farmers' fields (Barnett, Chisvo, & Pinto, 2011). The behavior of farmers should be the starting point for sustainable models of seed production and distribution. Smallholder farmers need science-based solutions to increase the efficiency of their crop production systems, solutions that build on the best of local knowledge and practice, and that are accessible and affordable (Garrity et al., 2010). Pretty et al. (2011) offer suggestions to support smallholder farmers across Africa: (i) combining scientific knowledge with indigenous farmers' knowledge while developing technologies and practices that combine crops–animals with agro ecological and agronomic management; (ii) creation of a novel social infrastructure that builds trust among individuals and agencies; (iii) improvement of farmer knowledge and capacity through the use of farmer field schools and modern information and communication technologies; (iv) engagement with the private sector for supply of goods and services; (v) a focus on women's educational, microfinance and agricultural technology needs; (vi) ensuring the availability of microfinance and rural banking; and (vii) ensuring public sector support for agriculture.

Seed is a major investment for smallholder farmers. Farmers will choose seed from suppliers that offer them the best (perceived) value. Thus, it is worthy to look at the executions of value chain function within and across the different seed supply systems and different actors (breeders, seed companies, agro-input traders, etc.). This may reveal opportunities to increase the effectiveness and efficiency of seed systems in creating and delivering superior value to farmer-customers and thus improve the use of improved seed by farmers.

Agricultural growth should be supported by policies that develop and diffuse affordable productivity-raising innovations such as improved seeds. Moreover, the distribution of ownership of land and other productive assets of agriculture should not be too unequal so that benefits from higher agricultural production are widely spread and do not accrue predominantly to large landowners (Bruinsma, 2017; FAO, 2017b).

1.1.2 Agriculture in Ethiopia

With a population of 94 million (2013) growing at annual rate of 2.5% in 2014, Ethiopia is the second-most populous country in Africa (Moller, 2015). According to the UN data[1], Ethiopia’s population is estimated at 115 million in 2020 (around 1.47% of the total world population) and it is growing at an annual rate of 2.7% with no projected peak year or period of decline. However, it is also one of the poorest, with a per capita income of $850. Ethiopia aims to reach lower-middle-income status by 2025. The agriculture sector plays a central role in the life and livelihood of most Ethiopians, where about 12 million smallholder farming households account for an estimated 95 percent of agricultural production and 85 percent of all employment (FAO, 2011). The sector accounts for 46.3% of GDP, 80% of exports, and employs 85% of the total labor force in 2014 (UNDP, 2014). In 2020[2], the share of agriculture in Ethiopia's GDP was 35.45%, while industry contributed approximately 23.11% and the services sector about 37%. Of the total number of farming households, 25 percent are women-headed. Moreover, 40 percent of the farming households operate on less than 0.5 hectare, 64 percent on less than 1 hectare, and 87 percent on less than 2 hectares (AGRA, 2018; Gebreselassie & Sharp, 2007). Under rain-fed agriculture, an average family of 6 persons requires around 2.5 to 2.8 hectares to meet annual household food requirements. Thus, it can

[1] Source: Worldometer https://www.worldometers.info/world-population/ethiopia-population/

[2] Source: Share of economic sectors in the GDP in Ethiopia 2020
https://www.statista.com/statistics/455149/share-of-economic-sectors-in-the-gdp-in-ethiopia/

be seen from the size of farms that most of Ethiopia's small-holder farmers are dependent, at least for a certain period of the year, on purchased food (ibid).

Ethiopia has 18 major agro ecological zones, with three main agro-climatic zones, that is, *dega* (above 2300 m asl), *woinadega* (1500-2300 m asl), and *kola* (below 1500 m asl) (MoA, 2000). Crop-livestock mixed farming is the dominant production system in Ethiopia, while its agriculture is largely small scale, subsistence oriented and crucially dependent on rainfall (Altaye, 2012a).

Cultivated crop area (13.2 million hectares in 2015/2016) accounts for a relatively small share (about 12%) of the total area of Ethiopia (110 million hectares/1.10 million km^2), because most land is not suited for cultivation. Around 36% of the Ethiopian land is suitable for cultivation (CSA, 2015/2016a).

Crop production has doubled from 119 million quintals in 2004/2005 to 266 million quintals (1 quintal= 100kg) in 2015/2016 (AGRA, 2018). Cereals dominate Ethiopian crop production. Cereals were grown on 70% of the total area cultivated by a total of about 14.4 million farmers (small, medium, and large-scale farmers). Together these holders produce a yearly average of 25 million tons of cereals. Teff accounts for 27.4% of the total cereal area cultivated with annual production of about 18%, while maize comprises 33.6% of total annual production, but only 25.5% of cereal area cultivated. After cereals, the second most important crop group (in terms of acreage) is pulses. In 2015/2016, 8.2 million holders grew pulses on 12.3% the total area cultivated. Total pulse production averaged 3.2 million tons per year. Pulses such as beans are usually grown in rotation or intercropped with cereals such as maize and wheat. Oil seeds form the third most important crop group. In 2015/2016, they were cultivated on 5.3% of the total area cultivated by 3.4 million holders who produced an average of 0.8 million tons of oil seeds yearly (CSA, 2015/2016a, 2015/2016b).

Ethiopia has experienced dramatic social and political changes in recent decades, shifting from a feudal regime to a Marxist military state, to the current government's support of economic liberalization and ethnic federalism. These policy developments affected not only how agricultural development was interpreted and promoted in different periods, but also shaped, more generally, the climate for agricultural science (McGuire, 2005). Since the mid-1990s, Ethiopia has dramatically liberalized its economy, removing price controls, and establishing policies to encourage – and regulate – private enterprise in agricultural input supply and marketing. These reforms have also addressed the seed sector, seeking to create a more dynamic, market-oriented, and well-regulated seed supply system that can better address farmer needs (ibid).

Ethiopia is fundamentally an agrarian country. Although the transformation towards a more industrial and manufacturing-oriented economy is well underway, the agriculture sector continues to be the most dominant aspect of the Ethiopian economy. Since the mid-1990s, Ethiopia put agriculture at the heart of its economic development by launching its Agriculture Development Led Industrialization (ADLI) strategy. This strategy puts agriculture at the forefront of Ethiopia's development process. It also provides an overarching plan for economic development on the basis of agricultural transformation for increased productivity, production and product quality (ATA, 2013/2014). This would then lead to increased employment, incomes, and investable surplus for the development of other sectors of the economy. ADLI is aimed at boosting agricultural production and productivity through integrated application of appropriate technologies and improved farming management practices (Demese Chanyalew & Mellor, 2010). ADLI is seen as a long-term strategy whereby during the first stage of its implementation, agriculture is to play the leading role in the growth of the economy. But the extremely small ratio of urbanization of the country could well raise market outlet as a critical issue owing to inadequacy of the domestic demand thereby making exports a necessity. This again implies that agriculture must be made internationally competitive for at least those products which have to be directed towards the export markets. Securing accelerated and sustained development of the agricultural sector through the transformation of the subsistence mode of agriculture to a market-oriented one was envisaged to guarantee the sector's contribution to the national economic development and attainment of the millennium development goals (MDGs) of the country. The strategy has identified key areas of focus including the introduction of high yielding and appropriate technologies supported by agricultural research and extension services; increasing the quantity and quality of marketable agricultural products that can meet the demands of both domestic and international markets as well as providing support to the establishment of appropriate marketing systems; expansion of small- and medium- scale irrigation and water conservation schemes; and ensuring prudent utilization of natural resources (Demese Chanyalew & Mellor, 2010).

Ethiopia has invested an average of 14.7% of government spending on the agriculture sector since 2003. There have also been considerable gains in increasing agricultural productivity: since 2006/07, overall agricultural production of cereals has increased by 45% while production levels per hectare (yield) have grown by 22% in the same period (ATA, 2013/2014). Fueled in large part by the growth of the agriculture sector, from 2000 to 2010, Ethiopia was the fifth fastest growing country in the world. Despite these staggering achievements, there is still more work to be done. On average, national yields of the main cereals, such as maize, wheat, barley and sorghum, have increased at a faster pace than the rest of the world, and yet Ethiopia's yields are still only 55% of the overall world averages (ATA, 2013/2014). Although the transition of subsistence-oriented smallholder farmers into more market-oriented production has already begun, there is still a long way to go. Large-scale value addition, mechanization, and agro-industrialization are also expected to be more robust in the coming years.

1.1.3 Seed and seed systems in Ethiopia

The Ethiopian government has identified improving the performance of seed systems as one of its objectives to improve agricultural productivity, to ensure food security and for economic growth (Alemu, Rashid, & Tripp, 2010). A well-performing agricultural sector is of paramount importance to Ethiopia, as it accounts for 43 percent of GDP, 70 percent of exports, and 85 percent of employment (UNDP, 2014). The performance of Ethiopian agriculture is, however, below its potential. The poor quality of the seed used, and a lack of demand focus on production, distribution, and marketing have been identified as the key underlying causes of this low performance (Alemu, 2010; Atilaw & Korbu, 2011; Lakew & Alemu, 2012; Thijssen, Bishaw, Beshir, & De Boef, 2008). Furthermore, most of the agriculture sector is made up of smallholder farmers who live off- of less than 2 hectares of land. As such, transformation of the agriculture sector will be central in Ethiopia's drive to reach middle-income country status by 2025 (ATA, 2013/2014). While many opportunities exist to accelerate growth and transformation in the sector, there are also many systemic challenges that must be overcome.

High quality seed is the basis for the sustainable increase of agricultural production and reduction of poverty. Assuring access to quality seed is essential in efforts to reduce food insecurity and increase farm-derived income. The challenge facing Ethiopian agricultural development efforts is how to sustainably improve access to quality seed, as part of improving agricultural sector functioning. However, there is a substantial gap between the production of seeds and farmers' demand for quality seeds in Ethiopia (AGRA, 2018; Alemu, 2010; Alemu et al., 2010; Louwaars & de Boef, 2012; Thijssen et al., 2008). However, we do not sufficiently understand the mismatch between supply and demand for seed.

Seed systems have a long history in Ethiopia and find their basis in the centrally led political system that has long been dominant in Ethiopia. However, Ethiopia is currently moving toward a market economy with room for entrepreneurship and local initiatives, which provide alternatives to the state-level institutions that have long dominated the seed systems (Alemu, 2010, 2012; Louwaars, de Boef, & Edeme, 2013).

Seed supply systems include all organizations, individuals, legal frameworks, and institutions involved in the collection and conservation of germplasm, variety development, testing, and release; early generation seed multiplication and maintenance (at both the breeder and pre-basic level), multiplication of basic and certified seeds; storage and processing; quality control and certification; and distribution and marketing of seeds (Maredia et al., 1999). The research and development function develops new varieties that offer solutions for the farmer customers. The government reviews and approves these new varieties for admission and release to the Ethiopian market. The approved new varieties are then scaled up to a sufficient quantity to allow large-scale multiplication. The seed multiplication function produces quantities sufficient to meet the market demand. Storage spans the time between harvest and demand, while maintaining the quality of the seed; the seed is ventilated, and protected from insects, diseases, pests, rain, and heat. Processing provides clean seeds, treated against pests, and packaged, with the required labelling. Quality control and certification play an important role in providing guarantees and transparency regarding genetic characteristics, purity, germination, moisture content, and seed health. Distribution provides the seed on time and to accessible locations. Marketing communication provides the farmer customers with information about varieties, services, and prices. Marketing facilitates the exchange of seeds with the end customers in terms of availability and accessibility, supported by product information and services.

The quality control and certification function represent an important distinction between the formal and informal seed systems. Outside the formal seed system described above, an informal seed system, known as the farmers' seed system, also exists. In this system, individual farm households carry out the seed system functions for landraces. It is based on seed saved from previous crops, seed obtained from the informal economy through farmer-to-farmer exchange, or seed obtained from traders. The informal seed system in Ethiopia is deeply rooted in local communities, traditions, and networks. It has two important distinguishing features. First, the informal system is not regulated by law and operates without legal certification of the process (Alemu, 2010; Louwaars et al., 2013). Second, the quality of the seed deteriorates rapidly across the different cycles of its use, because of lack of quality control and the reliance on farm-saved seed. Hence, after several cycles, the seed needs to be replaced by new higher quality seeds to safeguard against insufficient levels of productivity and quality of produce.

Despite its limitations, the informal system dominates the Ethiopian seed supply, accounting for approximately 90% of all seed supplied, leaving 10% for the formal system (Atilaw & Korbu, 2011; CSA, 2011). However, the formal system supplied roughly 14.6 % of the total seed supply in 2015–16 (CSA, 2015/2016a, 2015/2016b) compared to 10% in 2010 (Atilaw & Korbu, 2011; CSA, 2011) and only 4.7% in 2007-2008 (CSA, 2009). Nevertheless, considerable variation exists between crops. The informal seed system in Ethiopia mostly supplies local landraces for a wide range of crops (cereals, pulses, oilseeds, vegetables, root crops, fruits, stimulant crops), such as teff, wheat, barley, sorghum, finger millet, beans, faba beans, field peas, sunflower, sesame, tomatoes, red peppers, carrot, onion, potatoes, mangoes, and coffee. The formal seed system in Ethiopia mostly supplies improved and certified seeds for a limited range of crops, mainly major grain crops (cereals, pulses, and oilseeds) in the country, such as maize, teff, wheat, barley, rice, faba beans, field peas, haricot beans, chick-peas, and linseed. The formal system also offers to a limited extent improved seeds for vegetables, root crops, fruits, and stimulant crops, such as tomatoes, red peppers, carrot, onion, potatoes, and coffee. Hybrid seeds (dominant in crops such as maize and horticultural crops) do not have an important position in the informal seed systems because harvested seeds cannot be used as seed in the next season.

Coming from a centrally led political system, the formal seed system has long been dominated by state control. In this system, the variety development and early generation seed production have been dominated by public agricultural research institutes and state universities. These institutions select varieties from landraces and imported materials from international agricultural research centers (e.g., CIMMYT, ICARDA, etc.), and further optimize them to local Ethiopian conditions, which is challenging given the large ecological heterogeneity across Ethiopia. MoA (2000) indicate that Ethiopia has 18 major agro-ecologies. The government selects seeds to be added to the formal seed registration list of approved varieties and, through the Ethiopian Seed Enterprise (ESE), takes the lead for multiplication. Multiplication is done through different channels, mainly state farms, farmers' cooperatives, unions, and community-based seed production based on contractual agreements. From the seed produced for ESE, seed producing cooperatives can keep 10% for own use and return 90% of the seed to the ESE. However, this contractual arrangement does not include hybrid maize, for which cooperatives are required to return 100% of the seed they produce to the ESE. The produced seed undergoes further quality control and a number of processing steps at the ESE, before formal certification is granted. Distribution of the certified seed is organized through public agricultural extension organizations based on demand assessments or forecasts across the regions. The seed is distributed through local agricultural extension organizations (Woreda Office of Agriculture; WoA), and general unions. These unions are groups of cooperatives for further distribution of seed to end customers (farmers) through local multipurpose cooperatives accessible to both members and non-members. Marketing support to smallholder farmers is realized through the multipurpose cooperatives and the local extension organizations. The informal system has always existed next to the formal system based on the 10% of seed retained at the level of the seed-producing cooperatives. The cooperatives can sell this seed to farmers who can use it for their own use and subsequently sell it for cash to traders or end consumers, or barter in exchange of other commodities. In the informal seed system, individual farm households multiply the seed of local landrace varieties for cash and household consumption. Individual farm households also multiply improved varieties obtained from the formal system. However, the informal system does not rigorously follow systematic procedures for seed multiplication.

In recent years, with Ethiopia moving to a market economy, the seed system has largely diversified with new partners, stakeholders, and structures emerging. Multinational companies have entered the seed supply system, but for selective crops, mainly hybrid maize and vegetables, such as potato, tomato, and onion. As part of the formal system, multinational companies (MNCs) play an important role in the development of seed varieties and the early generation seed development, which they typically conduct in the private domain, as also holds for the multiplication of their seeds. They adhere to the formal certification procedures and work closely with the government to discuss the quantities needed in response to the government's demand forecasts. The seed from the MNC seed system is distributed through agents (own and public channels), who also conduct the marketing functions. The seed often sells at double the price of that from the public seed system. Domestic private producers (companies and out growers) have also entered the seed supply system, but for selective crops, mainly hybrid maize. As part of the formal system, they play an important role in the multiplication of certified seeds, for which they typically depend on the public breeding material for source seed. Seed from the domestic private producers is distributed through agents (own and the contacting public enterprise channels), who also conduct the marketing functions.

In Ethiopia, a powerful regional political system exists, and next to the national-level ESE, Regional Seed Enterprises (RSEs) have been established in the three main regions of Ethiopia, Amhara, Oromia, and South, and most recently in Somalia. Mostly, the RSEs conduct the same role as the national-level ESE. An intermediary seed system (between the formal and informal seed system) has also emerged in recent years. The intermediary seed system is a framework of organized farmer groups with distinct and inter-dependent roles in multiplying, storing, processing, distributing, and marketing seeds of (new) or existing varieties at the local level. Such system takes the form of community-based seed production, seed producing cooperatives (SPCs) and local seed business, which are organized, supported, and financed by different governmental and non-governmental organizations. The varieties they multiply are mainly certified seeds that are obtained from the formal seed systems. The recent development in the intermediary seed system is the inclusion of those local preferred varieties accessed from the informal seed systems. As part of the intermediary seed system, emerging pilot projects are local seed businesses (LSBs). LSBs are organized groups of farmers, and farmers seed producing cooperatives performing seed production (both local and improved varieties) and business at local levels. LSBs traditionally served as seed multiplication units for ESE, RSE and farmer-based Cooperative Unions in the formal system (as previously described). Now they have greater independence and are working without contractual agreements. LSBs buy seed from various parties, including the ESE, RSE, Research Centers, and Seed Unions. They multiply seed and distribute directly to customers. LSBs serve local governments (WoA), individual farmers (both members and non-members), other cooperatives, multipurpose distribution cooperatives, and NGOs.

A variety of options have become available for local farmers to obtain seed. Such seed may be (1) obtained from their own storage (i.e., farm-saved seed), (2) obtained from the local community through a bartering system, (3) purchased from the cooperative, (4) purchased from agents representing MNCs, domestic private producers, and public enterprise-seed systems, (5) obtained from the local market (grain), (6) obtained sometimes directly from research organizations, universities, projects, and public extension organizations in the case of demonstration and popularization (promotion) of newly released varieties at local farm level or (7) occasionally obtained from NGOs in the case of severe seed scarcity and drought.

Despite the free choice of farmers to obtain seed, (partially) liberal markets, and competing supply chains, there is a huge gap between the supply of and demand for seed. We do not sufficiently understand the reasons accounting for the mismatch between the supply of and the demand for seed in Ethiopia. Systematic studies on market orientation and performance in complex chains - the total “seed system” involves multiple stakeholders playing different roles - in developing and emerging (D&E) markets are limited.

Effective and efficient seed systems should enhance customer satisfaction and obtain superior performance for firms and/or public and private sector organizations. Market orientation (MO) should contribute to effective seed systems, but measures for the MO of functions do not exist. Measuring the MO of seed systems is also difficult because measures of MO may not be comparable across functions and perspectives. This thesis contributes to the gap in the literature by analyzing seed supply systems, using the theoretical framework of MO, from the perspectives of all channel actors and farmer customers.

At the level of the seed supply chains a variety of functions has to be performed to deliver and add value to seed. Such functions center around key tasks of (1) R&D, (2) seed multiplication, (3) storage and processing, (4) quality control and certification, and (5) distribution and marketing.

This thesis takes end customer satisfaction as the key dependent variable, because satisfied farmer customers will continue to use improved seeds and thus increase agricultural productivity. Market orientation increases customer satisfaction (Kohli & Jaworski, 1990; Slater & Narver, 1994a). However, market orientation of supply chains is not understood, yet. This thesis looks at the market orientation of functions performed in (seed) supply chains. It considers market orientation from the lens of the stakeholders/chain actors and customers (i.e., farmers), because market orientation is not a well-established concept in the Ethiopian context. Market orientation should reflect the extent to which the voice of customers and the end-customer is heard and responded to across the various functions involved in supply chains. Our analyses should reveal strengths and weakness of functions within and across seed supply chains for farmer-customer satisfaction.

Thus, the thesis contributes for seed system development in developing countries. It does so by identifying from an end-customer perspective, the critical success and failure factors of alternative seed supply systems. This can serve as a basis for improvements in the effectiveness and efficiency of formal, intermediary, and informal seed systems of Ethiopia and often other developing countries. Thus, to improve the effectiveness and efficiency of the Ethiopian seed systems that is responsive to farmers demand for quality seed.

1.2 Objectives and research questions

This thesis extends market orientation-performance research to supply systems in D&E markets. It provides a case study on Ethiopian seed systems. We analyze differences in responsiveness to market demand of seed supply systems using market orientation theory as a guiding framework. Thus, we investigate the different seed systems from the perspective of customers and stakeholders, identify key drivers of and barriers for the proficiency of seed systems, and offer suggestions for how stakeholders, policy makers and development programs can overcome some of the barriers.

Main objective: to identify from a stakeholder and an end-customer perspective, the strength and weakness of seed supply systems, as a basis for improvements in the effectiveness and efficiency of seed systems of Ethiopia.

Research Questions

Focusing on Ethiopia, the thesis seeks to answer the following research questions.

1. How do end customers evaluate the performance of the Ethiopian seed supply systems?

2. What is the influence of market channel functions on customer satisfaction with supply systems?

3. What is the degree of market orientation of Ethiopian seed supply systems?

    a) Do they have adequate knowledge of customers and farmer customers' needs?

b) How is customer knowledge distributed within and across seed supply systems?

c) Do supply chain functions respond in terms of their role in seed supply chains?

4. How does market orientation influence the proficiency of supply chains or market channel functions?

Overall, we found that it is very useful to apply the concepts of market orientation, customer satisfaction and proficiency in seed supply chains.

Past research shows that market orientation (MO) enhances performance in private, public, and service sector and not for profit organizations, regardless of their size. Our thesis argues that MO increases proficiency and thus that it is useful to overcome the lack of market-oriented responsiveness. Our novel approach can provide useful insights on the functioning of the seed supply systems of the different crops that are addressed in the present studies. Improving the MO and performance of seed systems is one of the Ethiopian government's ambitions to ensure food security, for agricultural production and productivity and for economic growth of the nation (ATA, 2014). To achieve these goals, it is beneficial for Ethiopia to increase the market orientation of seed supply chains. By examining and comparing the market orientation and performance of the formal and intermediary seed systems by looking at roles and functions, and their distribution across actors, we will identify which stakeholders, roles and functions do and do not respond to the market in each seed supply chain. Then we can discuss possible solutions to overcome the lack of market-oriented responsiveness, such as combining seed systems to stimulate and efficiently meet farmers' evolving demand for quality seeds or suggesting a road map towards an alternative and more market-oriented seed system in general.

We also extend customer satisfaction theory to seed supply systems in emerging markets, with their specific contextual challenges. We argue that satisfied customers are more likely to continue to use improved seeds, which increases productivity and efficiency and hence contributes to attaining governmental goals, including the sustainable millennium developments goals of achieving "No poverty" and "zero hunger". We explore how functions in the supply chain contribute to the customer satisfaction of the final customer. Moreover, a standard model measuring supply chain performance from the customer perspective does not exist to the best of our knowledge. Hence, our study will identify the criteria that farmers use to evaluate seed supply systems and evaluates Ethiopian seed supply systems from a farmer customer's perspective, which can be used as a basis to increase customer satisfaction.

We also use the concept of proficiency as used in literature on new product development (Cooper & Kleinschmidt, 1987a, 1995; Ernst, 2002) and apply it to seed supply systems in emerging markets, with Ethiopian seed systems as a relevant case. By analogy, we adopt the approach of sub-process proficiency to better understand the truly critical success factors in overall value chain performance. Proficiency contributes to performance and increases customer satisfaction. However, past studies did not investigate how proficiency of functions contributes to overall customer satisfaction with seed supply chains. The new product development (NPD) process is a series of interrelated activities that need to be performed. The ultimate success of the new product is affected by all these activities and particularly the proficiency with which these are performed. The influence of marketing functions on customer satisfaction can be analyzed in a similar vein.

1.3 Structure of the thesis

This thesis is organized into seven chapters, including this general introduction (chapter 1), research context and theory (chapter 2) and a general discussion (chapter 7). The remaining chapters, chapter 3 to chapter 6, answer the research questions of the thesis. The structure of the thesis is displayed in Figure 1.1.

Chapter 1 (Introduction) describes the central theme of the topic by providing background information on the African agriculture, Ethiopian agricultural seed systems, role of seed, the economy, policy, challenges, and the various actors and commercial seed companies. It briefly highlights the difficulty of market orientation theory in a supply chain context.

Chapter 2 (Seed supply systems and marketing functions performed in the Ethiopian seed sector) describes relevant theory on customer satisfaction, market orientation, supply chain management, value chains and other key concepts. It also highlights the difficulty of market orientation theory in a complex chain of developing and emerging (D&E) markets. This chapter also combines the research context and theory. It presents the types and positions of the different Ethiopian seed supply systems, their contribution to seed supply, actors' roles, and linkages, and how they are organized and operated. It also provides a theoretical framework of market orientation and proficiency, and it ends up by developing a market orientation framework for the Ethiopian seed system by looking at roles and functions, and their distribution over actors.

Chapter 3 (Customer evaluation of supply systems: the case of Ethiopian seed supply systems) explores end customers' evaluations of the performance of seed systems of Ethiopia. Interviews with end customers that can evaluate the different seed supply systems for different crops and regions were used. The main purpose is to identify end customers' criteria to evaluate market offerings from different seed systems. It also helps to develop a measure of seed systems performance from the perspectives of farmer customers. The result also helps to acquire quantitative information (for further testing) on the criteria farmers use to evaluate the offer of the different seed systems.

Chapter 4 (Influence of market channel function proficiency on customer satisfaction with supply systems) empirically and quantitatively tests the relationship between market channel functions proficiency and performance (customer satisfaction criteria). In doing so, the study used those end customers' criteria identified in the previous study (chapter 3) and tests the relationship with a large representative sample of end customers of three agro-food value chains (maize, teff, and beans) in Ethiopia.

Chapter 5 (Market orientation of supply chains: the case of Ethiopian seed supply systems) uses a quantitative approach to understand and examine the degree of market orientation of the different seed supply value chain functions. All upstream to downstream actors [until the end customers served by a particular value chain (maize, teff, and beans)] assessed the market orientation of functions performed by themselves, their direct customers, and suppliers. Farmer customers evaluate all the functions performed by their seed suppliers. The chapter evaluates the process of market orientation across the different stages of crop value chains. Thus, chapter five analyses the market orientation of functions in the Ethiopian seed supply system and validates the market orientation measures for the Ethiopian seed system.

Chapter 6 (Influence of market orientation on proficiency of supply chains: the case of Ethiopian seed supply systems) fills the gap in the literature on the generalizability of the market orientation and performance relationship in D&E markets by providing an empirical test in the seed supply system of Ethiopia. Thus, increasing our understanding of why a particular seed system and/or function is better than another and thus preferred by farmers. In addition, chapter 6 explores whether market orientation increases proficiency in a multi-actor value chain setting, and how the relationship is influenced/moderated by functions, perspectives, and crops.

Chapter 7 (General discussion) discusses and concludes by presenting the key findings and the policy and managerial implications. This chapter also suggests a road map towards an alternative more market-oriented seed system. The potential contribution of the alternative seed systems to the Ethiopian economy more generally is also elaborated.

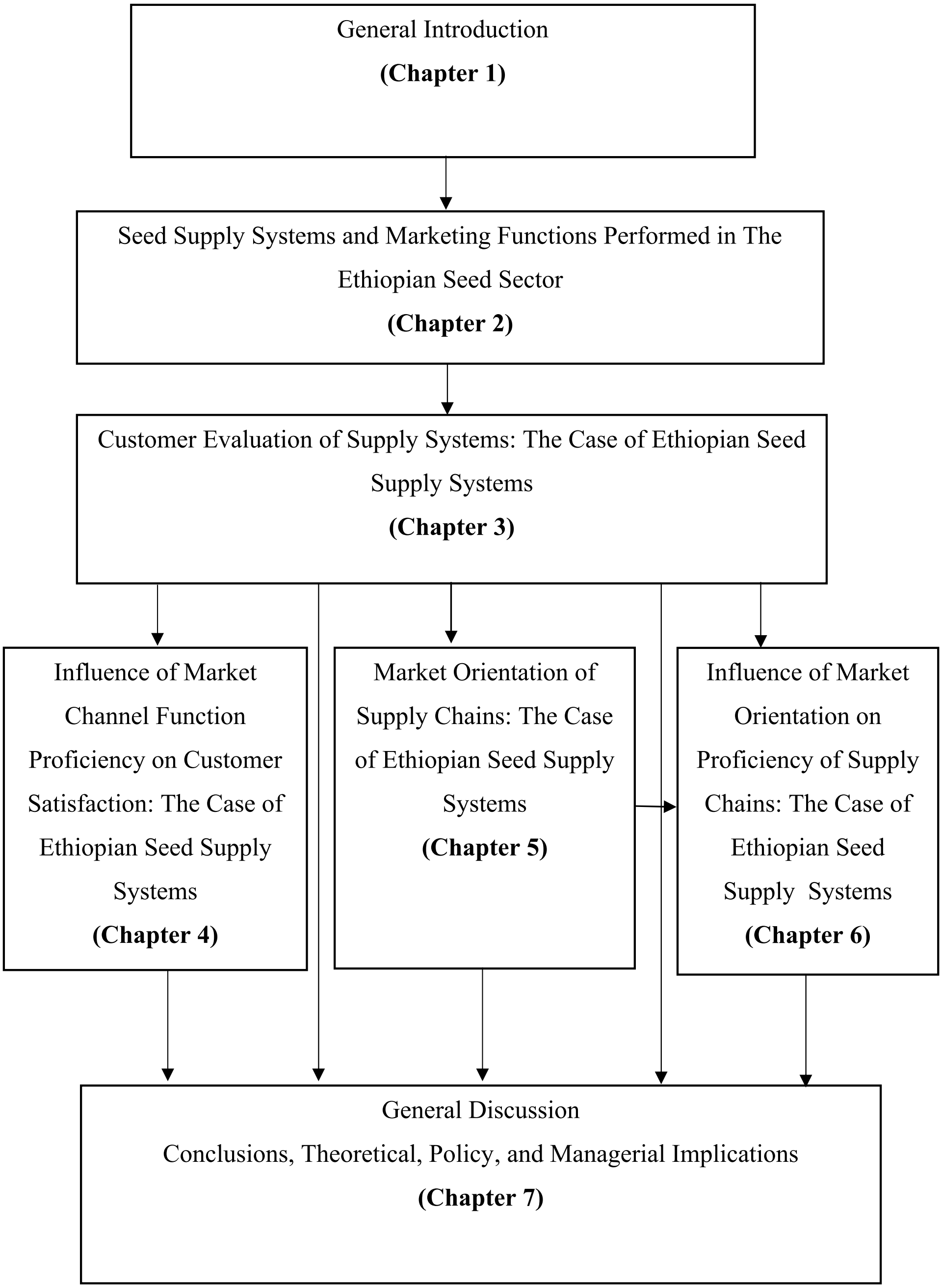

Figure 1.1: Structure of the thesis

CHAPTER 2

Seed Supply Systems and Marketing Functions Performed in The Ethiopian Seed Sector

This chapter will be submitted as: Shimelis Altaye Bogale, Frans J.H.M. Verhees, and Hans C.M. van Trijp. *Seed Supply Systems and Marketing Functions Performed in The Ethiopian Seed Sector.*

Abstract

The paper reviews the different seed supply systems in the Ethiopian seed sector. More specifically it focuses on the positions of the alternative seed supply systems, their contribution to seed supply, and how they are organized and operated in terms of actor's roles and linkages. Effective and efficient seed supply systems are very important for food security of a nation. Effectiveness and efficiency come from the extent to which seed supply systems deliver seeds in line with the needs of society in ensuring the right quantity of the right quality seed at the proper moment to the right customers, at an acceptable price. This paper therefore reviews relevant literature to describe the different features and types of seed supply systems. It also compares the different seed systems in terms of marketing functions /market channel functions performed and actors involved. The paper then presents the key concepts used, especially on customer satisfaction, market orientation, market channel functions, proficiency, supply chain management (SCM), value chains and a review of studies closely related to this paper/topic. The paper finally describes the theoretical framework of market orientation in the Ethiopian seed system. It adapts the market orientation concept for developing and emerging markets and for seed systems by looking at marketing roles and functions and their distribution over seed system actors. Market-orientation consequences and major propositions of the thesis are also explored. The outtake is that various development partners and government should support and strengthen the different seed systems to increase agricultural development and for a more market-oriented and commercial seed sector in Ethiopia.

Keywords: Seed systems, Supply chains, Agricultural development, Marketing functions, Market orientation, Linkage, Emerging markets

2.1 Introduction

Ethiopia is fundamentally an agrarian country. Although the transformation towards a more industrial and manufacturing oriented economy is well underway, the agriculture sector continues to be the most dominant aspect of the Ethiopian economy, accounting for nearly 46% of GDP, 85% of employment, and nearly 80% of foreign export earnings (UNDP, 2014). Furthermore, much of the agriculture sector is made up of smallholder farmers who live off of less than 2 hectares of land. As such, transformation of the agriculture sector will be central in Ethiopia's drive to reach middle-income country status by 2025 (ATA, 2013/2014). While many opportunities exist to accelerate growth and transformation in the sector, there are also many systemic challenges that must be overcome. One important reason is the poor quality of the seed used, and a lack of demand focus on production, distribution, and marketing (Alemu, 2010; Atilaw & Korbu, 2011; Lakew & Alemu, 2012; Thijssen et al., 2008). Often the agricultural sector is characterized by small-scale, subsistence orientation and crucial dependence on rainfall. That calls for a more market oriented and commercial sector that can be able to respond to the growing demands of foods for different categories of customer segments.

Seed is farmers' most precious resource and concerns about the viability of traditional agricultural systems center around the diversity and stability of seed supply (Tripp, 2001). To a large extent, the quality of seed determines the success of crops in terms of yield (and yield stability) and product quality, and thus their contribution to food security and the value of crop products in the market. The quality of seed has several aspects: its genetic properties, i.e., the inherent genetic makeup of the variety, and the germination rate, seed health, and purity of the seed. This genetic diversity provides options to cope with adverse conditions and risks. Seed sector development gains attention when seed security and food security are linked together with agricultural economic development in developing countries. Good-quality seed is essential for any food production; it is also a technology transfer agent crucial for increasing productivity and production. Furthermore, seed is a potential commodity for stimulating local and national economic development and entrepreneurship and is an important component of agricultural biodiversity (Louwaars & de Boef, 2012; Louwaars et al., 2013).

Timely availability of improved seeds at affordable prices is critical to improving food security, resilience, and livelihoods for smallholder farmers in Africa. Improved seeds can deliver state of the art technology to farmers including higher yields, disease and pest resistance, climate change adaptation, and improved nutrition (Mabaya, 2016). With seed companies still only reaching 10% of the world's smallholders, a lack of access to quality seeds persists in many emerging economies (Mabaya, 2016). Key issues in determining the use of seed by farmers are availability, quantity, quality, and price. Seed has to be available, which means that there has to be physical access to the right quantity of seed of the right variety at the right time, and it needs to be affordable (Louwaars & de Boef, 2012).

Significant investments in the formal seed sector have been made throughout the developed and developing world to improve varieties and to produce and promote quality seed for some major food crops (Louwaars & de Boef, 2012). However, the reality in many agricultural systems is that informal systems that are based on farm-saved seed, informal exchange and markets have a very important position in the whole seed supply (Lipper, Anderson, & Dalton, 2010; Sperling & McGuire, 2010). More than 80% of the seed planted by African farmers remains to originate from informal systems, despite all investments in technology, dissemination, and marketing systems in the formal system (Almekinders et al., 2019; Byerlee, De Janvry, Sadoulet, Townsend, & Klytchnikova, 2007). For many crops, the estimate is closer to 100%, which means that informal seed supply is the main source of seed for most crops and farmers in developing countries, and is likely to remain so for the foreseeable future (FAO 2010). Throughout the world, it is the farmers themselves who produce the largest quantity of seed of most crops. This farm-saved seed is used for both locally and scientifically bred varieties (Louwaars & de Boef, 2012; Pretty, 1995).

Supplying high quality seeds of improved varieties preferred by farmers is a national development objective pursued by the Ethiopian government to secure food supply for the nation (MoA, 2018a). However, there is a substantial gap between the production of and farmers demand for seeds. There is a critical mismatch between supply of and demand for seeds. This calls for a more market-oriented seed sector that identifies and satisfies the needs of their target customers. However, there is a limited insight on the roles of market orientation (MO) in such contexts. Various internal and external factors can potentially affect the performance of agricultural seed systems. For example, domestic policy and institutional environment have a strong impact on the ability of domestic and regional seed trade to meet the needs of farmers for improved seed. A survey by the World Bank found that differences in domestic policies account for close to 50 percent of the variation in improved input usage at the household level in Africa, even where biophysical, demographic, and socioeconomic variables within the region are similar (Sheahan & Barrett, 2014). Further, Erenstein, Kassie, and Mwangi (2011) stressed that differences in policy implementation and perceived specific public support between countries has resulted in varying degrees of public-private sector roles.

As a result of the increasing global interest in agriculture, in a context of rising food prices and concerns about food security and climate change adaptation, seed sector development in Africa and/or in Ethiopia has regained the attention of governments, donor communities, civil society, and other stakeholders. At local level, farmers and entrepreneurs seek opportunities in the seed market (Louwaars & de Boef, 2012; Louwaars et al., 2013).

2.2 Seed system development for effective and efficient delivery

The term seed system initially referred to the network of formal sector actors and institutions involved in supplying seed (Venkatesan, 1994), but increasingly the term can also refer to farmers' own seed provision activities, sometimes distinguishing this as the local, informal, or farmer seed system (Almekinders, Louwaars, & De Bruijn, 1994; Almekinders & Louwaars, 1999; Tripp & Louwaars, 1997). Informal seed systems are also referred to as farmer-managed seed systems (Bal & Douglas, 1992), and traditional seed systems (Cromwell, Friis - Hansen, & Turner, 1992). The components of informal system are farmers and agro-ecological, socioeconomic, and cultural environments (Mekbib, 2007).

Amstel (1996) define seed system as the total of physical, organizational, and institutional components, their actions and interactions that determine the seed supply and use, in quantitative and qualitative terms. The seed system is a function of seed source, network, distribution, and availability (Mekbib, 2007).

Seed system, (Figure 2.1), represents the entire complex of organizations, individuals and institutions associated with the development, multiplication, storage, processing, quality control and certification, and distribution and marketing of seeds in any given country (Maredia et al., 1999). The seed system includes the traditional (or informal) system in which individual farm households carry out all seed functions for land races, including seed development, multiplication, storage, processing, distribution and marketing (Cromwell et al., 1992), and the non-traditional (or formal) systems comprised of specialized organizations with distinct roles in supplying seeds of new varieties. Legal institutions such as variety release procedures, intellectual property rights, certification programs, seed standards, contract laws, and law enforcement are also an important component of the seed system of any country (Figure 2.1). They help determine the quantity, quality, and cost of seeds passing through the seed system.

Seeds of new and landrace varieties flow from organizations and individuals in one stage of the "seed chain" to the next through channels depicted by arrows in Figure 2.1. A well-functioning seed system is therefore defined as one that uses the appropriate combination of formal, and informal, market and non-market channels to stimulate and efficiently meet farmers' evolving demand for quality seeds (Maredia et al., 1999).

Seed products pass through the chain of activities to one of three outlets. They are sold in the market, used in development programs, or retained by households for the next planting season (Figure 2.1). Seeds of landrace varieties and of new varieties that have entered the farmer based informal system are generally retained by farm households for their own use or exchanged with other farm households. Seeds of new varieties entering the formal system of seed organizations are usually marketed, but some are also used in development programs, such as drought and disaster relief (non-market channels) and the free distribution of seeds to promote new varieties.

As depicted in Figure 2.1, the three "supply targets" of the seed system – markets, non-market, and retained/exchanged seeds – form the three sources of seed for seed users (i.e., farm households). The relative importance of each source will depend on the effective demand for seeds of new varieties compared to landrace varieties (Maredia et al., 1999). Farmer retention is the most common source of landrace varieties for most grain crops. For new varieties, markets and farmer retention are both important sources depending on whether the demand for seeds is continuous or periodic. Non-market sources of seed are important in cases where demand for seed is affected by chronic poverty or by external conditions (such as drought, war, disasters) affecting a region.

It is usual for farming household to meet their single-crop needs from varied seed channels (McGuire, Manicad, & Sperling, 1999). However, during seed shortages farmers may rely on poor-quality planting materials, such as food grain obtained in the market and whose varietal characteristics and seed quality are unknown (Louwaars, 2007; McGuire, 2008).

Coupled with other agricultural inputs, the use of improved seed has an immense potential to drive major increases in production and productivity. Such gains, along with increased smallholder commercialization and the use of market-demanded varieties, is critical for agricultural transformation. Many developing countries, especially those in Asia, were able to transform their agriculture sectors and ensure food security for billions through the adoption of high-yielding varieties of seed, in addition to other modern inputs (ATA, 2013/2014).

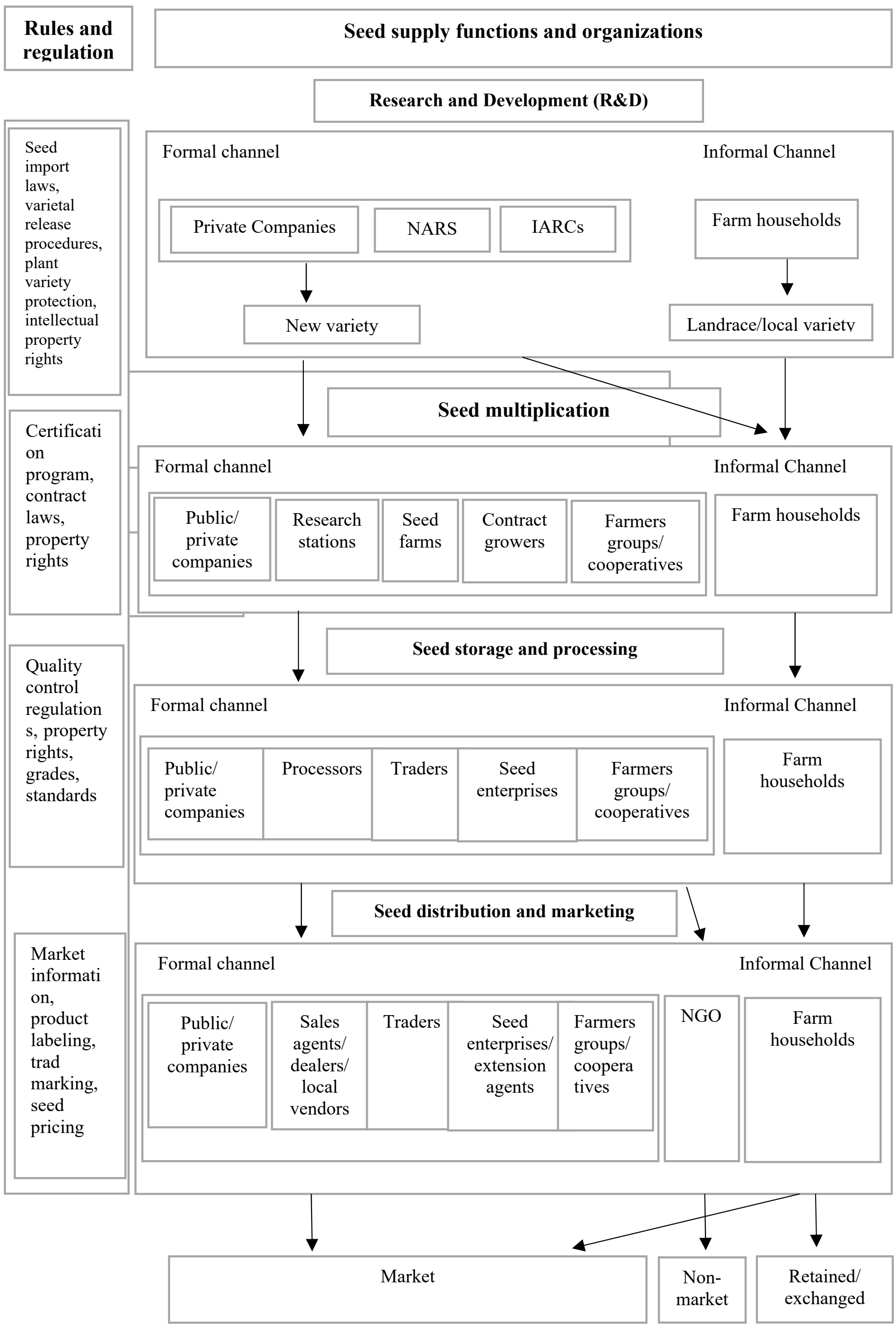

Figure 2.1: Seed system: an organizational and institutional framework (adapted from Maredia et al., 1999)

Current approaches to seed system development

The dominant approach

Seed system development goals in developing countries up to the 1980s was a formal public-private sector seed system model, whereby policies and regulations for formal seed systems dominate. The goals emerged because of advances in agricultural technology and a strong agricultural sector, which was so successful in Western economies. It was envisioned to reach a mature seed system, characterized by a well-developed agricultural sector in which commercial seed companies and the market supply most, but farmers were perceived as passive recipients of technologies (Douglas, 1980).

Other approaches

A contrasting approach is advocated by those who may be grouped under the banner of food sovereignty. The food sovereignty group is another approach often contrasting to seed system development. The group advocates an open-access seed system with rights of farmers to multiply and maintain seeds that represent their cultural identity and agroecology (Edelman, 2014). Other seed system approaches can be placed in between the two opposing extremes: they adopt a more pluralist vision that acknowledges the context specificity and diversity of farmers, farming systems and crops (Staver et al., 2010). Others empathize the multi-actor character of seed systems and promote an integrated seed system development (ISSD) model (Louwaars & de Boef, 2012).

Formal seed system development typically begins with heavy government involvement in seed research, production, and distribution. As the market grows, however, government breeding programs simply cannot supply the amount of new varieties farmers need. Opening the market to private seed companies allows for the necessary expansion of seed production (Tripp & Rohrbach, 2001). The most successful seed systems have all transferred responsibility to commercial seed production and sale as well as some regulatory oversight of the industry to the private sector.

In many developing countries, governments continue to exhibit a distinct mistrust of the private sector and attempt to suppress market entry and competition as well as to control the source of breeder and foundation seed. In East Africa, these restrictions commonly take the form of onerous seed company registration regulations, including high fees and resource requirements. In Ethiopia and Tanzania, for example, public seed companies retain sole responsibility for the provision of basic seed of certain crops. These tendencies are particularly acute with respect to field crops considered more critical for the country's food security (Tripp & Rohrbach, 2001).

Increasing the rate of introduction of new seed varieties is essential to achieving inclusive agricultural sector growth and improved nutrition outcomes. Regulations governing seed company registration, variety release, and seed certification can add unnecessary time and cost to the production and sale of improved seed. While specific country models may differ across countries, an efficient regulatory system is needed to promote the development of a robust private-sector-driven seed industry able to readily meet the needs of farmers at home and abroad (Tripp & Rohrbach, 2001).

A diversity of practices and realities exist in seed sector development. Many of these practices have been created based on a linear approach to seed sector development, thus with the assumption that one particular seed sector or system exists (Louwaars & de Boef, 2012). These practices have been supporting the public seed sector since the 1970s and primarily the private seed sector since the 1990s. Likewise, seed policies have been designed and implemented within such a linear approach. These have resulted in seed programs that are incoherent with the practices and variations that exist in agriculture in Africa.

Developments in the seed sector of different countries come in a variety of forms, practices, and operate at a range of levels (Local, National, Regional, and Continental). In all cases, however, it requires an adequate representation and shared roles of public and private sector seed actors with high focus on market-orientation. Regardless, the balance in terms of public–private seed sector roles and responsibilities and the transition from public dominated to market oriented seed sector, development differs from place to place and changes over time (Louwaars & de Boef, 2012). Generally, the context specificity and inherent complexity of seed systems have led to numerous (case) studies at various levels with a diversity of approaches and emphasis, and various analytical frameworks have been forwarded to seed system (sector) development, to explain public-private roles in market-oriented seed sector.

Since 1991, formal seed systems in Africa have been gradually liberalized resulting in increased participation of private seed enterprises (multinationals, regional and domestic companies) (Mabaya, 2016). However, the disincentives and uncertainty caused by seed distribution programs, the inefficiencies and privileges of public seed producers, and the existence of restrictive regulatory regimes all conspire to inhibit the development of a commercial seed sector in Africa (Tripp & Rohrbach, 2001).

The private sector can effectively carry out many seed production and distribution activities via a favorable policy environment (Alemu, 2010). The public and private sectors must have complementary roles for an effective seed industry, within the policy framework and some supporting infrastructure that has been set by the government (Loch & Boyce, 2003). The commercial opportunities presented by genetic engineering and legal protection of the intellectual property in new plant varieties, coupled with a shift in government policy towards deregulation has resulted in varying degrees of public-private roles (Loch & Boyce, 2003). The emergence of the private seed sector does not necessarily mean an end to public seed enterprises if they can be put on a more commercial footing. In India, some state seed enterprises have faded away, while others remain active and innovative (Tripp & Rohrbach, 2001).

To achieve access to affordable quality seed of superior varieties, a vibrant, integrated, and market-oriented seed sector that fosters pluralism in matching food and seed security to private sector development is necessary. Hence, public sector can fulfil effectively its supportive function in the seed sector in addition to participating on the production and supply of those crops that have limited commercial interest for the private sector (Louwaars & de Boef, 2012). Reality has proved more complex and that there is no blueprint seed policy implying that there is a need to understand seed systems to develop the corresponding seed policy options (Louwaars & de Boef, 2012; Louwaars et al., 2013).

2.2.1 Formal seed system

The structure of the formal seed system is guided by scientific methodologies for plant breeding and controlled multiplication operated by public or private sector specialists. The principal activities of the formal seed system – germplasm conservation, breeding and variety testing, certification, multiplication, and extension – take place in separate institutions. However, farmers' practices are integrated, whereby farmers perform each function by themselves (Almekinders, 2001).

Seed policies primarily concentrate on the formal seed system, which supplies in Sub-Saharan African countries less than 20% of the total seed demand and involves only a limited number of crops and varieties. Seed laws, and the mechanisms and organizations involved in their implementation, are developed with varying degrees of success (Louwaars & de Boef, 2012).

Within the formal seed system, commercial seed production and marketing is only possible for a limited number of crops. The private sector concentrates on hybrids (notably maize) and high-value horticultural crops that can guarantee that all the overheads, including transportation and quality-management costs, will be covered, and that can offer some profit. Profit margins on self-fertilizing crops like most cereals and legumes are generally low due to competition with farm-saved seed (Louwaars & de Boef, 2012; Louwaars et al., 2013; Tripp & Rohrbach, 2001). In some countries (e.g., Brazil, India), commercial companies produce such crops when they can generate enough profits from large quantities or when supplying large commercial farmers only. The private sector generally operates at countrywide and international levels and involves cash transactions and a profit orientation that results in the production of large quantities of seed and the marketing of just a few varieties with wide adaptation (Louwaars & de Boef, 2012; Louwaars et al., 2013; Tripp & Rohrbach, 2001). The public sector can support seed systems in different ways, notably by conducting research in breeding, by carrying out varietal development, by organizing (and subsidizing) seed quality control, or by promoting quality seed and improved varieties. Policy and legal frameworks facilitate investment in breeding and seed production, providing access to plant genetic resources, protecting breeders' rights, and ensuring seed quality control (Almekinders et al., 2019; McEwan et al., 2021).

Limitation of the formal seed system

The limitations of the formal seed system can be seen at the level of the individual components in the chain and in terms of the connections between the components. Consequently, formal seed chains, as with any value chain, are as strong as their weakest link. A formal seed chain where the breeding component is weak has "nothing to sell" that farmers do not already have and tends to lose impact, since many farmers purchase seed primarily to access new varieties. Similarly, the chain will break when seed production is poorly organized and seed quality is low, or when the delivery system fails and seed does not reach the farmers in the right quality and quantity at the right time and price (Gregg & van Gastel, 1997; van

Gastel, Gregg, & Asiedu, 2002). In such situations, “farm saved seed” of the informal system outperforms or is more competitive than “formal” seed. The interdependence of the different components is a challenge for the organization of formal seed chains (Louwaars, 2007).

The role of government in the seed sector is paramount, but highly depends on the kind of role it plays. The government’s role in promoting a strong seed industry includes regulatory functions such as registration of seed companies and retailers, assurance of seed quality, protection against pests and plant diseases, regulation of competition, and control of fraud and deception in the marketplace. Governments may also encourage investment in the industry through infrastructure improvements or granting intellectual property rights to seed breeders (Louwaars, 2007).

While the broad policy goals of a seed regulatory system are fairly widely accepted, the regulatory mechanisms for achieving these goals can vary substantially. Seed regulatory systems can be robust and serve the farming population well and still have substantial differences. The United States (US) and the European Union (EU), which have the most sophisticated seed industries in the world, follow very different models for regulation of the industry. In practice, most country seed systems fall broadly within either the US or EU model (Tripp & Rohrbach, 2001). Despite these differences, effective regulatory regimes share certain common characteristics, such as widespread private sector participation in the industry, efficient and predictable government regulation, and strong quality control mechanisms. By contrast, seed regulatory regimes in many developing countries, particularly in Sub-Saharan Africa, are much more restrictive and have been slow to cede regulatory oversight and commercial activities to the private sector, despite a lack of monetary and human resource capacity to implement the regulatory regime effectively. Meanwhile, resources for market inspection, public research, and infrastructure investments such as seed testing laboratories suffer. In effect, some of the most restrictive policies in the world are being maintained by governments with the fewest resources to implement them. These policies generate higher transaction costs for seed companies, thus lowering incentives to invest. Shortages in seed supply and poor quality control further threaten the viability of the domestic seed industry (Tripp & Rohrbach, 2001).

2.2.2 Informal seed system

The informal seed supply is the main source of seed for most crops and farmers in developing countries. The dominance of the informal seed system over the formal system, independent of whether farmers cultivate local or modern varieties are expressed by several reasons in the global setting (Almekinders & Louwaars, 2002; De Boef, Dempewolf, Byakweli, & Engels, 2010; Lipper et al., 2010; Pretty, 1995; Tripp, 2001). The most frequently stated reasons according to these authors include: (1) the cost of purchased (formally) seed; (2) the complex, risk prone and diverse environments that are difficult targets for formal research and dissemination systems, (3) inadequate access to markets; (4) the structure and functioning of market channels often unfavorable to those farmers living in remote areas; (5) limited access to financial resources or credit to buy or produce seed; (6) the limited effectiveness of the formal system in providing timely and adequate access to quality seed of improved varieties; (7) the lack of interest or capacity of the research system for developing genotypes that are specifically adapted to farmers production environment, owing to economic and organizational considerations, and (8) farmers are familiar with the seed they grow themselves and know that the variety is adapted to local conditions and preferences. Despite evidence of untapped farmer demand for seed from formal sources, developments in supply and marketing institutions, particularly those that lower farmers' transaction costs (e.g., by providing seed in appropriately-sized packets, with credit and trustworthy information), still remain rudimentary in SSA (Tripp, 2001; Tripp & Rohrbach, 2001). Even with more appropriate supply and marketing strategies, farmers may still have low demand for seed from formal sources. There still needs to be a demonstrable advantage over local supply, in terms of opportunity costs, prices, and benefits to the farmer, for there to be an appreciable demand for formally supplied seed. When formal systems supply seed of no better health or field performance than that from local systems, farmers' demand for its seed will probably remain low.

Limitations of the informal seed system

The informal seed system has several limitations. First, the assumption that seed is usually readily available in informal systems. In such situations, farmers are not well prepared when facing shortages during drought or chronic, which unable to put seed aside from the harvest because of low productivity. The consequential dependence on seed relief may lead to loss of genetic resources (FAO, 2004).

The fact that seed supply of major crops is anti-cyclical when compared to crop production creates another serious limitation to the performance of informal systems. Plenty of seed is available after a highly productive season and, consequently, seed demand is low due to farmers combination of saving seed with their consumption needs. However, seed availability after a poor season is inadequate not only for the individual farmers who rely on farm-saved seed, but also for their social networks (Louwaars, 2007).

The ability of farmers to produce quality seed may be limited by the knowledge system and practices associated with the informal seed system as the seed of some crops is more easily produced than that of others. Varieties may "degenerate" due to lack of adequate knowledge often relates to selection, diseases or processing and storage practices, and maintenance of varieties. The availability of modern varieties of crops may trigger a wider use of variation and a stronger interest in selection by farmers. In several cases, this practice has led to the development of "new farmers' varieties" that can be fairly uniform and well adapted to advanced mono-crop production (Almekinders & Louwaars, 1999). The other main limitation of the informal seed system is a lack of seed certification and regulation. Farmers themselves use their own experience to judge seed quality. Some countries by regulation introduced quality declared seeds (QDS) in the informal seed system to improve the quality of seeds catered by this dominant system (Louwaars & de Boef, 2012; Louwaars et al., 2013).

Despite the limitations that informal seed systems exhibit, their advantages are significant both in developing and industrialized countries. Understanding the system is crucial when considering any reforms in crop improvement, and notably to seed supply reform efforts. Therefore, it deserves recognition by, and the attention of, scientists, development partners, and policy makers (Louwaars & de Boef, 2012; Louwaars et al., 2013). The informal system may also be a starting point for a more commercially orientated seed-sector development at the local level, by sharing technical knowledge and organizing small-scale farmers in commercial seed production and promoting seed business and entrepreneurship (Louwaars & de Boef, 2012; Louwaars et al., 2013).

2.2.3 Boundaries of formal and informal seed systems

Several authors have remarked that activities for managing crop genetic resources are broadly similar in formal and farmer systems: the introduction of new diversity, recombination, seed selection, and seed exchange and storage all occur in both systems, shaping the nature and level of diversity that occurs in the field. However, details of practices for similar activities, may differ between farmers and scientists, with important implications for collaboration between formal and farmer seed systems (Almekinders & Louwaars, 1999).

The boundaries of 'formal' and 'farmer' seed systems are not sharp. Seed can be part of both systems at a given point in time. Farmer varieties sometimes directly lead to modern varieties, through pure line selections, and farmer varieties are the genetic raw material for most breeding. Modern varieties adopted by farmers are often incorporated into existing mixtures of farmer varieties (Sperling, Scheidegger, & Buruchara, 1993), and can come to be seen as a 'local' variety, especially when modern varieties hybridize with farmer varieties materials (Bellon & Brush, 1994; Smale, Heisey, & Leathers, 1995). However, the systems farmers use to acquire seed, and the seed itself, blend elements of both.

Generally, several authors noted three aspects of the intersections between the formal and informal systems: (1) Materials themselves flow between both systems—and create something new and potentially useful. Varietal identities frequently become blurred through several processes (McGuire, Manicad, & Sperling, 1999). For example, many successful so-called "modern varieties" from the formal system may be pure line selections from local landraces or may be incorporated as components of farmers' mixtures. Further, farmers may recognize that modern varieties cross with local materials. Farmers also may come to consider the modern introductions as "local" and eventually group them within the local genetic heritage. All those processes, frequent and on-going, serve to muddle the divide between what is new and old, what is pure or not, what is local and what is modern; (2) Farmers themselves often draw seed from both systems for different kinds of crops; and (3) Farmers themselves sometimes use different channels for the same crop (McGuire et al., 1999).

2.3 Seed supply systems in Ethiopia and their role in food supply

The seed system in Ethiopia, like most developing countries, comprises of both formal and informal seed system. Broadly speaking, Ethiopian seed systems are grouped into two broad categories, formal and informal systems. There also exist community-based organizations and/or farmers seed producing cooperatives that constitute a seed system in an intermediary position, between formal and informal systems (ISSD, 2012). The informal seed system in Ethiopia is highly dominated by individual farm households, while the formal seed system is dominated by the public sector.

2.3.1 Formal seed system

The major players in the formal seed system in Ethiopia are agricultural research institutes and universities; public extension organizations; public seed enterprises; domestic and multinational private companies; private producers or out growers; farmers' cooperative unions, and the certification authority. There are also some licensed seed importers or traders (although still at infant stage) that import and market vegetable seed of exotic varieties of cabbage, carrot, onion, lettuce, celery, and radish (ISSD, 2012). However, there are almost no importers and traders involved in major crops of Ethiopia, like maize and wheat.

The number of seed producers in Ethiopia has increased since the SG2000 and National Agricultural Extension Intervention programs (Abate et al., 2015). Pioneer Hi-Bred ended its relationship with ESE in 1995 but remained in Ethiopia and established itself as an independent hybrid maize seed producer, Pioneer Hi-Bred Seeds Ethiopia PLC. The regional governments of Amhara, Oromia, South (SNNP) and recently Somalia established their own parastatal seed production units—to provide seed for farmers in their regions, including hybrid maize. At the same time, a growing number of private seed producers and agricultural cooperatives emerged to supply hybrid maize seed primarily to the regional bureau of agriculture for distribution through their supply channels to farmers.

Overall, there are around 60 registered seed companies in Ethiopia producing and/or marketing major grain crops in Ethiopia (Mabaya, Emana, Mulugeta, & Mugoya, 2017). These entities include public seed enterprises (ESE, ASE, SSE, OSE), private seed companies (MNCS and local), and farmers' cooperative unions. They vary considerably in scale and capitalization, with ESE being the largest. Several, including SSE and Pioneer Hi-Bred, do not have their own seed multiplication farms but rely solely on contracted out-grower private investors and farmers to produce commercial quantities of seed. Only a minority of producers have any irrigated land on which to produce seed outside of the main rainy season. The smaller producers rely primarily on manual seed processing, with little or no mechanization. Most producers focus exclusively on hybrid maize seed, although some also produce teff, wheat, beans, sorghum, sunflower, and vegetable seed. Out of the 60, 21 seed companies meet the criteria of producing and marketing seed of the major crops, mainly maize, teff, wheat, sorghum and to a limited extent bean. Of the 21 companies, 18 produce maize, 9 produce teff, 8 produce wheat, 3 produce sorghum, and 4 produce beans (Mabaya et al., 2017).

The formal system in Ethiopia aims at developing, multiplying, and making available to local farmers quality seed of improved crop varieties. However, the market figures suggest that the system is only partly successful in making available the right quantity of the right quality seed at the proper moment in time to the right customers, at an acceptable price. The formal system supplies improved seeds that cover less than 10% of the total arable land under major grain (cereals, pulses, and oilseeds) crops in the country (CSA, 2011). The formal system supplied roughly 14.6 % of the total seed supply in 2015–16 (CSA, 2015/2016a, 2015/2016b) compared to 10 % in 2010 (Atilaw & Korbu, 2011; CSA, 2011) and 4.7 % of the total seed supply in 2007-2008 (CSA, 2009). This inevitably constrains agricultural productivity of the country. The formal system has resources for production, marketing and regulation (FDRE, 2006), but there remains a critical shortage of quality seed (Atilaw, Alemu, Bishaw, Kifle, & Kaske, 2016). Seed supply nowhere matches the potential demand. Although much progress has been made in recent years, the Ethiopian seed sector remains less diverse where the public sector dominates and the choice for seed supply is limited to few major crops (Abate et al., 2015). The overall share of private seed production in the country comprises less than 15% of supply (ESA, 2018). The role of private sector is significant only for hybrid maize (Bishaw & Atilaw, 2016). Some foreign seed companies for vegetables such as potato, tomato, and onion, are entering the country. The public and private sectors must have complementary roles for effective seed industry, within the policy framework and some supporting infrastructure that has been set by the government (Loch & Boyce, 2003). The Seed Sector Development Strategy states that "the mission of the public seed enterprises (government parastatals) should be to fill gaps that private companies will be less likely to fill, namely self-pollinating varieties such as wheat and teff, and geographies that the private sector cannot reach" (MoA, 2018a). However, the government parastatals are highly involved in seed production and distribution of the most profitable and commercial crop such as of hybrid maize (ATA, 2014). Despite some merit, the parastatals can crowd out the market and thus stifle competition and private sector investment (Altaye, 2012b; Mabaya et al., 2017).

The formal seed supply systems/chains in Ethiopia, will categorize around 1) public seed enterprises, 2) domestic private seed companies and out growers, 3) MNCs, and 4) seed producer farmers' cooperatives unions. Table 2.1 shows the characteristics of all seed supply system in Ethiopia. Each (formal) seed supply chains that are recognized in Ethiopia are described below:

2.3.1.1 Public seed supply chain

The Ethiopian Seed Enterprise (now Ethiopian Seed Corporation) was established in 1977 to produce and distribute quality seed of improved varieties to meet the national seed requirement of state farms, producer's cooperatives, and private farmers. The federal/national government-owned company Ethiopian Seed Enterprise (ESE) has been the largest supplier of foundation and certified seed in the country until recently. ESE operates a central seed testing laboratory and has six smaller seed laboratories. The company also operates six seed production sites in different regions of the country, with a total area of 6,543 hectares of land under rain-fed conditions. In addition, two seed production sites produce seeds under irrigation (ESA, 2018).

Currently, there are five public seed companies in Ethiopia: The Ethiopian Seed Enterprise (ESE), the Amhara Seed Enterprise (ASE), the Oromia Seed Enterprise (OSE), the South Seed Enterprise (SSE) and the Somali Seed Enterprise (SoSE) (ESA, 2018). The ESE was the only seed company in the country for several decades before some private companies entered the market. The regional public seed enterprises were established recently, starting with OSE in 2009, ASE in 2010, SSE in 2011 and SoSE in 2015. Their statutes foresee them producing different kind of seeds for Ethiopian farmers without profit-making being a primary goal.

Both national and regional level public seed enterprises are legally licensed to produce seed of food and cash crops on its own farms and on contractual basis with private producers and cooperative unions. The SSE did not have own farms but depends on contractual schemes. They are involved in the production of certified seed using known sources of basic seed of improved and released varieties. They depend on public national institutions for breeding materials, including the National Agricultural Research System (universities and research centers) and the Ministry of Agriculture. They produce, process and market seed of major cereal crops, (hybrid maize, wheat, teff), and the seed of other self- and open pollinated crops to some extent. ESE has also experimented with the production of its own maize hybrids, engaging in multi-locational testing of several areas (Abate et al., 2015; Sahlu & Beshir, 2011). However, popularization efforts for the ESE proprietary hybrids have not been extensive, so they are not commonly found in farmer's fields.

The public share of seed production varies by crop, with the public sector producing about 90 per cent of open pollinated varieties, OPVs, (such as wheat, teff, and barley) and about 60 per cent of hybrid maize (Alemu et al., 2010). Of all seed commercially produced in 2008, 83 percent was produced by Ethiopian Seed Enterprise, ESE, (8 percent on ESE farms, 35 percent through contracts with large farms, and 39 percent through contracts with small farmers), while the remaining 17 percent was produced by private producers (Alemu et al., 2010). However, the public share of seed production by crops is increasing in recent years. Of seed of the major crops produced in 2016, the combined market share of government parastatals (ESE and four regional enterprises) by crop is 59% for maize, 62% for teff, 77% for wheat and 83% for sorghum. Although, the country's national agricultural research system has developed and released more than 664 varieties of 50 different crop types, the ESE for example has only been able to produce 111 different seeds of just 26 different crop varieties in 2009 cropping season, but gradually producing 161 number of seeds of 28 different crop varieties in 2016 (self-reported data from senior manager of ESE). Annual supplies of certified seed by the enterprise don't exceed 20,000 tons until 2006 (Thijssen et al., 2008), but gradually increasing and reaching an annual supply of about 27,000 tons in 2016. Wheat and hybrid maize constitute about 86% of the total output of the enterprise. Generally, the formal system is dominated by four large parastatal enterprises (ESE, OSE, ASE, and SSE) contributing 75% of the total volume of seeds of different crops (MoA, 2018a).

Public seed enterprises in general exercise the double mandate of implementing the government's aim of producing sufficient quantities of improved varieties for key crops to facilitate adoption by smallholder farmers and becoming self-sustaining businesses. Hence, they produce seeds of varieties that are needed by farmers – even if they are not the most profitable. On average, about 60% of ESE's seed production has been wheat varieties, though the crop is less profitable for seed producers because of its high seeding rate, low multiplication rate and farmer's ability to recycle seed without significant yield loss. Moreover, public seed enterprises have limited profit margins since affordable and equitable distribution of seed is the primary priority determined by their respective board of governors, as part of their corporate social responsibility (ATA, 2014). More importantly, other government bodies are heavily involved in managing the public seed enterprises, even though they have autonomous budget. Even though the MoA governs ESE, it operates under its own budget. Like ESE, RSEs are governed by respective BoAs. In addition to their own budget, they also receive operational support including deployment of Bureau staff to serve as internal quality control staff for RSEs (ATA, 2014). Sometimes the RSEs also depends on the ESE for processing plant, though also have a conflicting role. Sometimes, there are also cases where the ESE's could not be allowed to sell their seeds until all the seeds produced by the regional seed enterprises get finished (Altaye, 2012b).

The Ethiopian government policy stimulated the transition from subsistence oriented to market-oriented production and business. However, the policy measures and implementation lagged far behind, and instead public sector dominance and continual investment via public sources has been made. As compared to SSA countries, Ethiopia has the highest presence of government parastatals involved in seed production and distribution (Mabaya et al., 2017).

The seed pricing mechanisms and fixation practiced by the government is also likely to affect the profit margin of the different seed-producing firms. For instance, in the ESE cases or even from the emerging regional seed enterprises, the government expects efficient service delivery, as part of the CSR, but also with some profit margins to survive and sustain in business. However, price setting of publicly released varieties do not allow producers to set their own pricing based on market factors. This might compromise the profitability and viability of the enterprises and the government emphasis towards market-oriented seed sector. Hence, a state planning apparatus sets targets for seed supply, defines seed prices, and organizes the quantification of farmer seed “demand” each year without detailed analysis of demand and supply side factors (Altaye, 2012b; Louwaars & de Boef, 2012). Such practice of the Ministry of Agriculture significantly needs to evaluate the responsiveness of the seed system in one hand and for the development of sustainable, reliable, robust, and resilient seed systems in the other hand. Concern should be also given to the potential role of entrepreneurs in the different seed systems, the formal, intermediary, and informal seed systems.

The centralization and formalization of seed supply, seed prices, and quantification of farmer seed "demand" might affect the market orientation of the public enterprises, and more broadly the whole system. Currently, however, there exist policy directions towards the recent initiative of strengthen the process of direct seed marketing from the different suppliers to end users. This might shades light for the development of market oriented seed supply system that satisfies the heterogeneous needs of customers (Bogale, 2015; ESA, 2018).

2.3.1.2 Domestic private seed supply chain

The private producers are legally licensed to produce seed of food and cash crops. They are involved in the production of certified seed using known sources of basic seed of improved and released varieties on a contract basis with government agencies or public seed enterprise (ISSD, 2012). They depend on public national institutions for breeding materials, including the National Agricultural Research System (universities and research centers) and the Ministry of Agriculture. They produce and market seed of mainly hybrid maize varieties, and to a limited extent to other cereals and pulses such as teff, wheat and beans. Mostly, they are out growers to public enterprises, except the recent involvement of some of the producers in direct seed marketing program.

Most domestic companies are small or medium in size and are locally oriented. Based on self-reported data, there are more than 100 (registered and unregistered) private seed producers and/or out growers across regions of Ethiopia that begin their commercial activities in seed production. The market share of domestic firms does not exceed 4% for all crops (Abate et al., 2015). There are only a limited number of private seed producers in Ethiopia whose primary focus is on hybrid maize, for which their current share in 2017-2018 is about 40% of the total volume of hybrid maize seed produced, slightly higher than their share (35%) in 2011 (ESA, 2018).

The role of the private sector has been limited in the past and private seed companies have been affected by limited technical capacity, lack of land and capital, inadequate access to breeder seed of publicly-bred varieties, less competitive seed pricing, and lack of clarity on freely marketing their materials (Alemu, 2010; Alemu et al., 2010; ATA, 2014; ESA, 2018; Spielman, Byerlee, Alemu, & Kelemework, 2010). They also have limitations in accessing new varieties for adding and diversifying their varietal portfolio (Spielman, Byerlee, Alemu, & Kelemework, 2010).

2.3.1.3 Multinational companies seed supply chain

An increasing number of international seed companies are now entering the Ethiopian seed sector, introducing commercial varieties of potato, vegetables, and hybrid maize. They are legally licensed to produce seed of food and cash crops. They use their own material using own R&D efforts. The multinational companies are involved in varietal development and breeding, testing and evaluation, in collaboration with research. In addition, they engage in promotion and demonstrations of improved varieties, and in seed production, quality control, storage, processing, distribution, and marketing. They can also import planting materials from their international mother organization/company. The Ethiopian seed sector is attracting MNCs due to the potential of growth of the agricultural sector, favorable investment environment, and availability of labor force. Few private companies including multinationals introduce the germplasm for local testing, registration and commercialization where there is limited technology transfer (Bishaw & Atilaw, 2016). Up to 2016, out of 1198 varieties released 143 varieties are from collaborations with private sectors (ESA, 2018). Unlike those domestic companies (small or medium in size, and are locally oriented), the production and marketing programs of international companies target the areas of high productivity, such as Amhara, Oromia, and the South Regional states.

Hybrid maize is one of the major crops offered by two MNCs (Pioneer international and SeedCo-Alemayehu Makonnen Farm) in Ethiopia. Although the public hybrids are the most common hybrids grown in the high-potential maize areas of Ethiopia, the market share of the existing MNCs is increasing. Pioneer Hi-Bred Seed has been an important supplier of hybrid seed since the mid-1990s; its annual average market share between 2004 and 2013 was 21.1% (Abate et al., 2015). The combined seed market share of parastatals (ESE, ASE, OSE, and SSE) in 2014 was 63 %, compared to 31 % for Pioneer Hi-Bred Seed, 4 % for community-based organizations (CBOs) and/or seed unions (e.g., Meki-Batu Union), and 2 % for all national small seed companies combined (Abate et al., 2015).

The successful experience of Pioneer in supplying proprietary hybrids to smallholders at prices that are significantly higher than those of the public hybrids is an important indicator of the solid prospects for a more commercially oriented market for hybrid maize seed in Ethiopia (Benson et al., 2014). The median price per quintal in 2013 for PHB-3253 (*Javi*) was ETB 4,000 and for PHB-30G19 (*Shone*), ETB 3,800. Moreover, Pioneer can sell almost all its seed every season and has much less carryover stock than other producers. Pioneer's experience offers strong evidence that farmers, particularly those in high-productivity maize areas, are willing to pay higher prices for high-quality hybrid maize seed. This might support the strength of arguments for maintaining fixed prices for public hybrid maize seed that are pegged to the costs of production. Other competing seed producers acknowledge Pioneer as an industry leader in terms of not just product quality but also business practices. Pioneer performs a good job of building relationships with local farmers, establishing demonstration plots, conducting useful field days at their demonstrations, and following up with the farmers who purchased its seed (Benson et al., 2014). Pioneer also actively introduces new hybrids while pulling hybrids from the market when it has new, improved hybrids to replace those older hybrids. For example, the popular variety named Pioneer, and PHB-30D79 (*Agar*) are replaced by a new variety, PHB-3812 (*Limu*) in 2014. *Limu* variety is promoted in its place. Pioneer's PHB-3253 (*Javi*) has found an important market niche as a green maize variety produced in the shorter *belg* cropping season in the Southern region. Its other hybrids compete directly with the medium-duration public hybrids BH-540 and BH-543, particularly its PHB-30G19 (*Shone*) variety is very successful.

The southern Africa-based regional seed company, SeedCo, has recently started marketing the maize variety Duma (SC 403) through its local representation by Alemayehu Makonnen Farm (Benson et al., 2014). Alemayehu Makonnen Farm offers additional insights into the prospects for a more commercially oriented market for hybrid maize seed. This firm has an agreement with SeedCo, a Zimbabwean seed producer, to multiply and sell SC-627 (*Aberaya*), a medium-duration hybrid. The hybrid has been popularized for 2011-2014 years principally in the *Alaba* Special Zone in the Southern region and neighboring *woredas*. Alemayehu Makonnen Farm has invested in extensive irrigated seed production facilities with the hope of expanding production of additional proprietary maize hybrids alongside improved cultivars for other crops.

2.3.1.4 Farmers unions seed supply chain

At the local/zonal level, seed producers' unions (groups of farmer seed cooperatives) play the multiplication of seeds of food and cash crops at community level. They are legally licensed to produce seed of food and cash crops. They are involved in the production of certified seed using known sources of basic seed of improved and released varieties. They depend on public breeding materials for source seed. They can access from research, public enterprises, and the Ministry of Agriculture. Most of them mainly produce fewer commercial crops such as teff, wheat and beans. Two seed unions (Meki Batu Union, Merekeb Union) have entered for the production and marketing of maize seed in Ethiopia (Abate et al., 2015). The Union with its own staffs and linkage with relevant actors strengthens the members of each cooperative by facilitating access to market information and credit, seeds, and marketing of inputs and outputs, among others. In general, the various seed unions (e.g., for teff, wheat, beans, etc.) and cooperatives mobilize and organize their members to work as out-growers for their own seed union, and/or for public or private seed companies. Moreover, they help members to get the required agricultural inputs (e.g., credit, seeds, fertilizers) and to negotiate seed prices with contracting parties. They also support members on advice in addition for the provision of trainings and technical support in seed production and marketing from the different governmental and non-governmental bodies (Altaye & Mohammed, 2013; Sisay, Verhees, & van Trijp, 2017).

The combined seed market share of seed unions for maize (e.g., Meki-Batu Union) in 2014 was 4% (Abate et al., 2015), while their share in other self-pollinated crops such as teff, wheat and beans in 2016 was 25% (Mabaya et al., 2017).

2.3.2 Informal seed system

The informal system in Ethiopia supplies the lion share of seed of different crop varieties. The system is deeply rooted in local communities, traditions, and networks; often includes farmer-saved and farmer to farmer exchanged seed of important food crops, comprising both local and improved varieties that have been accessed through the informal and formal systems. Local traders or local market are also considered as components of the informal system.

The informal system is extremely important for seed security in Ethiopia. The bulk of seed supply is provided through the informal system, implying its importance in national seed security. About 90% of the seed used by smallholder farmers are local seeds from the informal system (Atilaw & Korbu, 2011; CSA, 2011). Around 60-70% of seed used by Ethiopian smallholder farmers is saved on-farm and exchanged among farmers. The remaining 20-30% is borrowed or purchased locally (Atilaw & Korbu, 2011). The informal seed system supplied roughly 85% of the total seed supply in 2015-16 (CSA, 2015/2016a, 2015/2016b).

From the three seed systems in Ethiopia, most of the seed demand in Ethiopia is delivered through the informal seed system although it has largely gone unsupported, unappreciated, and unrecognized. It could be a rich source of information and understanding of a) how seed demand gets shape (the factors driving it), and b) how seed systems make decisions to meet farmers' demand.

The majority of Ethiopian farmers show a tendency of depending on the informal seed system to obtain seed due to the following key reasons (Atilaw & Korbu, 2011; Mekbib, 2007): (1) it is relatively cheaper and readily available in the farmer's villages just at the time of seed is needed, (2) it allows use of seeds after testing on primary adopter farmers, and (3) it is more reliable and more guaranteed than the formal system. The dominance of the informal system is also explained by other authors (Alemu, 2010; Alemu et al., 2010; Louwaars & de Boef, 2012; Thijssen et al., 2008). These are: (1) the limited effectiveness of the formal system in developing, multiplying and making available the right quantity of the right quality seed at the proper moment to the right customers, at an acceptable price, (2) the inefficiency of the centralized seed distribution and marketing model-the long distribution chain from producers and to farmers, (3) lack of knowledge and awareness of farmers about the existing improved varieties, and (4) a lack of network of independent input dealership and supportive policies that permit greater private participation in agribusiness. Several authors identified social capital and collective action as an important feature of informal systems which involve seed exchanges in the context of social interaction (Almekinders et al., 1994; Badstue et al., 2006; McGuire, 2005; Seboka & Deressa, 1999; Winters, Cavatassi, & Lipper, 2006). They refer to the importance of exchanges within networks built on family, community or other social ties, a form of bonding social capital. This provides connections to individuals and organizations both within and outside the community and might provide greater choices among crops and varieties to plant. Winters et al. (2006) notes that social interactions can be an important aspect even in market exchanges that require some level of trust between buyer and seller and in some cases involve patron-client relationships. Badstue et al. (2006) argued that collective action is an important feature of the informal seed system. They defined collective action as the actions of a well-defined group of farmers linked by a set of rights and responsibilities regarding the mutual supply of seed of a diverse set of farmer varieties, often governed by traditional institutions. They noted that the existence of collective action lower transaction costs for acquiring seed or reduced risk of seed shortages, and as well as providing certain advantages or benefits to farmers compared to working individually. Seboka and Deressa

(1999) in their part indicated that farmer-to- farmer exchange of seed is based on indigenous social networks and family relationships. Mostly, these networks are not governed by a commercial aspect of a seed but rather in the context of mutual interdependence and trust.

Generally, the dominant seed supply system for the majority of crops in Ethiopia is the informal system. For some indigenous crops, such as *Enset, Tef, Anchote*, the whole seed system is handled by the informal system (Mekbib, 2007). Farmers' seed system in Ethiopia has been found resilient, adaptive, and flexible, and it is the more established system that caters for all varieties of seed demand to a wide range of socio-economic groups at the local level. It has been always responsible for on-farm conservation, maintenance, and selection of farmers' varieties (Mekbib, 2007).

2.3.3 Intermediary seed system

There also exist an intermediate seed system, between formal and informal systems. The intermediary seed system takes a lot of forms: (1) seed producing cooperatives (SPCs) that produce and sell mainly for their contracting organizations (e.g., public enterprise, private companies, seed unions and BoA) and a limited extent directly for end customers (both members and nonmembers of the cooperative), (2) seed producing cooperatives performing local seed business (LSBs), and (3) community based seed production organized by different research organizations, NGOs, and development partners to cater new or preferred varieties to ensure seed security for food security. Out of the 80,000 agricultural cooperatives active in Ethiopia, around 5% of them engage on seed production and marketing of diverse crop types (Tefera, Bijman, & Slingerland, 2017). The total number of SPCs in Ethiopia that are engaged in seed production and marketing reaches 327 (FCA, 2016).

Most of the seed producing cooperatives (SPCs) in Ethiopia are out growers to public and private companies, seed unions, and government extension organizations. The total amount of seed produced and distributed by SPCs in 2015 (via the formal system) was 37% of the total distributed seed in Ethiopia (FCA, 2016). A recent development in the intermediary seed system is the emergence of Local Seed Business (LSB). LSB constitutes a seed system in an intermediary position, between formal and informal systems (ISSD, 2012). Local seed business aims to accelerate the transition from farmers' groups and community-based seed production towards farmers' groups becoming more autonomous, commercial, and entrepreneurial in their approach. Since seed in this system may not necessarily be certified, varieties being both local and improved, dissemination varies from bartering to commercial sale. Key players in this seed system are seed producer cooperatives that are associated, to varying degrees, with more formal seed systems (ISSD, 2012). LSBs sell their seeds via diversified market channels: direct selling to farmers (member and non-member), selling via contractual arrangement with intermediaries (public and private companies, seed unions, research), and direct sales to institutional buyers (GOs, NGOs).

NGOs' programs mainly focus on intermediary systems with a community-based and local seed business approach (ISSD, 2012). These NGOs support the establishment of primary cooperatives and unions for achieving local seed security, and consequently attaining food security. Other NGOs offer support for establishing community seed banks and provide emergency or relief seed apart from motivating farmers to engage in genetic resource conservation (Louwaars & de Boef, 2012; Louwaars et al., 2013). They play a role in strengthening the different seed producers technically, financially, and physically. They facilitate access to credit, marketing, and donation of post-harvest technologies, such as seed cleaning machines. In some instances, NGOs have indefinitely secured the market for cooperatives and community-based producers, purchasing seed in bulk at fixed prices and then disseminating seed from its area of production to where it is needed by individual farmers for planting (ISSD, 2012).

Multipurpose cooperatives

Ethiopia is a country with a strong cooperative history (Tefera et al., 2017). During the *Derg* regime (1974-1987), cooperatives were established by the government for political and military purposes, and with the intention to control agricultural production and marketing. After the downfall of this regime, cooperatives were still strongly associated with communist governance. The Cooperative Promotion Agency of the government was founded to control governance of cooperatives and promote establishment of new cooperatives. Currently, cooperatives are established for agricultural growth and to end rural poverty. However, the government still has a prominent role in the promotion of cooperatives and the execution of policies through them. Ethiopia has around 381 cooperative Unions and more than 80,000 cooperatives (Nederlof, 2017). Cooperatives are most often established in cooperation with the government or NGOs. About 74% of them are established by a government body or NGO (Bernard & Gabre-Madhin, 2007).

The structure of cooperatives takes four tiers: the primary cooperatives, which are organized on kebele (neighborhood) level and will be called cooperatives; cooperative unions, which are organized on zonal and woreda (district) level and will be called unions, and cooperative federations and cooperative confederations either at regional or national level. Until recently, neither federations nor confederations were run-in practice. Lately, some federations have been founded, however, they function like unions. In general, cooperatives in Ethiopia are mainly multipurpose cooperatives, 95% of them perform inputs provision as their main activity. Numbers of cooperatives that are active in marketing are very low (Tefera et al., 2017). Many agricultural inputs and basic needs in the country are mostly accessible through cooperatives. Avoiding effects of government interference is not applicable to Ethiopian cooperatives, as most are established by, or with help of, government institutions (Bernard, Spielman, Seyoum Taffesse, & Gabre-Madhin, 2010).

Table 2.1: Characteristics of seed supply system in Ethiopia (Adapted from ISSD Ethiopia Program Framework, 2012)

Characteristic	**Informal system**	**Intermediary**	**Formal system**			
	Farmer-saved	SPCs, organized groups of farmers, local seed business,	Public seed Enterprises	Private seed Producers	Private seed companies	Cooperative unions
General description	Traditional for food and subsistence crops	Emerging with short seed value chains increasingly linked to local markets.	Formal system targeting at major food security crops, primarily linked to governmental seed distribution	Emerging system which still operates as out growers, with a potential towards seed entrepreneurs	Few (national and foreign) companies that operate in maize market; new companies emerging for vegetables and potatoes	Formal system targeting at major food security crops, primarily linked to governmental seed distribution
Type of crops	Local food crops	Food and cash crops	Major food and cash crops	Major food and cash crops	High value crops	Major food and cash crops
Major crops	Sorghum, teff, barley, ensete, legumes etc.	Maize (OPV and hybrid), wheat, barley, beans and other legumes, potato, onion and other vegetables	Primarily maize (hybrid), wheat and teff	Maize (hybrid), wheat and some others	Maize (hybrid) and exotic vegetables	Maize (OPV and hybrid), wheat, barley, beans and other legumes, potato, onion and other vegetables
Type of Varieties	Local varieties	Local and improved varieties	Improved varieties	Improved varieties	Improved varieties (for maize and vegetables)	Improved varieties
Type of seed quality	Farmer-saved, informal	Certified, ‘quality declared’ and informal	Certified	Certified	Certified	Certified
Type of distribution and marketing	Own seed, bartering and exchange, local markets	Variation through contractual, marketing, NGO distribution and bartering	Dissemination	Contractual arrangements towards dissemination and marketing	Marketing	Dissemination

2.4 Marketing functions and roles of actors in the Ethiopian seed supply systems

Functions performed in seed systems include research and development, seed multiplication, storage and processing, quality control and certification, and distribution and marketing. The research and development function develops new varieties that offer solutions for farmer customers. The seed multiplication function produces quantities sufficient to meet market demand. Storage spans the time between harvest and demand while maintaining the quality of the seed; seed is well ventilated, and protected from insects, diseases, pests, rain, and heat. Processing provides clean seed, treated against pests, and packaged, with the required labelling. Quality control and certification provides guarantees about genetic characteristics, purity, uniformity, germination, moisture content and seed health. Distribution provides seed on time and to accessible locations. Marketing communication provides farmer customers with information about varieties, services, and prices. Marketing intelligence provides businesses with feedback from the market and coordinates the responsiveness of seed supply systems.

Functions required to put an offer in the market are rarely performed by a single firm. A single firm may focus on one function or a range of functions. The major players in the seed system/chain in Ethiopia include public agricultural research institutes and universities, public extension organizations, public seed enterprises, domestic and multinational private companies, private producers or out growers, farmers' cooperatives, farmers' cooperative unions, quality control and certification authorities, and individual farm households (of informal seed chains).

Research and development functions are guided by public agricultural research institutes, universities, and multinational private companies. Varieties would be tested in extensive trials before they are proposed for release at regional or national level (ATA, 2014; Belay, 2003). Some selections for local landrace varieties are conducted by individual farm households. Seed multiplication is commonly a multi-generation process (from breeder to pre-basic to basic to certified seed) undertaken over three to five years. Public agricultural research institutes, universities, and multinational companies perform multiplication from breeder to pre-basic seed. Public seed enterprises, domestic and multinational companies, private producers or contract growers, farmers' cooperatives and unions multiply from basic to certified seed for final users/ farmer customers. Individual farm households multiply seed of local landrace varieties for cash and household consumptions. Individual farm households also multiply improved varieties, but do not rigorously follow systematic procedures for seed multiplication. Storage and processing functions are performed by all actors producing different classes of seeds, except for those contract producers (domestic private ones and farmers seed producer cooperatives) that leave the processing function to their contracting organizations (namely public seed enterprises and farmers seed unions). Storage and processing steps are carried out by farm households using traditional techniques. Quality control and certification is performed by public quality control and testing laboratories or quarantine body. Seed producers have their own internal quality control but leave external quality control and certification to the seed quarantine body. Farmers use their own experience to judge quality, purity, germination, moisture content, uniformity, and seed health, but quality control and certification is often lacking (Alemu, 2010). Distribution and marketing are performed by public enterprises, domestic and multinational companies, farmers' cooperative unions, farmers primary cooperatives, local multipurpose cooperatives, private agro dealers, company's sales agents, and public extension organizations (ATA, 2018). Specific marketing tasks such as coordination and feedback are predominately performed by public extension organizations. Distribution and marketing also are carried out by individual farm households, through their long-lasting relationship with other farmers, informal networks, bartering or purchasing from local markets.

In general, despite the different configuration of actors performing marketing functions, the performance of the Ethiopian seed system is, however, below its potential. One important reason is a lack of attention in developing effective and efficient seed systems. A lack of MO insight in the business and/or value chain function is a missing link in the Ethiopian seed sector. There is also a limited systematic study on market orientation and performance in complex chains (of informal economies) in developing and emerging markets.

We elaborate the various seed system functions of Ethiopia below.

1. Agricultural Research and Development (R&D) Function

The specific tasks performed in this function include a) germplasm development- collection and conservation, b) variety development and testing, c) variety release and registration, d) maintenance of varieties, and e) pre-extension demonstration and promotion of newly released crop varieties.

A number of authors have remarked that agricultural research functions are broadly similar (or occur) in formal and informal seed systems (Almekinders & Elings, 2001; Jarvis & Hodgkin, 2000). In the formal seed system, the research functions are guided by scientific methodologies operated by public or private sector specialists. In the informal seed system, they are operated by individual farm households that often lack systematic breeding and selection of local landrace varieties.

The availability of modern varieties of crops may trigger a wider use of variation and a stronger interest in selection by farmers. In several cases, this practice has led to the development of “new farmers’ varieties” that can be uniform and well adapted to advanced mono-crop production (Almekinders & Louwaars, 1999; Salazar, Louwaars, & Visser, 2007). There also exist integrated approaches in breeding or farmer participation in plant breeding (Louwaars & de Boef, 2012). These methods aim at generating genetic material that better suits the small farmer and production environment. They concentrate on obtaining information on selection criteria directly from farmers and on screening of germplasm in farmers' fields in the final stages of selection.

Germplasm development- collection and conservation

In Ethiopia, germplasm development- collection and conservation, have been dominated by institute of biodiversity, public agricultural research institutes and state universities. These institutions select varieties from landraces and imported materials from international agricultural research centers (e.g., CIMMYT, ICARDA, etc.), and further optimize them to local Ethiopian conditions. However, there are weakness on germplasm development/function. These problems are related to (1) coordination and integration between federal and regional research institutes, (2) capacity and capability to develop germplasm (no pre-breeding and genetic enhancement), (3) region-based organization responsible for plant quarantine organization and conservation of plant genetic resources, and (4) accountability and responsibility (Alemu, 2010; Altaye, 2012a; ATA, 2014; ESA, 2018).

Variety development and testing

The Ethiopian government has an enabling policy framework for agricultural research and technology generation and is fully supporting the research system by allocating resources at various levels. In Ethiopia, the major actors performing crop varietal development include 7 public RARI'S (Regional Agricultural Research Institutes); national public EIAR (Ethiopian Institute of Agricultural Research) (under EIAR there are 17 Agricultural Research Centers/ARC); 4 HLIs (Higher Learning Institutes/Universities); and Private companies, especially the multinational companies like Pioneer and Sedco. There is no locally organized private breeding company in Ethiopia. To release/register a new variety, the private sector is expected to work with the public research institutions in the evaluation of its elite varieties. Public owned plant varieties are literally and legally opened for use by all registered seed producers though there are administrative problems in the implementation process (ATA, 2014; ESA, 2018). Most domestic private companies source their foundation seed from the above public-sector institutions. The maize and wheat breeding programs are supported by the International Maize and Wheat Improvement Center (CIMMYT).

Plant breeding and releases practiced by the formal system may not lead to the development and availability of a broad range of varieties to customers, particularly for smaller, more subsistence-oriented farmers. In Ethiopia, most of the generated improved crop varieties by the public research system are limited to specific agro ecologies. About 92% of released varieties available for seed production in Ethiopia are adapted only for high rainfall areas (in high altitudes). Within cereals, which make up a significant share of staple food crops, 91% of released varieties are for high potential areas (CSA, 2011). Therefore, new varieties are needed for low altitude and for all other agro-ecologies that have limited rainfall. Similarly, farmer's preference for a given product (seed) is driven by so many factors. Likewise, there is a claim from the end users/farmers that some of the developed and disseminated seeds of improved crop varieties by the formal system are not demand-driven, thereby affecting the adoption and wide use of improved seeds (Alemu, 2010; Altaye, 2012a; ATA, 2014). Out of the formally released improved crop varieties (around 1,200 varieties of 9 different crops) about 10% of the varieties were adopted by farmers (MoA, 2017).

The main weakness of variety development in Ethiopia include: low generation of improved varieties for low-rainfall/marginal areas; lack of baskets of varietal options; lack of participatory plant breeding; limited participation of farmers and private sectors; limited attention on farmer's needs; insufficient capacity and capability; lack of incentives and plant breeder's right; less maintenance of breeder seeds, and accountability and responsibility (Alemu, 2010; Altaye, 2012a; ATA, 2014; ESA, 2018).

Variety release and registration

Since 2004 variety release and registration has become the responsibility of the MoA, Animal and Plant Health Regulatory Directorate (PHRD). Varieties would be tested in extensive trials before they are proposed for release at regional or national level (ATA, 2014; Belay, 2003). Before release by any research organizations, universities, and seed companies, the variety is tested and evaluated by NVRC (National Variety Release Committee) for 2-3 years in 3-5 locations of the respective local agro ecological environment. The minimum time for release ranges from 6-8 years, excluding the period for germplasm development. In Ethiopia, the major actors performing variety release include the NVRC under MoA (Ministry of Agriculture) and assisted by the technical committee (TC). The NVRC members include as representatives often directors from: MoA, EIAR, ESE (Ethiopian Seed Enterprise), RSEs (Regional Seed Enterprises), RARI'S (OARI/Oromia agricultural research institute, ARARI/Amhara regional agricultural research institute, TARI/ Tigray agricultural research institute, SARI/ Southern agricultural research institute, and the 4 HILs (Hawassa, Haramaya, Jimma, and Ambo universities).

Since the establishment of research centers in 1970s, the country's national agricultural research system (NARS) has, up to 2009, developed and released more than 664 varieties of 50 different crop types (MoA, 2009), but is gradually increasing the rate of technological development by releasing 1198 varieties of 9 different crop types up to 2016 (recommended or released by NVRC-MoA) (Bishaw & Atilaw, 2016; MoA, 2017). Compared to other East and Southern African countries with much smaller national populations the country's research output, as measured by number of varieties released, is low (Mabaya et al., 2017). For example, between 2013 and 2015, EIAR released a total of 37 varieties for the four major crops in Ethiopia: 12 for maize, 15 for wheat, 3 for teff, and 7 for sorghum. As compared to Africa, other developing countries manage to release an average of three to six new varieties per crop per year (Gisselquist et al., 2013). Across Sub-Saharan Africa, countries currently average less than one new variety released per year across all food crops (Gisselquist et al., 2013). The low rate of variety release in Ethiopia can be attributed to inadequate breeding facilities and the lack of a strong and autonomous variety release and protection system that motivates local breeders (Mabaya et al., 2017).

The main weaknesses in the crop variety release and registration practices in Ethiopia include: limited commitment and active participation of all the NVRC members; limited involvement of stakeholders: public and private producers, farmers and agro-processers in NVRC and TC; ineffective notification of newly released varieties; less encouragement of variety developed through participatory plant breeding; poor performance of some of the released varieties as compared to landraces; and accountability and responsibility (ATA, 2014; Belay, 2003).

Maintenance of varieties

All released varieties need to be maintained to ensure genetic quality and higher productivity. In Ethiopia, the national variety register comprises the name of a variety maintainer, and usually NARS which bred the variety. NARS are legally and technically responsible for maintenance as well as breeder and pre-basic seed production of the variety. The public and/or private companies, and farmers seed unions are mainly involved in basic and certified seed production. Public research, higher learning institutions and some domestic private companies are producing early generation seeds (EGS), while MNCs rely on foreign varieties and maintenance is done by respective companies. There are different approaches in variety maintenance to ensure varietal purity and identity based on pollination habit of crops. For instance in hybrid maize seed maintenance, the number of heads or plants used can be determined by the number of plants that can adequately represent a variety (ESA, 2018).

Pre-extension demonstration and promotion of newly released crop varieties

Once the research organizations, universities, and seed companies develop, release, and register a new improved variety, the task of the seed system is to promote the varieties under farmers' fields and research stations. The above organizations in collaboration with other seed system actors enhance awareness about the new varieties by conducting on farm demonstration of the newly released varieties in small scale at different localities of farmers (Alemu, 2010; ATA, 2014). The major actors performing this activity include research centers and universities through farmers research and extension group (FREG); regional, zonal, and district office of agriculture via model farmers' development groups and farmers training centers (FTCs); multinational companies via own demonstration sites; NGOs and agro-processors via model farmers groups found on different agro ecologies, often food insecure and lowland areas by certain NGOs.

The farmers' adoption for certified seed is increasing in Ethiopia. This is a result of large-scale popularization and awareness campaigns conducted through the collaboration of MoA, EIAR, BoAs and international partners such as Sasakawa Global-2000, CIMMYT, ICARDA and others. In response, more seed producers have emerged and increased seed supply significantly. As compared to domestic and public companies of Ethiopia, the multinational maize company namely Pioneer Hi-bred has been promoting all varieties aggressively in farmers' fields and own demonstration sites. Almost all seeds provided by pioneer company are availed and sold to farmers, while most public varieties with limited promotion remained unsold. This is mainly due to the high quality of seed in terms of productivity for pioneer and due to the wide promotion of varieties (Benson et al., 2014; ESA, 2018). However, most of the improved seed varieties developed by public institutions were not properly promoted hence the adoption of new varieties are low. This is related with low interest of the domestic companies since they are competing for the same public owned varieties. Seed producers need to work with research institutes to increase the crops/varieties inflow in their seed business. Government and development partners (e.g., NGOs, projects) intervene in areas where producers require intensive and organized support.

Despite the different configurations of actors performing varietal promotion, farmers' awareness of improved varieties in Ethiopia is low (Altaye, 2012a; ATA, 2014). Inadequate varietal demonstration and promotion, long gestation period between variety release and significant adoption, focus only on narrow agro-ecology, weak integration, and lack of clear-cut mandate among actors, lack of sustainability, accountability and responsibility are some of the challenges affecting varietal promotion.

A conducive extension system that offers timely information and promotion of varieties is needed. Ethiopia's extension worker to farmer ratio is 1:476, compared to 1:1000 for Kenya, 1:1603 for Malawi and 1:2500 for Tanzania. However, farmers awareness of improved varieties is very low in the county. Thus, increased use of improved seed varieties and other inputs like mineral fertilizers, coupled with increased extension services are the key factors promoting higher agricultural productivity in Ethiopia (Abate et al., 2015).

2. Seed Multiplication Function

Once the formal R&D system develops, releases, registers and demonstrates a genetically improved variety, the task of the seed system is to multiply and produce quality seeds in bulk for users (Maredia et al., 1999). The same holds true for the informal seed system where farmers themselves multiply local varieties as well as improved varieties obtained from the formal system.

EIAR is the major source of nationally registered improved varieties while RARIs have released several varieties with specific regional adaptations. Most privately registered/proposed varieties are foreign affiliated once. However, the supply of varieties and subsequent early generation seed (EGS) distribution by these organizations is limited and far below the demand (ESA, 2018).

In Ethiopia, most seed producers focus on the production of public maize hybrids (BH-540, BH-543, and BH-660), and three hybrids produced by Pioneer Hi-Bred MNC, PHB-3253 (*Javi*), PHB-30G19 (*Shone*) and PHB-3812 (*Limmu).* The hybrids are well known by farmers and the extension services, and producers are assured a reasonably secure market through seed supply contracts for the hybrids entered with the regional BoAs. Seed producers rely on EIAR for source seed of the hybrids' parental lines.

In Ethiopia, there are no exclusive production or licensing agreements related to the use of the public hybrids or their parental lines: those who wish to produce them are free to do so (Benson et al., 2014). Before the planting season, the parastatal seed producers—ESE and the seed enterprises of Amhara, Oromia, and South, in consultation with the MoA and regional BoAs, jointly establish the prices at which they will be selling the different public hybrid maize seed types that they produce. All producers of these hybrids, whether parastatal or private producers, generally respect these set prices, except adding the costs of transportation and incentives for their dealers/sales agents.

Multiplication of EGS (breeder, pre-basic and basic seeds)

In the formal system, multiplication of seeds is commonly a multi-generation process (from breeder to pre-basic to basic to certified seed) undertaken over three to five years. Research organizations and seed companies that have own R&D are mainly the original source or multipliers of breeder and pre-basic seed. While basic and certified seed multiplication activities are performed by private and public companies, contract growers, and farmers organizations.

The Ethiopian seed law permits that all holders of certificate of competence can access breeder, pre-basic and basic seeds of registered varieties from producing institutions (Ethiopian seed proclamation no 782/2013). Nevertheless, commercialization of public-bred varieties remains the big challenge. This is mainly due to lack of clear policy guidance, overlapping institutional responsibilities and absence of binding contractual agreement in EGS production and supply (Atilaw et al., 2016).

The demand for early generation seeds (EGS) has increased greatly due to the increasing demand for certified seed in the country. However, the quantity of EGS produced by research and public enterprise falls far short of the demand. Moreover, EGS allocation brings an institutional problem in that it is not distributed based on the agreement entered between agricultural office/bureau and the proposed producer of EGS. Hence, the volume of production, quality, and delivery of EGS continues to be one of the major bottlenecks in the Ethiopian seed sector. The total EG seed production by EIAR was 6,000 quintals (600MT) seeds of nine crops, while maize and wheat being the dominant crops produced by EIAR. This is due to the fact that the demand of certified seed in the country is dominated by these two crops (Atilaw et al., 2016). The demand for foundation or EG seed by seed companies of the popular hybrid (BH660 and BH540) is rapidly growing. Currently, ESE produces pre-basic, basic, and certified seed of 25 crops and 137 varieties (Atilaw et al., 2016). In 2015, ESE produced 3,290 tons of pre-basic seeds and 5,239 tons of basics seeds of cereals, pulses, and oil crops. The enterprise produces basic seed in its seed farms located in Gonde-Eteya, HawassaShallo, Ardayita, Chagni and Kunzila farms. The basic seed is further multiplied to certified seed on its own farmers or through contractual agreement with state farms, private farms, and farmers (Atilaw et al., 2016). In 2012 Ethiopian Seed Enterprise (ESE) produced 6 MT of certified seed; by 2014 five companies, including Amhara Seed Enterprise (ASE), Avallo, ESE, Oromia Seed Enterprise (OSE), and Southern Seed Enterprise (SSE) produced nearly 2,900 MT (Abate et al., 2015). Only two OPVs (Melkassa2, Melkassa4) have been used extensively in the last several years. Two new ones (Melkassa6 and Gibe2) were recently introduced into the market (Abate et al., 2015).

The domestic private seed companies, and those private out growers (i.e., out growers to their contracting party) in Ethiopia faces serious limitations in accessing pre-basic and basic seed for multiplication, or even new varieties for adding and diversifying their varietal portfolio. Seed for self-pollinated crops faces constraints on both the demand side and the supply side.

On the demand side, there is an insignificant, perceived advantage over the production of seed through farmer-saved and exchange options, which generates little incentive to purchase quality seed. Only in the case where new varieties are made available, will farmers perhaps be interested in purchasing quality seed (ISSD, 2012). On the supply side, the production of seed of self-pollinated varieties faces similar productivity gaps as hybrid maize, regarding demand assessments, and is currently a loss-making enterprise for public seed enterprises. This prevents the parastatal public Enterprises from significantly expanding supply, and the private companies from seeing the potential for greater profit in marketing such crops varieties.

Certified seed production

In Ethiopia, seed production is dominated by the public sector. The private sector, and mainly the multinationals (Pioneer Hi-bred, Seedco), primarily focuses on hybrid maize. There is a substantial increase in the amount of certified seed supply in recent years. In the 2016/17 crop season, a total of 81 varieties of cereals (five species), 19 varieties of grain legumes (seven species) and seven varieties of oilseeds (four species) crops were produced. The total of certified seed production was 1.282 million quintals out of which about 13% was supplied by private producers and the rest is supplied by public enterprises. In the same year the supply of cereals was 94%, and that of pulses is 5% and the remaining 1% is oil crops (ESA, 2018).

Parastatal enterprises and small-scale private producers, including farmer cooperative unions and primary cooperatives, handle seed production in Ethiopia. The four large parastatal enterprises [Ethiopian Seed Enterprise (ESE), Oromia Seed Enterprise (OSE), Amhara Seed Enterprise (ASE), and South Seed Enterprise (SSE)] supply 75% of cereals, pulses, and oil crops. The total of certified seed production in 2018 was 1.35 million quintals, 44% of the target in the growth transformation plan -GTP (3.05 million quintals). Maize and wheat comprised 86% of this total while their area coverage was 30.17% only (MoA, 2018a).

A relatively small number of varieties dominate seed production, and the rates of varietal change as well as seed replacement are low. Of the 1198 varieties released, only 10% (mainly wheat and maize) are commercially produced (MoA, 2018b). With few exceptions, the seed producers in Ethiopia do not have the capacity to supply enough seed to farmers and cannot withstand shocks that may arise from market, production, competition, and globalization. The capacity of the four parastatal seed enterprises is also limited by a physical infrastructure that has little contribution towards building resilience to shock.

The quantities of seeds multiplied by different organizations is increasing, but still there exists a critical shortage of quality seeds in Ethiopia. Supply nowhere matches overall potential demand. The current average annual national seed supply of improved varieties for most food crops covers less than 10% of the total agricultural land area, as compared to 25% in many other African nations (ATA, 2013/2014). The main weaknesses of seed production in Ethiopia include (Altaye, 2012b; ATA, 2013/2014, 2014; ISSD, 2012): (1) Insufficient capacity to respond rapidly to farmer needs, (2) Lack of clarity of institutional mandates and loose integration among the different seed class producers, (3) Skilled manpower, financial and physical constraints/shortage of land, irrigated land, equipment for maintenance system, (4) Insufficient quality and quantity, (5) Lack of clear and well communicated quality guidelines and standards, (6) Inadequate involvement of private seed producers, often poor business and regulatory support for private sectors, (7) Focus on a limited crops and varieties, (8) Limited demonstration and popularization (PVS) of new varieties, (9) Lack of constant review of portfolio of newly released varieties and to implement a strategy for increasing adoption of priority varieties in appropriate agro-ecologies, (10) Inaccurate seed demand planning of all classes of seeds, (11) Lack of well-established seed section within research organizations and companies, and (12) the lack of experimenting with a business to business approach, e.g., linking research to a farmer group for pre basic and basic seeds production.

3. Seed Storage and Processing Functions

After seed is multiplied, it may be stored in a favorable environment until processing or enter directly into the processing system in the formal system. Contaminants and poor-quality seed are discarded or cleaned, and seed is dried, sized/labelled, treated, and packaged. These steps maintain the physical qualities of seed to enhance seed appearance and germination rate, deter seed-borne diseases, prevent insect infestation, and facilitate planting. In the formal seed system, seed processing is a mechanized activity using specialized equipment, facilities, and products. Seed processing can be an in-house activity for many seed companies, or it can be carried out as a specialized activity by processors. The seed processing plant is usually one of the largest capital investments in a formal seed system (Maredia et al., 1999). However, in the informal seed system, the storage and processing steps are carried out by farm households using traditional techniques. Farmers simply use traditional materials and own labor for processing and storage of seed. They sell the seed un-dried and un-cleaned. The small farmers mainly apply Sun drying. Very few farmers do clean by winnowing or by soaking for pre germination. The storage and processing functions might be constrained by farmers' limited capacity of standard storage facilities and processing.

Several factors influence the producers of the formal seed systems. Limited seed processing machines (cleaning, grading, and packaging), and a lack of standard storage and its associated facilities affect the different seed producers. For example, the small private companies, and even the public seed enterprises, largely depend on rented seed cleaners and stores, which raises the cost of processing and storage. Lack of standard storage and processing machines, low standard seed cleaners and seed stores, old and high maintenance cost for seed cleaners, lack of processing different often small package sizes are some of the challenges in the storage and processing functions in the formal seed systems (Altaye, 2012b; ATA, 2014). Based on personal reported data, staff turnover of experienced staffs (e.g., as in the case of ESE) is also one of the main problems affecting the processing operation of seeds.

4. Seed Quality Control and Certification Function

The seed quality control function is cross cutting the whole seed value chain starting from breeding to distribution and marketing of seeds. In the formal system, the different producers including research, seed companies, public enterprises, private producers, and farmers' cooperative unions', undertake seed quality control internally by their own staffs. Public extension organizations via public seed laboratories or quarantine bodies, however, undertake external quality control of the whole producers before formal certification is granted.

Seed quality assurance in Ethiopia follows two approaches (ATA, 2014; ESA, 2018). The first is a well-organized and planned quality assurance starting from source seed, land allocation and isolation, agronomic performance, and final seed laboratory test-based activity. This is highly linked with seed laboratories that are both under federal and regional bureaus of Agriculture. The quality controlling function considers verification of seed source, field inspection and sampling, seed testing against quality standards, and assessment of expectation to meet minimum field and laboratory standards. If the producers fulfil these criteria, the certification agency provides them certification for the produced seeds for final sales to their respective customers. They ensure seeds that fulfill the standards of quality seed, i.e. (i) true to type (ii) required purity, (iii) required germination rate, (iv) required moisture content, and (v) required seed health. The second mechanism, which is mainly relevant to community-based seed production (CBSP) is Quality Declared Seed. Such quality assurance mechanism is through the support of seed and quarantine experts at zonal and district levels for the seed certification and quality control activities of CBSP. Both the Ministry and regional authorities issue certificates of competence for those people or organized groups willing to start seed-related businesses. In the informal seed system, there is no certification, quality assurance, standardization, and regulation (Alemu, 2010). Farmers generally manage their seed using their own experience to judge quality, purity, and uniformity.

About 13 seed laboratories and around 32 public seed inspectors exist in Ethiopia (Mabaya et al., 2017). Currently, there are 15 seed laboratories across regions and a temporarily located National Seed Testing Laboratory (NSTL) which is a member of ISTA laboratory although not accredited (ESA, 2018). Several public and private seed companies have their own seed inspectors, though they are not licensed by the government. There exists lack of accreditation of at least those bigger companies like the MNCs (Louwaars et al., 2013). The role of the in-house inspectors is to monitor their company's seed quality and obtain quality assurance from the public inspectors of the Bureaus and MoA. Given the large size of Ethiopia and the wide distribution of seed producing regions, the number of inspectors is low compared to most African countries (Mabaya et al., 2017).

A lot of factors affect the quality control and certification practices in Ethiopia (Altaye, 2012b; ATA, 2013/2014, 2014; ESA, 2018; ISSD, 2012), such as: (1) No system of quality assurance to support the quality improvement of the informal system that supplies about 90% of the national seed requirement, (2) Few seed testing laboratories and inspectors as compared to other African countries, (3) Limited capacity and capability of seed laboratories, materially and technically, (4) Seed sold without undergoing quality tests, (5) Limited capacity and capability of producers, (6) Lack of timely inspection, on-time reporting, and certification tags are rarely attached to seed bags, (7) Absence of independent seed certification and quality control bodies, though gradually emerging, (8) Absence of clear cut procedures, system and mandates, (9) Inappropriate cost structure/no certificates fees for services, although gradually emerging, (10) Limited focus on point-of-sale inspection, often considering only producers field and store, (11) Weak linkage and integration among actors, inaccessibility of farm to road to seed farms, and poor communication between seed companies and quality control offices or laboratories, (12) Lack of a well-established internal quality control system, (12) Lack of clear and well communicated quality guidelines and standards for different classes of seeds, (13) trust and commitment on serving customers, and (14) Lack of accountability, proper label and traceability of all classes of seed for tracking poor quality seeds.

5. Seed Distribution and Marketing Function

Seed distribution and marketing functions involve the supply of sufficient quality and quantity of seed in a timely manner to the right customers in the most convenient place, and at an acceptable price. It also includes promotion or information provision, provisions of improved seed marketing services before, during and after sales.

In the formal seed system, seed distribution and marketing is carried out by government agencies, farmers' cooperatives and unions, private seed dealers, and community-based organizations like NGOs (Maredia et al., 1999). In the informal seed system, this function is carried out by individual farm households, mainly through their long-lasting relationship with other farmers or through informal networks based on exchange with, gift or through bartering, purchasing from local markets, or using own saved seed.

Seed system performance is often measured by the efficiency of distribution and marketing, as it connects all the stages of seed supply with seed demand, reflecting both the strengths and weaknesses of linkages between various components of the seed value chain (Maredia et al., 1999). Seed distribution is also an activity that potential seed users can directly observe and compare with alternative formal and informal distribution systems. Over-centralization, poor management, and high production costs are common problems in public seed distribution systems, which often lead to losses, late delivery, deterioration in seed quality, and unmet seed demand in remote areas (Maredia et al., 1999). Private sector seed distribution is often more efficient, but private firms usually confine their operations to commodities and areas where there is a strong interest and assured demand for seed and profits are likely to be greater (Louwaars & de Boef, 2012; Louwaars et al., 2013; Maredia et al., 1999).

In Ethiopia, seed distribution and marketing are highly centralized and regulated by the government through Inputs Marketing Directorate (IMD) of the MoA at the federal level and the Input Marketing Processes of regional BoA. The key market actors are public seed enterprises, MNCs, seed unions and domestic private firms as suppliers, and the cooperative unions and their respective primary cooperatives, and local extension organizations and private dealers as distributors and marketers.

The certified seed demand assessment and forecast is performed by public extension organizations based on information obtained via the local level extension organizations. Often such demand assessment is characterized by its mismatch with actual seed supply that leads to shortage and/or surplus supply at different times (Alemu, 2010).

The seed price for public enterprises is determined by federal and regional seed enterprises in a joint meeting which is conducted once in four months on a rotational basis. After then each enterprise will report the price to its respective board of directors for approval, without any changes. The set price is communicated to the key stakeholders and will be used accordingly. The overall direction in price setting is to sell the certified seed at the same price throughout the country, while considering the differences due to overhead, transportation, and handling costs. However, the private sector such as Pioneer MNC can set their own seed price without any external interference based on market forces, but they need to follow the decisions made by the public sector. The Ethiopian formal seed sector annual seed selling value transaction is estimated to be more than ETB 5 billion (self-reported data from the MoA).

The price setting mechanism has both advantages and disadvantages. The advantages are that it: (i) limits the entrance of more intermediaries in the market, which helps farmers to get seed at reasonably better prices, (ii) enables farmers with limited access to markets (those in distant areas with poor road) to purchase seed equitably, and (iii) promotes group marketing especially through membership in cooperatives. The disadvantages are that it: (i) limits the competitions among the different seed producers, (ii) creates disincentive for seed producers to work and invest in their own distribution systems, and (iii) disincentives producers to work for more quality product as price setting does not consider the quality of the seed produced (Bishaw & Atilaw, 2016). The consequences of such price controls and price ceilings of this nature, that fix prices below market equilibrium, are entirely predictable. They lead to shortages in supply, and disincentives for private investors to enter the market.

In Ethiopia, the seed distribution and marketing function is unable to guarantee farmers' access to seed of improved varieties, in the right quantity, of the right quality, and in a timely manner, mainly because of the highly centralized public seed distribution and the ineffective seed demand planning and forecasts practices performed by public extension organizations (Alemu, 2010; Bogale, 2015). The primary challenge for the distribution and marketing system in Sub-Sahara Africa is to make seed available to a range of seed users on time and at a low cost (Maredia et al., 1999). Meeting these challenges will require integrating the commercial and development forces that drive formal seed systems with the versatility, elasticity, and sustainability of traditional seed systems (Maredia et al., 1999). However, there are a lot of improvements in the Ethiopian seed industry in relation to distribution and marketing functions.

In 2011, the ISSD program of the Netherlands introduced a Direct Seed Marketing (DSM) innovation model in the Ethiopian seed sector with the aim to strengthen the process of DSM from the different suppliers to end farmer customers. It does so through supplier's own retail outlets, licensed private dealers, sales agents, and farmer cooperatives on commission basis. Starting with two districts and 1 crop/hybrid maize in 2011, DSM covers 228 districts of Ethiopia by marketing eight different types of crops in 2018 (ATA, 2018). Thus, seed marketing has shifted from a centralized distribution system in 2010, with a long and inefficient chain, to a more market-oriented one. Currently 60% of field crop seed is marketed directly by producers; while Regional BoA and Federal MoA (MoA, 2017, 2018a) allocate the remaining 40% for further distribution of certified seeds for farmers through local agricultural extension offices, farmers cooperatives, and multipurpose cooperative unions.

With DSM, producers sell their seed, through agents or their own shops, to farmers in the designated *districts*. In 2018, 60% of the seed is marketed through DSM in proportionally less districts (228), while the remaining 40% is distributed, through centralized systems in the four major regions, in more *districts* (more than 450). Currently, in the four regions, 76% of maize seed and 62% of wheat seed is sold through DSM, but in far less districts (228) compared to the total (about 670 districts) (MoA, 2017, 2018a). This shows that if access were created, farmers would use more certified seed, which, in turn, will contribute to increased production and productivity. In general, farmer customers, policy makers and stakeholders are satisfied with the DSM model. As compared to the centralized public seed distribution and marketing model, DSM is perceived to be better by making available to local farmers high quality seed of improved crop varieties, preferred by farmers, in sufficient quantities, in a timely manner, to accessible locations, an affordable prices, supported by varietal information and improved seed marketing services before, during, and after sales (Bogale, 2015). Seed marketing directive has now been developed with new seed proclamation, regulation, and DSM technical guideline. The seed marketing directive developed ensures both private and public seed producers and sales agents to freely participate in the distribution and marketing of their products and services. The seed marketing directive developed is submitted to the MoA input marketing directorate so as to facilitate the endorsement process (ESA, 2018).

Seed sector coordination and latest developments in seed policies of Ethiopia

The Federal Ministry of Agriculture and Rural Development (MoARD)-now Ministry of Agriculture and Natural Resources and Regional Bureaus of Agriculture and Rural Development (BoARD)- now Bureaus of Agriculture and Natural Resources coordinate the public and/or formal seed sector with an impact on both the research institutions and public seed enterprises, for which both federal and regional entities exist. In this institutional landscape, a complex of organizations and institutions operate, each responsible for parts of components of the public seed value chain (ISSD, 2012). There is an industry body for the formal seed producers in Ethiopia, the Ethiopian Seed Growers and Processors Association-now Ethiopian Seed Association/ESA, which primarily serves to represent the interests of seed producers and to bring about reforms to the seed sector (Benson, Spielman, & Kasa, 2014). The association has 27 active members, comprising 22 private seed companies (20 of which are local), four public seed enterprises, and one cooperative union (Mabaya et al., 2017). The association has 34 members and has an essential role to play in representing the interest of seed companies, and working closely with policy-makers, development partners and relevant stakeholders (ESA, 2018). The association has given due focus to bring together all concerned seed value chain actors and domestic and international companies involved in different crop commodities to share experiences in the promotion of the seed industry in the country. In doing so, the ESA has been organizing forums to discuss the progress, challenges and suggest possible intervention areas for promoting the seed sector (ESA, 2018).

Seed system operationalization involves strong coordination across stakeholders both internal and external to the agricultural sector, as well as strong leadership and oversight (Sombilla & Quilloy, 2017). In principle, these roles should be within the auspices of the MoA. However, ad hoc teams such as the Seed Unit and National Seed Advisory Group (NSAG) at national level and regional seed core groups and seed units at regional level mainly run the coordination.

Ethiopia officially adopt a Pluralistic Seed System Development Strategy (PSSDS) in 2017 as an alternative to the dominant linear approach, i.e., formal seed system development (FDRE, 2019; MoA, 2019.). The strategy is pluralistic and proposes three major seed systems operating in the country (informal, formal, and intermediate) and promotes complementarity between value-chain components of each seed system. The Ministry of Agriculture adopted the PSSDS and the government subsequently revised the national seed policy, and developed/amended a series of laws and regulations concerning (a) A plant breeders rights law or a plant variety protection, (b) A national seed law and regulation for commercial seed production and distribution of certified seeds;, and (c) A QDS scheme and community based seed (CBS) production directive for multiplication and distribution of non-certified seeds of either improved or local varieties within the local community, and (d) several other service and governance related directives concerning seed marketing.

2.5 Literature review and theoretical frameworks

2.5.1 Literature review

This section presents the key concepts used, especially on market orientation, marketing functions or market channel functions, supply chain management (SCM), value chains and a review of studies closely related to our study/thesis.

Market orientation (MO)

Researchers have identified MO as a key ingredient in an organization’s successful adaptation to environmental changes and challenges (Kirca, Jayachandran, & Bearden, 2005; Tajudin, Musa, & Musa, 2012). Much of the MO research has conceptually and empirically supported the hypothesis that MO has a positive influence on organizational performance (Deniz Eris, Ozmen, & Neczan, 2012; Homburg & Pflesser, 2000; Kirca et al., 2005; Kohli, Jaworski, & Kumar, 1993; Narver & Slater, 1990; Verhees & Meulenberg, 2004). This relationship has been found in research on public, private, and service sector organizations regardless of the size. Market orientation has a lot of consequences such as customer consequences and innovation consequences. Customer consequences include the perceived quality of products or services that a firm provides, customer loyalty, and customer satisfaction with the organization's products and services (Kohli et al., 1993). Market orientation enhances customer satisfaction and loyalty because; a) market-oriented firms are well positioned to anticipate customer needs and to offer goods and services to satisfy those needs (Slater & Narver, 1994a), and because b) a market orientation involves multiple departments sharing information about customers and engaging in customer-linking activities designed to meet customer needs (Kirca et al., 2005). Day and Wensley (1988) assert that companies that offer products or services with a higher perceived value, at lower relative costs than competing companies tend to have a positional advantage in the market. Possessing market sensing (the ability to understand customers' expressed and latent needs) and customer linking (the ability to create and manage customer relationships) is essential in understanding and satisfying customers (Day, 1994). Thus, market-oriented companies may perform better because of customer satisfaction, more clientele and hence economies of scale. Innovation consequences include firms' innovativeness: their ability to create and implement new ideas, products, and processes (Hult & Ketchen, 2001); and new product performance (i.e., the success of new products in terms of market share, sales, return on investment, and profitability) (Kirca et al., 2005). Thus, market-oriented companies may perform better because of the organization's innovativeness and new product performance.

Market orientation is the operationalization and implementation of the marketing concept (Greenley, 1995; Shapiro, 1988). The marketing concept, a cornerstone of modern marketing thought, stipulates that to achieve sustained success, firms should identify and satisfy customers' needs more efficiently than their competitors do (Kirca et al., 2005). Much of the MO literature examines the extent to which firms behave, or are inclined to behave, in accordance with the marketing concept (Kohli & Jaworski, 1990). So, MO has been of great interest to both practitioners and academics. By adopting the marketing concept, several definitions of MO have been derived, emphasizing its philosophical, cultural, behavioral, or strategic components (Deshpandé, Farley, & Webster Jr, 1993; Kohli & Jaworski, 1990; Narver & Slater, 1990; Shapiro, 1988). However, differences among these approaches exist more in terms of emphasis than on content, which suggests that they are complementary and not mutually exclusive (Ruekert, 1992). Seminal works (Kohli & Jaworski, 1990; Narver & Slater, 1990) showed the need for the development of instruments for measuring MO. First, Narver and Slater (1990) defined MO in terms of culture and related it to the fundamental characteristics of the organization (e.g., customer orientation, competitor orientation, and inter-functional coordination). Second, the more widely accepted (Kohli & Jaworski, 1990; Kohli et al., 1993) model defined MO in terms of specific behaviors related to the organization-wide generation of market intelligence pertaining to current and future customer needs, dissemination of the intelligence across departments, and organization-wide responsiveness to the intelligence. This thesis examines the degree of MO of the Ethiopian seed systems using these three phases of MO as a guiding framework.

Market intelligence generation refers to the collection and assessment of both customer needs/preferences and the forces (i.e., task and macro environments) that influence the development and refinement of those needs. Importantly, multiple departments should engage in this activity because each has a unique market lens. Thus, market intelligence is a broader concept than customers' verbalized needs and preferences (customer focus) as it includes an analysis of (1) exogenous market factors (e.g., competition, regulation) that affect customer needs and preferences and (2) current as well as future needs of customers. Intelligence dissemination refers to the process and extent of market information exchange within a given organization. It occurs both formally and informally and as well as between both horizontal (i.e., interdepartmental) and vertical (top to bottom) directions. Responsiveness refers to the actions taken in response to intelligence that is generated and disseminated.

Market orientation and performance in developing and emerging (D&E) markets

A large stream of research has identified positive MO and performance relationships. However, much of this insight comes from the studies that have been conducted in the United States and other Western economies, often from within larger companies that have many resources/competencies ‘under one roof’. D&E markets differ dramatically from the USA and Western contexts in which MO theory was developed. The institutional characteristics of D&E markets differ from that of the industrialized society. Relatively fewer resources (socioeconomic institutional environment), including the absence of formal institutions (regulative) and some supporting infrastructures such as finance, transport, and insurance are typical characteristics of such contexts. Resources are shared in D&E markets between many people. D&E markets exhibit relatively strong cultural institution like trust, hierarchy relations and social networks, that often act as a substitute for the absence of formal regulative institutions (Ingenbleek, Tessema, & van Trijp, 2013). Buyers and sellers in D&E markets build social capital because of daily interactions, where borrowing, lending, and collecting are daily practices. Through these practices, relationships are developed, and trust thus serves as an informal institution at the level of relationship (Ingenbleek et al., 2013). The social capital theory explains that social network ties embed economic value in the form of information and the repayment of social obligations (Coleman, 1988; Herreros, 2004). Social resource theory further argues that networks may embed reputational value–for example, status–which, in turn, provides access to economic resources, such as credit (Khaire, 2010; Lin, 1999).

Systematic studies on MO and performance relationships in emerging economies and in developing countries are lagging behind (Rodrigues & Pinho, 2010; Tessema, 2012). Moreover, the studies focused on domestic markets and private sectors except for a few studies that investigated the applicability of MO into not-for-profit and public organizations. In emerging markets, studies also tend to focus on large and medium-sized firms embedded in a network of formal institutions located in and around cities with relatively well-developed infrastructures. Thus testing the MO theory requires adaptations of the theoretical frameworks of MO to the characteristics of D&E markets (Ingenbleek et al., 2013).

Insights into market orientation and performance relationships are constrained by limited research in D&E markets. The MO and performance constructs and the rationale for their relationships may differ as well (Ingenbleek et al., 2013). Thus, researchers in the field of marketing have claimed the need to expand the MO construct to new areas and to test its applicability. A framework delineating four stages through which emerging markets research contributes to the growth of marketing science is proposed (Burgess & Steenkamp, 2006): 1) theory development, 2) acquisition of meaningful data, 3) analysis of the data to test one's theories, and 4) learning. Quantitative research in emerging markets that offers practical, theoretical and societal relevance regarding the generalizability of mainstream marketing theory is needed (Ingenbleek et al., 2013). The role of MO in other contexts, such as transitional economies, is still unclear (Deshpandé & Farley, 2000). Transitional economies experience unprecedented changes in their social, legal, and economic institutions (Zhou, Gao, Yang, & Zhou, 2005). Researchers also call for the inclusion of stakeholder’s involvement in MO studies (Crittenden, Crittenden, Ferrell, Ferrell, & Pinney, 2011; Ferrell, Gonzalez-Padron, Hult, & Maignan, 2010; Slater & Narver, 1995). Specifically, MO and performance research at the system’s level with multiple actors playing different roles are not clearly understood, yet. Investigation of the gap on sellers’ and customers’ reported perceptions of customer-orientation/market orientation is also needed (Deshpandé & Farley, 2004; Gray, Matear, Boshoff, & Matheson, 1998; Verhees & Meulenberg, 2004).

Market orientation in supply chains

MO has mainly been studied in the context of large-scale businesses in the western context, and this may partly explain why there has been limited attention for MO across complex supply chains. Except for a few studies such as Siguaw, Simpson, and Baker (1998), the conceptualization and implications of MO to date have been mainly in the context of individual firms, in spite of the growing importance of supply chain management (SCM). To fill the research gaps, we take advantage of Ethiopia, as an emerging economy in D&E markets, which has made fundamental transitions since the 1990s. In doing so it provides Ethiopian seed systems as a relevant case.

MO has been viewed from a dyadic perspective, i.e., as a characteristic of a company dealing with a set of current and potential customers, often in the context of large multinational companies. As a result, research on MO from a value chain perspective is still limited but gradually emerging (Baker, Simpson, & Siguaw, 1999; Elg, 2000; Grunert et al., 2005; Grunert et al., 2002; Langerak, 2001; Siguaw et al., 1998; Simpson, Baker, & Siguaw, 1999).

MO is a value creation process in which capabilities are combined, integrated, and synergized across different functions, such that the outcome creates customer-recognized value. This also implies that the degree of MO can be undermined at any level of the value chain. This is a challenge to supply chains because being market-oriented requires a focus on shared goals and a willingness to align activities (Kohli & Jaworski, 1990). The challenge becomes even bigger if the MO concept applies to multi-actor value chains, with absent channel leader. In such situations, the value creation process (Gummesson & Mele, 2010; Horvath, 2001) becomes more complex because subtasks and functions are more isolated. The key challenge is how the different actors that are executing value creation functions together perform the task of generating intelligence on end-user needs and use it to guide their overall value-creating activities. This should contribute to the competitiveness of the whole value chain in serving end-users.

Supply chain management (SCM)

One of marketing's main concerns is delivering value to the end users. Effective and efficient supply chains are imperative for marketing (Min & Mentzer, 2000). When firms make mistakes anywhere within a supply chain, the effects can ripple through the chain in both directions (Ellram & Cooper, 2014; Kozlenkova, Hult, Lund, Mena, & Kekec, 2015). Firms without a well-managed supply chain will have trouble surviving as global competition increasingly puts the financial squeeze on all sectors of the economy (Hult, Ketchen, & Arrfelt, 2007).

Efforts to align objectives and integrate resources across company boundaries is critical to deliver greater value (Fawcett & Magnan, 2002). Over time, in a free market economy, marketing functions will be allocated or shifted to the most efficient performers in the institutional structure of the marketing system (Rosenbloom, 2013). SCM allows a company to focus on doing exceptionally well a few things for which it has unique skills and advantages (Cox, 1999; Rich & Hines, 1997). Non-core activities are outsourced to channel members that possess superior capabilities in those areas (Cox, 1999; Rich & Hines, 1997). Forming “teams” of suppliers, finished goods producers, service providers, and retailers helps to create and deliver the very best product/service offerings possible (Fawcett & Magnan, 2002). Such allied teams of companies form an integrated supply chain, which competes against other supply chains in today’s global economy (Fawcett & Magnan, 2002). The channel manager needs to identify the marketing functions that must be performed and then allocate them to the organizations that can perform them most effectively and efficiently. In short, marketing functions must be performed and appropriate organizations must be found to perform them (Rosenbloom, 2013).

Traditional supply chains in developing countries typically involve many players, and are tightly linked with long-standing social structures (Woods, Johnson, & Hofman, 2004). As developing countries enter World Trade Organization arrangements their agricultural industries will be subject to increasing competition in their domestic markets and have greater incentives to meet global standards in export markets. It is argued that SCM provides one approach to planning the improvements needed in the management of their agricultural production and marketing systems to meet future challenges (Woods et al., 2004).

Customer satisfaction in supply chains

Customer satisfaction, a measure of how the products and services provided by a company meet or exceed customer expectations (Fornell, 1992; Olsen & Johnson, 2003), is an important source of competitive advantage (Lemon, Rust, & Zeithaml, 2001), often leading to customer loyalty and repeat purchases (Bolton, 1998; Lam, Shankar, Erramilli, & Murthy, 2004), which will eventually lead to an increase in the number of customers (Busacca & Padula, 2005; Kim, Jung, Suh, & Hwang, 2006), as well as increases in sales, profitability and return on investment (Luo & Homburg, 2007).

Two conceptualizations of customer satisfaction dominate the literature: as a transaction-based evaluation and as an overall evaluation of a series of transactions. The literature on transaction specific satisfaction views customer satisfaction as a post-choice evaluative judgement of a specific purchase occasion (Fornell, 1992; Olsen & Johnson, 2003). It is an immediate post purchase evaluative judgment or an affective reaction (Gupta & Zeithaml, 2006). Cumulative satisfaction is conceptualized as an overall evaluation based on the total purchase and consumption experience with a good or service over time (Anderson, Fornell, & Lehmann, 1994; Homburg & Stock, 2004), thus reflecting the customer's entire experience with the company.

Increasing and maintaining high levels of customer satisfaction enhances customer loyalty and serves as a safeguard against increasing price competition and the commoditization of products (Anderson et al., 1994; Oliva, Oliver, & MacMillan, 1992). Several factors may account for customer dissatisfaction. In the services marketing literature, service failure may occur and lead to customer dissatisfaction especially when product performance fails to meet customer expectations, which may increase the risk of customer loss (Marimon, Alonso-Almeida, Bernardo, & Llach, 2015), or customers shift to competing firms (Smith, Bolton, & Wagner, 1999). Under the current competitive environment such firms facing service failure need to respond either to restore customer satisfaction and reinforce loyalty (Smith et al., 1999), or need to identify customer requirements and develop strategies that allow them to meet or beat the service levels provided by other sellers (Verwijmeren, van der Vlist, & van Donselaar, 1996). Such customer-oriented contacts typically focus on determining relevant dimensions of service and/or products as well as an assessment of the customers' perceptions of how well the selling firm is doing in meeting those expectations (Sterling & Lambert, 1987).

Satisfying customers has become commonplace in today's competitive environments. Over the past years in the marketing research, over thousands of customer satisfaction studies have been conducted, mainly on consumer services (Heskett, Jones, Loveman, Sasser, & Schlesinger, 1994) (e.g., hotel, tourism, banking, etc.), and/or in consumer goods and services (Oliver, 1996), as well as on industrial manufacturing and distribution (Bendapudi & Leone, 2002). However, research on customer satisfaction in D&E markets is limited but is gradually emerging (Mittal, Han, Lee, Im, & Sridhar, 2017). Despite its wider use, customer satisfaction drivers have not been sufficiently examined in such contexts. Specifically, research in supply chains with multiple actors that perform different roles in the context of D&E markets is limited.

Understanding customers' satisfaction of marketing offerings can help supply chains to understand how they may achieve a competitive edge and greater performance. Participation of customers in the creation of market offering and value enhance customer satisfaction and better performance of firms or supply systems. By co-creating, sellers receive inputs for new offerings (Mustak, Jaakkola, & Halinen, 2013; Saarijärvi, Kannan, & Kuusela, 2013); are able to customize their offerings (Prahalad & Ramaswamy, 2004a); enhance customer loyalty (Rosenbaum, Ostrom, & Kuntze, 2005); increase customer trust (Dabholkar & Sheng, 2012) and customer satisfaction (Grönroos, 2008). Co-creation also enhances new product development (Hoyer, Chandy, Dorotic, Krafft, & Singh, 2010). However, little information on customer satisfaction (or customer satisfaction criteria) on supply systems is available in D&E markets.

2.5.2 Theoretical frameworks

This section describes the theoretical framework of MO in the Ethiopian seed system. It adapts the MO concept for D&E markets and for seed systems by looking at marketing roles and functions and their distribution over seed system actors. Market-orientation consequences and major propositions of the thesis are also explored.

Figure 2.2 displays the proposed conceptual framework of MO. An understanding of MO and its role in the supply chain organizations can be gained within the context of the framework. The model has four major components: (1) the customer satisfaction and how it enhances the performance of supply chains, (2) the proficiency that influences the level of customer satisfaction, (3) the MO and its components and how it is implemented at each stages of a seed value chain, and (4) the MO that influence the proficiency of functions.

This section first takes a customer perspective by discussing the value creation process. Then a firm perspective is taken by discussing marketing strategy and the marketing mix. This firm perspective is elaborated by discussing functions in a firm's value chain that allow it to make an offer (i.e., a marketing mix). Next it describes about customer satisfaction, market channel functions, supply chain and the role of MO for seed supply systems and the major propositions of the thesis.

Value creation

Companies that excel in satisfying customers integrate market and customer knowledge with their own operational flexibility in a superior way (Tuominen, Rajala, & Möller, 2004). The ability to continuously generate intelligence about customers' expressed and latent needs and about how to satisfy these needs is essential for companies to continuously create superior customer value (Slater & Narver, 2000). Thus, in times of quickly changing consumer needs, attention on customer orientation and high customer satisfaction in all areas of production is the key to survival in a very competitive market.

Customers will choose offers that fit into their value creation processes (Grönroos, 2011), and offers them the highest expected value. Whether customers are satisfied depends on whether the offer meets or exceeds their expectations, during buying, use/ consumption, and disposal. Two types of customer satisfaction are seen as having an important impact on overall feelings of satisfaction with the product or service experience (Anderson et al., 1994; Kristensen, Martensen, & Gronholdt, 1999). Feelings of satisfaction arise when consumers compare their perceptions of the performance of a product or service to both their desires and expectations. This process produces not only feelings of satisfaction with the product or service, but also feelings of satisfaction with the information (often supplied by marketers in such forms as advertising, package information, and salesperson communications) on which their expectations are based. Overall satisfaction with the individual transaction has two direct antecedents: satisfaction with the product outcome itself (attribute satisfaction) and satisfaction with the information (Anderson et al., 1994). Kristensen et al. (1999) identified that customer expectation and perceived quality are drivers of customer satisfaction. Consumers' purchase criteria such as product assortment, quality, buying atmosphere, pricing policy, and customer oriented interactions have a significant impact on customer satisfaction (Schöps, 2010). The smallholder literature also shows how customer satisfaction and/or value is perceived differently by customer segments. Smallholder consumers in subsistence markets, for example, evaluate the value of products on among others sufficient quantity of acceptable quality at a lower price levels (Sheth, 2011) as compared to higher income and relatively middle class markets that tend to encode price as a quality signal, or tend to associate with quality, health and safety standards.

As suggested by the literature, both expectation and performance facets of customer satisfaction are influenced by a variety of factors operating at different levels. Satisfaction or dissatisfaction, which affects consumer value perceptions, consumer communications, and repeat-purchase behavior, and/or customer's buyer behavior and the resulting purchase decision are strongly influenced by cultural, social, personal, and psychological factors (Kotler & Armstrong, 2009).

Marketing strategy and the marketing mix

Firms try to make an offer that is more valuable for the customer than other offers. To do this they first acknowledge that the value creation process is different for every customer and that they cannot satisfy every customer. Thus, they segment the market into groups with more homogeneous value creation processes (i.e., market segmentation). Then they choose which customers they want to serve, based on the expected profitably of serving each group. Next, they develop a positioning, which is the place they would like to take in the target customer's mind. They choose this positioning in such a way that their target customers will choose their offer over competitive offers. This process is called strategic marketing. Firms position their offer in the customer's mind via the marketing mix: a product with services, in a certain place and time, for a specific price, and accompanied with communication about the offer.

Value chains

To be able to put an offer (i.e., marketing mix) in the market firms need to perform primary functions, such as inbound logistics, production, outbound logistics, services, sales, etc. (Porter, 1980). Secondary functions need to be performed to support and guide the primary functions, such as human resource management, financing, and market orientation. Firms vary in the effectiveness and efficiency in which marketing functions are performed, which results in different possibilities to offer a specific marketing-mix (Hunt and Morgan, 1995).

Value chains consist of organizations that perform functions required to put an offer in the market. Each organization varies in the effectiveness and efficiency with which they perform functions. Thus, the constellation of organizations in a value chain determines what offer it can make in the market and the success of the value chain depends on how well each function is performed.

A value chain may only be as strong as its weakest link (Horvath, 2001; Kotler & Armstrong, 2009; Porter, 1980). Subsequently, the success of the value chain influences the success of the organizations in the value chain. Thus managers of functions need to look beyond their own functions and into the functions performed by its suppliers, distributors, and customers to improve the performance of the supply chain as well as their own performance (Freeman, Wicks, & Parmar, 2004).

The activities or functions to facilitate exchange are examined in the functional approach to marketing, with the objective to improve them. In functional organizations marketing activities, such as sales, advertising, marketing research, customer service, and new product development, are performed by functional specialists or managers (Kotler & Armstrong, 2009). Hence, marketing functions are spread over the organization and not limited to the marketing department. Activities that have an impact on customers are not only the responsibility of marketing specialists (Grönroos, 1989).

One crucial secondary function is market orientation. Market orientation provides a unifying focus and clear vision to an organization's strategy, which is centered around creating superior value for customers (Kohli & Jaworski, 1990). This unifying focus and clear vision are crucial, but difficult to obtain if the organization is a value chain comprising several organizations that have to coordinate their activities to put an offer in the market that creates a position that feeds into the customer's value creation process. Varying degrees of market orientation between value chains will create even more differences between offers from different value chains.

Customer satisfaction and market-oriented performance of value chains

A widely applicable construct of customer satisfaction is needed and beneficial especially to firms operating at a supply chain level, often in a fragmented supply chain with absent channel leader, with limited supply chain management and orientation, and with poorly developed infrastructure.

Market orientation starts with the marketing concept, which holds that the best way to achieve the organization's goals is to satisfy customers more effectively and efficiently than competitors do. This requires organizations to obtain information about and understand the customer's value creation process and competitive offers. Then they need to decide on a marketing strategy, which requires sharing and discussing the information. Then they need to develop a coordinated response to make an offer to the market. If everything is done perfectly, the offer will meet or exceed the customer's expectations and the customer is satisfied. Thus, customer satisfaction is a measure of market-oriented performance.

Proficiency of market channel functions and supply chain performance

Supply chains are conceptualized as a network of companies from suppliers to end-users, which have the intention to match supply and demand via coordinated efforts (Gundlach, Bolumole, Eltantawy, & Frankel, 2006). Effective and efficient supply chains increase customer satisfaction and performance. An effective and efficient supply chain allows firms increase and pass along value to the end-customers/users (Kozlenkova et al., 2015).

Effective and efficient performance of supply chain functions increase customer satisfaction and performance. Most studies, however, are conducted in the context of high income economies (Stock et al., 2010). Systematic studies of the influence of market channel functions on end customer satisfaction in D&E markets are limited. D&E markets are also characterized by fragmented supply chains with rarely a channel leader; and relationships between actors that are on a transactional basis, without too much alignment and overall management (Woods et al., 2004).

Most studies in supply chains focus on firms that sense the need for a supply chain orientation, SCM, and effective relationships and networking. Seed supply chains in Ethiopia, however, consist of large, medium, and even micro firms, located in dispersed rural areas with little knowledge of SCM, networking abilities, and access to information technology. Moreover, they have limited capacities, resources, or power to manage supply chains.

Understanding the role and importance of market channel functions and their contribution to overall customer satisfaction can help supply chains to understand how to improve their offer, achieve a competitive edge and consequently improve performance.

2.5.3 Market orientation for seed supply systems in Ethiopia: Market oriented performance of Ethiopian seed supply systems

Seed systems from the perspectives of marketing: **market-oriented functions and roles in seed systems**

MO increases performance or contribute to effective seed systems. However, measures of MO of seed systems does not exist or measures for the MO of functions do not exist. Measuring the MO of seed systems is also difficult because measures of MO may not be comparable across functions and perspectives. This thesis contributes to the gap in the literature by analyzing seed supply systems, using the theoretical framework of MO, from the perspectives of all channel actors and farmer customers. We take a marketing functions approach and build on seminal research in the field of new product development (Cooper & Kleinschmidt, 1987a, 1987b, 1995). By analogy, we adopt the approach of sub-process proficiency to better understand the critical success factors in overall value chain performance. The thesis will adapt MO in seed systems by looking at roles, functions, and their distribution over actors. MO at supply systems where independent organizations performing marketing functions does not exist. The thesis adds knowledge on the role of MO in supply chains and/or in a multi-actor value chains setting in the food industry of D&E markets. It does so by providing Ethiopian seed systems as a relevant case.

The thesis will examine and compare the MO of the different functions in alternative seed systems in Ethiopia. In doing so, we try to identify which functions do or do not respond to the market in each seed system. Then we can discuss possible solutions to overcome the lack of market-oriented responsiveness, such as combining seed systems to stimulate and efficiently meet farmers' evolving demand for quality seeds. Thus, the thesis would develop and apply MO insight into seed systems and suggest the possible policy recommendations for improving the effectiveness and efficiency of the Ethiopian seed sector. The inclusion of both end customers and diverse stakeholders/chain actors into the MO model could also shed light on the sustainability of the model in the Ethiopian seed systems.

Domain 1: Customer satisfaction

Each organization varies in the effectiveness and efficiency in which they perform functions. Thus, the constellation of organizations in a value chain determines what they can offer in the market. However, it is not clear how functions in the supply chain contribute to the customer satisfaction of the final customer. The thesis explores how fragmented supply systems in D&E markets contribute to the customer satisfaction of the end users. It does so in the context of Ethiopian seed supply systems from the perspective of farmers as the end customers.

This thesis defines a farmer customer's satisfaction with a supplier as an overall evaluation based on the total purchasing and consumption experience with a good (seed varieties) or service over time. Thus, we conceptualize customer satisfaction as cumulative satisfaction. Following the disconfirmation paradigm (Parasuraman, Zeithaml, & Berry, 1988), farmer customer's feeling of satisfaction is a result of a comparison process between perceived performance and expectations (Oliver, 1980, 1981, 1999). Thus, if farmers are to use seeds being supplied by a wide range of seed supply systems, the farmers' first need to believe that the offers of the seed supply systems are indeed useful. The perception of the offers, however, differs from farmer to farmer, and thus it is useful to understand the level of customer satisfaction of Ethiopian seed supply systems for potential improvements. This also helps to develop a standard model measuring supply chain performance in the context of D&E markets and in seed supply systems.

Understanding customers' satisfaction of marketing offerings can help supply chains to understand how they may achieve a competitive edge and greater performance. However, little information on customer satisfaction (or customer satisfaction criteria) on seed supply systems is available in Ethiopia. Hence, this study explores the performance of Ethiopian seed systems from a customer's perspective.

Domain 2: Proficiency

This thesis analyzes how different functions proficiency influence customer satisfaction. This is analyzed with approaches used in the new product development/NPD literature (Cooper & Kleinschmidt, 1987a, 1995; Ernst, 2002). The NPD process is a series of interrelated activities that need to be performed. The ultimate success of the new product is affected by all these activities and particularly the proficiency with which these are performed. The influence of market channel (marketing) functions on customer satisfaction can be analyzed in a similar vein.

Supply chains should become proficient in all market channel functions performed within the seed supply chains to ensure the creation of customer value and thus increase the performance of all organizations within seed supply chains. Marketing research emphasizes the importance of end customers (Lings, 1999) to create customer value and increase performance of organizations. The value (co) creation literature also emphasized the importance of customers in creating and delivering superior customer value. Supply systems can enhance customer satisfaction and customer value by improving functions within value chains.

The thesis develops measures applicable to seed system functions. Firstly, a standard model measuring supply chain performance does not exist at the context of seed systems. It was thought impractical to expect the respondents to provide actual objective/business performance data. In addition, obtaining such data from documentary sources, such as publications and reports may not a viable alternative for the Ethiopian purpose because of their accuracy and poor documentation. Moreover, it is difficult to obtain comparable performance measures for the different seed supply systems. Thus, in measuring the performance of the seed systems, the thesis is limited to interviewing chain actors and farmers who have in-depth knowledge and skills on the Ethiopian seed sector via three commonly used proficiency measures adopted from the NPD literature.

Market channel functions are expected to contribute to customer satisfaction, but in seed value chains not equally for all market channel functions. The closer the function is to the end customer; we expect the stronger the relationship between market-channel- function proficiency and customer satisfaction. This study considers end customers for the analysis of market channel functions and their contribution to overall customer satisfaction.

We hypothesize that market channel functions positively influence the customer satisfaction of the different seed supply systems in Ethiopia.

Domain 3: Market Orientation

Having identified how proficiency of functions influence customer satisfaction, the thesis further examine how proficiency is influenced by the MO of actors performing market channel functions. MO elements will be adapted to the context of the different seed systems by looking at roles and functions, and distribution over actors.

Market-oriented seed value chains require the responsiveness to the market demand of marketing functions. Actors need to understand their roles (i.e., the marketing functions performed) in the seed systems, sense the needs for the marketing functions they perform, and respond accordingly. The thesis investigates the degree of MO of different functions performed in seed supply value chains. MO of seed value chains is assessed by analyzing how these functions are guided by (1) information generation, (2) dissemination across actors, and (3) coordinated response to serve customers better. However, these market-oriented activities need not be evenly distributed across the chain. All intelligence-generation might be concentrated at the downstream level closer to the end customer, and responsiveness could be concentrated entirely upstream in primary production (R&D). Only dissemination would then have to involve all members of the chain. However, the more we go down the chain, we expect a greater intelligence generation on end-users. We also expect that there will be differences in the extent to which end-user intelligence is disseminated further up the chain, and in the extent to which responsiveness is not only concentrated upstream but also distributed more equally across the chain according to actor roles and functions performed.

Thus, this study extends MO research to supply chains in the context of D&E markets with their specific contextual challenges. In doing so, it explores MO of value chain functions. The thesis adapts the 20-item MARKOR scale developed by Kohli et al. (1993) at each function performed in seed supply systems. Answering these questions leads to the analysis of MO of the alternative seed systems. This is instrumental in the fundamental understanding of the degree of MO in D&E markets as a basis for recommendation for better alignment between the different seed systems of Ethiopia.

Domain 4: Market orientation and performance

A Positive market orientation-performance relationship is usually hypothesized and empirically supported in many studies. However, in the context of D&E markets and supply chains it has been under-researched. The purpose of this thesis is to examine the influence of MO on the proficiency of seed supply systems in Ethiopia. Thus, empirically testing the generalizability of MO and performance/proficiency relationship in a multi-actor value chain setting in D&E markets. As per the extant research in marketing and the general marketing theory, we expect that MO contributes to the performance of value chains. More broadly, we expect a positive relationship between MO and performance for all the market channel functions performed in seed value chains. However, the relationship is not equal for all functions performed in seed value chains. The closer the function to the end customer we expect the greater the relationship between MO and performance.

The thesis will also examine how the relationship between MO and performance is moderated by functions, perspectives, and crop types. We argue that the different configuration of actors performing market channel functions in the different seed value chains, and the evaluations of MO and proficiency from the standpoint of four perspectives (organizations performing a function, suppliers, customers, and farmer customers) can potentially influence the relationship between MO and performance.

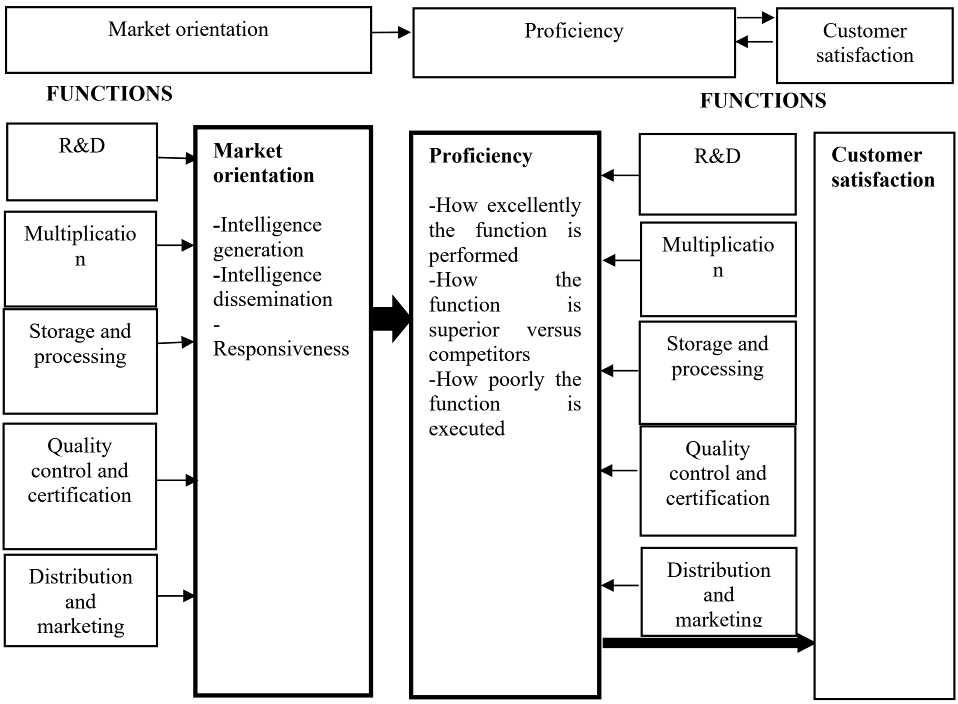

Figure 2.2: Proposed model of market orientation and proficiency in Ethiopian seed systems

The study explores the degree of MO of actors performing market channel functions in the formal and intermediary seed systems. Hence, data for chapters 5 and 6 are provided by supply chain actors (according to their role and marketing functions performed in 3 crops), and by farmers. Each supply chain actor evaluates the MO and proficiency of its own functions, suppliers', and customer's functions. However, farmers were asked to evaluate the MO and proficiency of each supply chain that they obtain their seeds from. Here we did not include or ask about the MO and proficiency of the informal seed systems in both chapters, because it is dominated by smallholder farmers that perform every function in an integrated way. We consider farmers as customers and not as producers of seed.

Characteristics of the studied crops (Maize, Teff, and Beans)

Cereals, pulses, and oil crops are the major grain crops in Ethiopia. Among, cereals such as maize, teff, wheat, and sorghum are the major food crops for ensuring food security in Ethiopia as they constitute the major component of staple diet for majority of the population. They also served as a source of income at household level and a contributor for the country's foreign currency earnings, among others (CSA, 2020/21). The results of the year 2020/21, main Season Post-harvest Crop Production Survey indicate that a total cropland area of about 12,979,459.91 hectares is covered by grain crops i.e. cereals, pulses and oilseeds, from which a total volume of about 341,828,693.39 quintals (1quintal=100kg) of grains are obtained, from private peasant holdings (CSA, 2020/21).

Out of the total grain crop area in 2020/21, 81.19% (10,538,341.91 hectares) was under cereals (CSA, 2020/21). Teff, maize, sorghum and wheat took up 22.56% (about 2,928,206.26 hectares), 19.46% (about 2,526,212.36 hectares), 12.94% (1,679,277.06 hectares) and 14.62% (1,897,405.05 hectares) of the grain crop area, respectively. Cereals contributed 88.36% (about 302,054,260.58 quintals) of the grain production. Maize, teff, wheat and sorghum made up 30.88% (105,570,935.92 quintals), 16.12% (55,099,615.14 quintals), 16.91% (57,801,305.96 quintals) and 13.22% (45,173,502.18 quintals) of the grain production, respectively. Pulses grown in 2020/21 covered 12.90% (1,674,950.34 hectares) of the grain crop area and 9.36% (about 31,999,988.65 quintals) of the grain production. Faba beans, haricot beans (white), haricot beans (red), chickpeas (red), chickpeas (white) and field pea were planted to 3.89% (about 504,569.99 hectares), 0.80% (about 103,288.55 hectares), 1.60% (about 208,295.03 hectares), 1.37% (about 177,546.76 hectares), 0.33% (about 43,172.44) and 1.69% (about 219,927.59 hectares) of the grain crop area. The production obtained from faba beans, haricot beans (white), haricot beans (red), chickpeas (red), chickpeas (white) and field peas was 3.13% (about 10,706,365.38 quintals), 0.54% (about 1,855,340.69 quintals), 1.07% (3,670,300.05 quintals), 1.09% (3,740,361.89 quintals), 0.24% (832,831.81) and 1.10 (3,762368.83 quintals) of the grain production, in that order. Oil seeds added 5.90% (about 766,167.66 hectares) of the grain crop area and 2.27% (about 7,774,444.17 quintals) of the production to the national grain total (CSA, 2020/21).

In 2018/19 main season, a total of 12,727,191.21 ha of land covered with major food crops in the country, and accounts for 315,602,058.49 quintals of the harvested crop in the country (CSA, 2019). About 71.6% of the total area under the crop and more than 69.5% of crop output is generated from cereals. Pulses such as faba bean, haricot bean and chickpea are the second food crop after cereals in terms of area and production in which they account for about 11.2% of the overall area under the crop and 7.5% of total production (CSA, 2019). Hereafter, we discuss the characteristics of the crops studied in this thesis: Maize, Teff, and Beans (haricot bean) and across three regions of Ethiopia, Amhara, Oromia, and the Southern region.

Maize

Maize is one of the most important cereals broadly adapted worldwide. It is grown by smallholder farmers in low- and middle-income countries. It is used both as a food crop for home consumption and for income generation. About 1 billion tons of maize are produced annually in the world, of which 15% of the total production is estimated to be used directly for human consumption, and the other 85% for animal feed and processing (Hoogendoorn et al., 2018).

In Ethiopia, maize is grown in 13 agro-ecological zones (in lowlands, the mid-altitudes and the highlands) covering 90% of Ethiopian arable land (Abu, 2020; Gizaw & Assegid, 2021). However, maize varieties mostly grown in the highlands at an altitude ranging from 1,700 to 2,400 m.a.s.l of Ethiopia are local cultivars with poor agronomic practices (Beyene, Botha, & Myburg, 2005). Hybrid maize is also developed and being supplied by two MNCs (Pioneer international and SeedCo-Alemayehu Makonnen Farm), and by the public national and regional research organizations (public hybrids) in Ethiopia (Abate et al., 2015).

Maize is the largest cereal commodity in terms of total production and yield and second in terms of area. During the 2019/20 main cropping season, cereal crops accounted for 10.8 million hectares of the total area under crops, of which maize ranked second to teff. It is an important field crop in terms of area coverage, production and utilization for food and feed purposes (Gizaw & Assegid, 2021). Maize is also the most important food crop in terms of number of farmers engaged in cultivation. Smallholder farmers produce over 95% of total maize and the remaining from commercial farms (Abu, 2020). Maize occupies about 2 million ha with an average yield of upwards of 3 MT/ha. Maize area and yields in Ethiopia have doubled since the early 1990s, with yields reaching more than 3.5 MT/ha, significantly higher than the East Africa average (Abu, 2020). This change happened due to improved varieties from research, hybrids seeds especially from Pioneer MNCs and increased investment in extension systems. This shows that maize production can be a model for scaling up agricultural production through improved agricultural innovations to achieve food security (Abu, 2020).

Maize occupied roughly 16 % of the total cereals area in 1981–83 compared to 30 % for teff, 20 % for sorghum, 14 % for wheat, and 19 % for barley; the area occupied by maize, teff, sorghum, wheat, and barley in 2001–03 was 24, 31, 17, 15, and 13 %, respectively (Abate et al., 2015). Teff, maize, sorghum, wheat, and barley occupy 30, 22, 20, 17, and 11 %, respectively, of the total cereal acreage of Ethiopia in 2013. As a sub-Saharan country, Ethiopia has the fifth largest area devoted to maize but is second, only to South Africa, in yield and third, after South Africa and Nigeria, in production (Abate et al., 2015). The annual rate of growth for the number of households cultivating maize grew at 3.5 % each year between 2004 and 2013, compared to 3.0 % for sorghum, 3.1 % for teff, 2.1 % for wheat, and 1.8 % for barley. The popularity of maize in Ethiopia is partly because of its high value as a food crop as well as the growing demand for the stover as animal fodder and source of fuel for rural families. Approximately 88 % of maize produced in Ethiopia is consumed as food, both as green and dry grain (Abate et al., 2015). In 2019/2020, maize consumption is estimated at 8.48 million metric tons, which is increasing because of the growing demand for food and feed (Abu, 2020). Maize for industrial use has also supported growing demand. Very little maize is currently used as feed but this too is changing in order to support a rapidly growing urbanization and poultry industry (Abate et al., 2015). Recently processing industries have emerged to start producing maize oil, snacks, and breakfast cereals (Abu, 2020). Green maize is cash crop for the farmers before the main harvest. Maize alone constitutes more than 60% of the caloric intake of a typical household. This indicates the clear significance of the crop in the livelihood of most Ethiopians. There is much room for improved yields caused by: shortage of improved seeds, poor agronomic practices, low grain prices, and climate variability (Abu, 2020).

Teff

Teff (*Eragrostis tef*) is the first most widely cultivated crop in Ethiopia. It is the first cereal crop in terms of total area and second in terms of production and yield. In 2019, teff accounts for 29.6% of the main cereal crop area (Abu, 2020). In 2017, it accounts for 24% of the grain area, followed by maize 17% and sorghum 15%. Amhara and Oromia are the two major regions, and collectively, the two regions account for 85.5% of the teff area and 87.8% of the teff production (Lee, 2018). In addition, teff is an untouched cereal crop at worldwide than other cereal crops like maize; wheat; sorghum and barley. However, it is a staple food grain in Ethiopia mainly used to make injera as a traditional fermented Ethiopian pancake (Fikadu, Wedu, Derseh, & Mugoya, 2019). The grains are a daily food staple for about 50 million people – about 60% of the country's total population. Teff is also the second most important cash crop (after coffee), generating almost 500 million USD income per year for local farmers (Minten, Tamru, Engida, & Kuma, 2016). Teff has also various health benefits and unique nutritional contents: high in fiber and rich in iron, calcium, magnesium, protein, and amino acids. Compared to other cereals, teff is a low-risk crop, which resists many biotic and abiotic stresses. Moreover, the seeds are not attacked by storage pests, and also the seeds are gluten-free (safe for diabetics as well as sufferers of immune reactions to wheat gluten) and rich in minerals and protein (Baye, 2018; Lee, 2018; Minten et al., 2016). However, teff was considered an orphan crop-one receiving no international attention regarding research on breeding, agronomic practices, or other technologies applicable to smallholder farmers, though gradually emerging (Baye, 2018). Now, national, and regional research organizations are performing scientific breeding and adaptations of different teff varieties for the different agroecology's of Ethiopia. Teff production and value chain in Ethiopia largely rely on traditional farming practices, faces harvest losses and there are inadequate financial incentives for farmers to modernize the system (Lee, 2018). Teff productivity is very low compared to other major cereals due to the limited use of improved seeds, inefficient farming practices and fragmented farm plots (ibid).

Some 6.5 million farmers produce 44 million quintals (a unit equal to 100 kilograms) (9.7 billion pounds) of teff every year. Moreover, Ethiopia produces over 90% of the world's teff (Anadolu, 2017). But because of its growing popularity, teff production has attracted other countries including Australia, China, India, South Africa, and the US. However, in these countries; like Australia, South Africa, and the United States; it is predominantly used as a forage crop for animal feed (Baye, 2018). Teff has a significant role on Ethiopian agriculture, food, and trade sectors. Major Ethiopian farmers rely on teff production because teff is their daily consumption. Therefore, Ethiopia has a great chance to assure food security by boosting teff production and exporting (ibid).

Beans (Haricot bean)

Haricot bean (Phaseolus vulgaris L.) is an annual pulse crop with considerable variation in vegetative characters, growth habit, flower color and the size shape and color of the pods and seeds (Zebire & Gelgelo, 2019). Pulses in general, and haricot bean in Africa have constituted an important food category for humans. For thousands of year's food from pulses were incorporated in various forms into most traditional diets around the globe. Haricot bean contains the highest amount of carbohydrates and calcium (Lemu, 2016; Zebire & Gelgelo, 2019). It is often considered as 'a poor man's meat' because of its high protein content. Haricot bean is an important crop in addressing the issue of nutrition security in Ethiopia where people's diet is dominated with teff, maize, root and tuber crops (Negash, 2007). Haricot bean has several advantages. It is mainly used as sources of food and cash. It is exported to earn foreign exchange and is also one of the cash crops locally used by farmers. It allows for double cropping in a season using early maturing cultivars. It is convenient for intercropping because of its short growth duration and diverse growth habit. It can be used as a rescue crop whenever long duration crops fail due to unfavorable growth factors (Bekele, Mekbib, Keneni, & Amsalu, 2019; Fikiru, Taresa, & Badassa, 2020; Lemu, 2016; Negash, 2007).

Haricot bean is the second pulse crop next to faba bean in terms of cultivated area (21%) and volume of production (19%) in the country (CSA, 2015/2016a, 2015/2016b). A wide range of haricot bean types are grown in Ethiopia including mottled, red, white, and black varieties. The most commercial varieties are pure red and pure white colored beans and these are becoming the most commonly grown types with increasing market demand (Ferris & Kaganzi, 2008). The increasing demand for quality haricot bean on the world export market, suitable climate of the country, low production costs, and availability of arable land are a great opportunity for Ethiopia to export large quantities all over the world and boost its export earnings. Due to the increasing demand in the international and domestic markets, Ethiopian haricot bean production has increased more than twofold from 138 to 513 thousand tones between 2005 and 2014 (CSA, 2015/2016a, 2015/2016b). Haricot bean exports account for about 41 percent of pulse production and exports 51 tones to 171 tons from 2005 to 2014. The country's export earnings from haricot bean exceeds that of other pulses such as lentils, horse bean and chickpea. However, the value chain, remains underdeveloped (Amanuel & Girma, 2018; Bekele et al., 2019; Fikiru et al., 2020; Lemu, 2016; Negash, 2007). Low production and productivity, which are mainly associated with poor adoption of improved technologies, less resistance to disease and pests, poor agronomic practices, and poor marketing system, were among the major problems. The national average yield of haricot bean in Ethiopia is 1.7 ton/ha, which is far below the corresponding yield recorded at research sites (2.5-3 tones ha^{-1}) using improved varieties (CSA, 2018).

Various actors involved in bean production, marketing and exporting. The major actors are farmers/producers, input suppliers, traders/retailers, processors, and exporters. There are also enabling institutions, such as research, extension and credit institutions that play pivotal roles in varietal development, production, distribution, marketing, and export system. These functions jointly improve the performance of the sector (Lemu, 2016).

Characteristics of farmers in Ethiopia

Ethiopian farms are divided into two major groups based on the Central Statistical Agency (CSA): smallholder farms (<25.2ha) and large commercial farms (>25.2ha). Most Ethiopian farmers are smallholder farms, producing mostly for their own consumption. Farms smaller than 2 hectares constitute nearly 90 percent of the total number of farms in Ethiopia (Rapsomanikis, 2015). About 40% of smallholders cultivate more than 0.90 hectares. These medium sized farms account for three-quarters of the total cultivated land. Large farms about 323 hectares per farm are not widely spread in Ethiopia (CSA, 2015/2016a).

Smallholder families live in farms which in many countries are significantly smaller than 2 hectares. In Ethiopia the average small farm size is 0.9 hectares, compared with 0.47 in Kenya, and over 2 hectares in Latin American countries (Rapsomanikis, 2015). In Ethiopia, smallholder families with a farm of about 0.9 hectares generate income amounting to about $0.8 per person per day. But larger farmers – cultivating 3.5 hectares on average they make about twice as much ($2.1 per person per day). In the country, where families are large (5-8), there are on average 2.2 women for 2.4 men working per hectare each day. Smallholders sell less than a quarter of their production, retaining most of it for household consumption. An Ethiopian farmer applies 20 kg of inorganic fertilizer per hectare, the average use of fertilizer in Europe amounts to over 130 kg per hectare (Rapsomanikis, 2015).

Smallholders produce 0.87 tonnes of teff per hectare – the country's staple food – while larger farmers achieve yields of 0.59 tonnes (Rapsomanikis, 2015). As the country's population is rapidly increasing, farm sizes are becoming smaller, making it challenging for family farmers to sustain their subsistence agriculture.

The study explores the performance of Ethiopian seed systems from an end customer and chain actor perspective. Data are obtained from individual farmer-customers. Specifically, individual farmer-customers evaluate seed supply value chains for maize, teff, and beans, across three regions of Ethiopia: Amhara, Oromia, and the Southern region. A total of 200 farmers (30 farmers for study 1, and 170 farmers for study 2 to 4) were interviewed on their farm fields by trained enumerators. Farmers/end customers grow crops in a mixed cropping system with a diversified crop portfolio. There are farmers that grow all three crops-maize, teff and beans, a combination of any of the two crops, and/or specialization in a single crop depending on their localities. There are also farmers that use formal seed sources of all three crops. There are also farmers that use a combination of formal, informal, and intermediate channels for seed sourcing of the same crop (e.g., for teff and beans) and a combinations of these crops. Especially, medium, and large-scale farmers buy seeds of high quality at higher prices from the formal and intermediary seeds systems, as compared to small and poor farmers that tend to buy seeds of lower quality with lower prices from the informal seed systems, especially for self-pollinated crops such as for teff.

We have selected farmers having different characteristics– age, farming experiences, farm size, educational level, economic status, members and non-members in farmers' development groups, and women headed households. We randomly selected around 200 farmers from 18 districts of Ethiopia, with the help of local level agricultural offices. As these offices have their own categorizations of farmers based on income level, farm size and poverty, etc., we initially informed the offices to randomly select farmers from the different class groups such as small, medium, and large scale, and those considered as poorest of the poor, poor, middle class, and large sized and often rich farmers. We randomly selected sample farmers from these categories. We argue that our sample respondents are representatives of most farmers. Our study's main objective is to focus on supply chains and not on farmer customers. It is not about comparing preferences of customers in varietal traits or in different demographic variables. We wanted to understand the performance of different supply chains from an end customer perspective.

Questionnaires were prepared in the local languages of each respondent. Both closed and open-ended questions, were prepared, pre-tested, and administered to obtain data from the farmers. Farmers do understand most of the questions and they also asked an elaboration if question items were not clear. The trained enumerators and the researcher participating in the data collection, offered farmers an explanation of the questions if requested. Farmers do evaluate the supply chains that they are aware of as viable alternatives for seeds. As different farmers have different experiences with supply chain actors and some actors may be more prominent, the number of evaluations differs per supply chain organization.

Descriptions of the study area

The PhD data were collected [starting from 2013 to 2016] from chain actors and farmers located in the following 18 districts/ woredas and 5 urban cities of Ethiopia.

Table 2.2: Distributions of sample respondents by region and locality

Study areas	Region		
	Amhara	Oromia	South
Wereda/district (sample farmers and actors)	Mecha	Arsi Negele	Bona Zuria
	Dangilla	Shalla/Aje	Misrak Badwacho
	South Achefer	Adha	Dallocha
	Bahir Dar Zuria Woreda (Zenselema Kebele)	Bako Tibe	Meskan
	Yilmana densa	Sibusire	Sodo
			Halaba especiall wereda
			Boricha
			Hawassa Zuria (Dure Bafana)
Urban city (sample actors)	Bahir Dar	Adama, Bishoftu, Addis Abeba	Hawassa

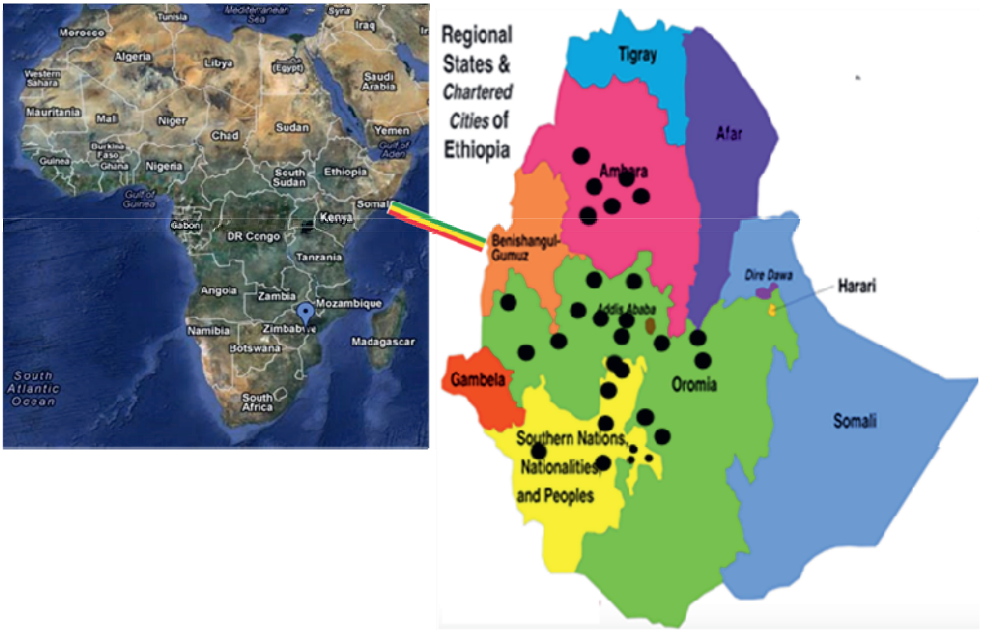

Figure 2.3: Map of the study areas

CHAPTER 3

Customer Evaluation of Supply Systems: The Case of Ethiopian Seed Supply Systems

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Abstract

This study explores the performance of Ethiopian seed systems from a customer's perspective. The study builds on the view that seed supply systems perform marketing functions such as developing new varieties of seed, multiplying the right quantity and quality, and distributing to the right places, at the right time, for an acceptable price. Hence, supply systems create value and satisfy customers. This study's contribution is two-fold. First, customer satisfaction theory is applied to complex chains (i.e., seed supply systems) in emerging markets, with their specific contextual challenges. Second, it identifies the criteria that farmers use to evaluate seed supply systems and evaluates Ethiopian seed supply systems from a farmer customer's perspective, which can be used as a basis to increase customer satisfaction.

Key words: Customer Satisfaction, Seed Systems, Supply Chains, Customer Value, Emerging Markets

3.1 Introduction

Customer satisfaction is considered a central concept in marketing theory. It results from quality and value that customers receive (Hurley & Estelami, 1998). Customer satisfaction is an important source of competitive advantage (Lemon et al., 2001), often leading to customer loyalty and repeat purchases (Bolton, 1998; Lam et al., 2004), which will eventually lead to an increase in the number of customers (Busacca & Padula, 2005; Kim et al., 2006), as well as increases in sales, profitability and return on investment (Luo & Homburg, 2007). Thus to increase customer satisfaction, firms try to improve quality and create value for customers more than their competitors do (Kotler & Armstrong, 2009).

Customer satisfaction is a measure of how products and services meet or exceed customer expectations (Fornell, 1992; Olsen & Johnson, 2003). Two conceptualizations of customer satisfaction dominate the literature: as a transaction-based evaluation and as an overall evaluation of a series of transactions. The literature on transaction specific satisfaction views customer satisfaction as a post-choice evaluative judgement of a specific purchase occasion (Fornell, 1992; Olsen & Johnson, 2003). It is an immediate post purchase evaluative judgment or an affective reaction (Gupta & Zeithaml, 2006). Cumulative satisfaction is conceptualized as an overall evaluation based on the total purchase and consumption experience with a good or service over time (Anderson et al., 1994; Homburg & Stock, 2004), thus reflecting the customer's entire experience with the company. This perspective suggests that the most important antecedents of satisfaction include past, current, and future customer expectations (Anderson & Fornell, 2000; Oliver, 1980; Zeithaml, 1988). Combining both perspectives, customer satisfaction involves keeping customers happy in day-to-day interactions and during consumption (Ellinger, Daugherty, & Plair, 1999; K. H. Hunt, 1991; Johnson & Fornell, 1991). This requires that firms track customer's needs and customer satisfaction (Day, 1994; Kohli & Jaworski, 1990; Narver & Slater, 1990).

Customer satisfaction theory has its basis in developed, mostly Western, economies. Research on customer satisfaction in developing and emerging (D&E) markets is gradually emerging (Mittal et al., 2017), but customer satisfaction drivers have not been sufficiently examined in such contexts. Consequently, firms often find themselves involved in a variety of strategic initiatives that they believe are helping customers. Customers see it differently—they see a firm that is unfocused, inconsistent, and not satisfying their needs (Mittal et al., 2017).

Research on customer satisfaction in business-to-business relationships or in supply chains is still limited and lagging far behind consumer marketing (Mittal et al., 2017; Rossomme, 2003). Research in supply chains with multiple actors that perform different roles in the context of D&E markets is limited. Moreover, a standard model measuring supply chain performance from the customer perspective does not exist to the best of our knowledge.

Each organization varies in the effectiveness and efficiency in which it performs functions. Thus, the constellation of organizations in a value chain determines what they can offer in the market. However, it is not clear how functions in the supply chain contribute to the customer satisfaction of the final customer. Our study explores how fragmented supply systems in D&E markets contribute to the customer satisfaction of end users. It does so in the context of Ethiopian seed supply systems from the perspective of farmers as end customers.

Using individual interviews with 30 farmers, the central research questions that this paper aims to address are (1) from an end customer's perspective, what criteria do farmers use to evaluate a seed supply system, and (2) to what extent do different seed supply systems meet these criteria. Together, these two research questions provide a perspective on the current level of customer satisfaction of alternative Ethiopian seed supply systems, as a basis for potential improvement.

The remainder of this paper is organized as follows. The next section presents the research context. The paper then presents an overview of the relevant literature on customer satisfaction in D&E markets. It also presents the theoretical framework and concepts used in the present study. Then, the study's methodology is described, followed by a presentation of the results and the conclusions. The paper then presents a discussion of the results and implications for managers and theory, and its implications for the African Agribusiness literature. The paper ends with a direction for further research and limitations.

3.2 Research context

The specific research context of this study is that of seed supply systems in Ethiopia. The Ethiopian government has identified improving the performance of seed systems as one of its objectives to improve agricultural productivity, to ensure food security and for economic growth. Seed is one of the most economical and efficient inputs to agricultural development (FAO, 2006). Use of quality seed alone can increase crop yields with 50% (Islam et al., 2010).

Thus, quality seed is crucial to an agrarian country such as Ethiopia. In Ethiopia, agriculture is the mainstay of the economy. It accounts for 46.3% of GDP, 80% of exports, and employs 85% of the total labor force (UNDP, 2014). Despite its significant contribution to the economy, the performance of Ethiopian agriculture is below its potential. One important reason is the use of poor quality seed (Alemu, 2010; Thijssen et al., 2008). Despite the release of several improved crop varieties, there has been limited use of improved seeds by the majority of farmers in Ethiopia (CSA, 2011; MoA, 2009; MoA, 2017). The key factors include unavailability of the right amount of quality seeds at the right place and time, and poor promotion and distribution (Lakew & Alemu, 2012), thus by ineffectiveness of the seed systems.

Effective and efficient seed supply systems are very important for food security of a nation. Effectiveness and efficiency come from the extent to which seed supply systems deliver seeds in line with the needs of society in ensuring the right quantity of the right quality seed at the proper moment to the right customers, at an acceptable price. What is right quality, demanded quantity and affordable price differs between farmers and overtime (e.g., climate and market demand), making this a challenging task. Also, what is best quality changes as a result of agricultural research that improves seed quality, i.e., innovation?

Local farmers play crucial roles both as customer and as producer of seed. In Ethiopia, local farmers have a choice from two broad seed systems: informal and formal. These systems are differently organized and operated in terms of delivery and responsiveness. An intermediate seed system, also known as the community-based seed system, exists between the formal and informal system. It involves farmer seed producing organizations, and local seed businesses.

The informal seed system is also known as local system or "farmers" seed system. It is called informal because it is not regulated by law and operates without legal certification of the process (Alemu, 2010; Atilaw & Korbu, 2011). The system refers to all seed selection, production, management, storage, and dissemination activities, including the exchange of seed outside the formal sector (Almekinders et al., 1994; Almekinders & Louwaars, 2002). Farmers obtain seed and varieties through informal networks based on exchange with, or gifts from, relatives and neighbors, bartering with other farmers, purchasing from local markets, or using saved seed. In Ethiopia, the informal system is deeply rooted in local communities, traditions, and networks; and often supplies local and uncertified seeds of wide ranges of crop varieties. This inevitably constrains agricultural productivity and hinders the government's central policy of technology-led intensification for agricultural products. About 90% of the seed used by smallholder farmers in Ethiopia are local seeds from the informal system (Atilaw & Korbu, 2011). Thus, the majority of farmers reside to the informal system to obtain their seed, which is indicative for market preference. Key players in the informal system are individual farmers and those organized groups of farmers that do not enter, or are linked only to a little degree to, the formal system.

The formal seed system is a framework of specialized organizations with distinct and inter-dependent roles in developing, multiplying, storing, processing, distributing, and marketing seeds of new varieties (Ndjeunga, Kumar, & Ntare, 2000). The major players in the formal seed system in Ethiopia are agricultural research institutes and universities; extension organizations; public seed enterprises; domestic and multinational private companies; private producers or out growers; and farmers' cooperative unions. Generally, the formal system aims at developing, multiplying, and making available to local farmers quality seed of improved crop varieties. However, current market figures suggest that the system is only partly successful in making available the right quantity of the right quality seed at the proper moment in time to the right customers, at an acceptable price. The formal system supplies improved seeds that cover less than 10% of the total arable land under major grain (cereals, pulses, and oilseeds) crops in the country (CSA, 2011). This inevitably constrains agricultural productivity of the country. The formal system has the resources for production, marketing and regulation (FDRE, 2006). However, the system does not perform to its fullest potential in developing and making available to farmers high quality seeds of improved and superior crop varieties (Alemu, 2010; Alemu et al., 2010; Atilaw & Korbu, 2011; Louwaars & de Boef, 2012; Mekbib, 2007; Thijssen et al., 2008). This may affect farmers' access to affordable, quality, and high yielding varieties. The role of private sector is significant only for hybrid maize. Some foreign seed companies for vegetables such as potato, tomato, and onion, are entering the country.

A recent development in the Ethiopian seed sector is the intermediary seed system. It is also known as the community-based seed system, which exists between the formal and informal system. It involves farmer seed producing organizations, and local seed businesses. These organizations perform seed functions for improved varieties obtained from the formal seed supply systems and for local varieties from the informal seed system. The intermediate seed system in Ethiopia is supported by governmental (e.g., extension, certification, and research organizations) and non-governmental programs to meet local demand for seed via local production schemes. Apart from formal and informal seed system actors, NGOs and various development partners in the intermediary position also play key role to improve the performance of the Ethiopian seed systems. They play a role in strengthening the different seed producers technically, financially, and physically (Altaye & Mohammed, 2013; Sisay, Verhees, & van Trijp, 2017). They facilitate access to credit, marketing, and donation of post-harvest technologies, such as seed cleaning machines. NGOs and partners also support the establishment of farmers' seed producing cooperatives and unions, community seed banks, and provide emergency or relief seed apart from motivating farmers to engage in genetic resource conservation.

A variety of options have become available for local farmers to obtain seed. However, the vast majority of seed demand in Ethiopia is catered through the informal seed system although it has largely gone unsupported, unappreciated and unrecognized. It could be a rich source of information and understanding of a) how seed demand gets shape (the factors driving it), and b) how seed systems make decisions to meet farmers' demand.

Generally, the total "seed system" involves multiple stakeholders playing different roles, but its effectiveness and efficiency lags far behind farmers demand for improved quality seed. There is a huge gap between supply and demand for seed. However, we do not sufficiently understand the critical success and failure factors accounting for the mismatch between the supply and the demand for seed in Ethiopia. One important reason is the lack of or the limited systematic studies on customer perception and evaluation (satisfaction criteria) in complex chains (seed supply systems) in developing and emerging (D&E) markets.

Because local farmers have a choice from different seed systems in obtaining their seed, and because market orientation and/or customer satisfaction is not a well-established concept in the Ethiopian context, this study approaches customer satisfaction from the lens of the end customers (i.e., the farmers), and from their perspective of perceived satisfaction. This should be reflective of the extent to which the voice of the end-customer is heard and responded to in an integrative offering across the various actors/functions involved. This enables to identify market orientation related issues at different levels / functions of the value chain that increase / decrease the level of (perceived) satisfaction.

3.3 Literature review and conceptual frameworks

This section first takes a customer perspective by discussing customer satisfaction theory and the value creation process. Then, a firm perspective is detailed by discussing the functions in a firm's value chain that allow it to make an offer (i.e., a marketing mix). Next, it is acknowledged that the functions in value chains may be performed by different organizations and with varying degrees of efficiency and effectiveness, which results in several value chains that customers can choose from. Consequently, each value chain will offer a different marketing mix that customers can choose from, and each value channel will have elements that customers like or dislike.

Customer satisfaction

This research defines a farmer customer's satisfaction with a supplier as an overall evaluation based on the total purchasing and consumption experience with a good (seed varieties) or service over time. Thus, we conceptualize customer satisfaction as cumulative satisfaction. Following the disconfirmation paradigm (Parasuraman et al., 1988), farmer customer's feeling of satisfaction is a result of a comparison process between perceived performance and expectations (Oliver, 1980, 1981, 1999).

Customer satisfaction has customer consequences, such as (1) repeat sales and customer loyalty (Fornell, Johnson, Anderson, Cha, & Bryant, 1996); and (2) positive word of mouth (Fornell et al., 1996). These result in organizational performance indicators, such as (3) current performance (Anderson et al., 1994), including profitability and return on investment (Luo & Homburg, 2007); (4) future performance (Anderson et al., 1994), including sales growth (Luo & Homburg, 2007), market share (Adeoye & Lawanson, 2012), and business extension (Kim et al., 2006); (5) shareholder value (Anderson, Fornell, & Mazvancheryl, 2004; Gruca & Rego, 2005) and stock market performance (Fornell, Mithas, Morgeson III, & Krishnan, 2006); and (6) lower transaction costs .

Market offerings, including product attributes (Zeithaml, 1988), service attributes, such as interactions with service-support personnel (Humphreys & Williams, 1996), price, location, and communication influence customers' satisfaction (Mittal et al., 2017).

Different factors mediate between product attributes (including services) and customer satisfaction. Customers see products as solutions to their problems (Shahhosseini & Ardahaey, 2011) or as complex bundles of perceived benefits that satisfy their needs (Vargo & Lusch, 2004). Customers' perceptions are defined as what customers think about an offer. Customer evaluations determine how these perceptions contribute to value for customers. The customers' perception and evaluation of a market offering, i.e. customers' value creation process (Grönroos, 2008; Gummerus, 2013; Saarijärvi et al., 2013), highlights that value of offers can only be evaluated through the lens of the customer (Vargo & Lusch, 2004). This "lens" model suggests that 1) customers see the world through the lens of their perceptions, 2) customers choose (buy) a product or service if they evaluate it to be superior to others (Griffin & Hauser, 1993) and 3) customers only choose offers that are available to them in the marketplace. In summary, offers are different in terms of their attributes, customers' perceptions of those attributes, the benefits derived from those attributes as a function of customer needs, the perceived costs to acquire the offer, and the trade-off between the benefits and costs (Woodruff, 1997).

Price is for customers the total costs of obtaining, using, and disposing of a product (Shahhosseini & Ardahaey, 2011; Zeithaml, 1988). Price is usually one dimension that influences how offers are perceived (Sinha & Smith, 2000) and is very influential in purchasing decisions. Customers also use high prices as cues for superior product quality (Rao, 2005).

Location is important, as customers' convenience includes availability in the right place at the right time and in the right quantities. It is critical to achieving customer satisfaction/success (Sterling & Lambert, 1989). The product has to be available, which means that there has to be physical access to the right quantity of the right product at the right time (Louwaars & de Boef, 2012).

Communication influences expectations and thus customer satisfaction. Quality is defined as the difference between customer expectations and the perceived product/service performance (Lewis & Mitchell, 1990). Quality is strongly related to customer satisfaction (Cronin, Brady, & Hult, 2000; Kuo, Wu, & Deng, 2009), and even considered as a main predicator of customer satisfaction (Zeithaml, Berry, & Parasuraman, 1996).

Market offerings in value chains

To be able to provide an offer in the market, firms need to perform primary functions, such as inbound logistics, production, outbound logistics, marketing and sales, and services (Porter, 1980). Secondary functions need to be performed to support and guide the primary functions, such as human resource management, infrastructure, financing, and market orientation (Porter, 1980). Firms vary in the effectiveness and efficiency in which marketing functions are performed, which results in different possibilities for offering a specific marketing-mix (Hunt and Morgan, 1995).

Value chains consist of organizations that perform the functions required to provide an offer in the market. Each organization varies in the effectiveness and efficiency in which they perform functions. Thus, the constellation of organizations in a value chain determines what offer they can make in the market.

Perceived seed quality

In this study, perceived quality is the farmer customers' judgement about the superiority of a product in terms of genetic and physical characteristics. In the seed industry, perceived seed quality is determined not only by the seed genotype and physical characteristics, such as size, shape, appearance, and moisture content but also by farmer customers' expectations about and experience with the genotype and the characteristics. Farmer customers are satisfied when the seed quality meets or exceeds their expectations, but the majority of Ethiopian farmer customers are not satisfied with the quality of seed they receive from their seed suppliers (Alemu, 2010; Alemu et al., 2010; Thijssen et al., 2008). Therefore, understanding the customers' perceived quality and the influencing factors is critical to increase supply chain performance.

High quality seeds have good germination, have low moisture content, have uniform grades, are pure, and are free from diseases, insects, physical damage, trash, or foreign seed. However, the right quality of seed differs between farmers because farmers seek crop varieties that are adapted to the local environment. Moreover, perceived quality changes over time as a result of agricultural research, which constantly improves the seed (i.e., innovation), information (i.e., expectations), and competition (i.e. experiences) (Zeithaml, 1988). The perceived quality is also strongly related to productivity of the seed, which is the volume of grain production on harvest. Genetic and physiological characteristics of the seed influence perceived productivity, but also experiences and expectations of farmers, adaptation to the local climate, and prevailing weather conditions.

Price as perceived costs

Farmer's trade-off perceived quality against perceived costs. Farmers also use high prices as cues for superior product quality. In the seed industry, farmer customers always compare the prices of alternatives before making a purchase. Considerable variation exists, however, between crops and farmers. Most smallholder farmers in Ethiopia buy seeds of lower quality and lower prices from the informal seed system instead of purchasing seeds of higher quality and higher prices from the formal seed system. This is also related to the nature of the crop. For example, farmers are more inclined to use the offers of the informal seed supply system for open or self-pollinated crops, such as teff and wheat, because their yield potential diminishes less between generations.

Perceived costs also vary between farmers. For example, Ethiopian farmers are more inclined to use the non-cash-based seed channels (gift, exchange) of the informal seed system than the cash based seed channels of the formal system (Mekbib, 2007). Lack of cash increases the perceived costs of the formal system. Typically, large- and medium-scale farmers buy more from the formal system, because they have more cash available than the small-scale farmers have. Specifically, they purchase high yielding varieties of superior quality seed from the formal suppliers, such as hybrid maize, vegetables, wheat, teff, and bean crops.

Place as customers' convenience

In the seed industry, spatial gaps exist between the multiplication of seed and the use by farmer customers of seed. Farmers are dispersed over a large geographical area, while seed trade is usually located in towns and seed multiplication is concentrated and thus distant from many farmer customers. The availability of seed influences purchase decisions (MacRobert, 2009). In addition, a time gap exists between the multiplication of seed and the farmer customers' use of seed. Farmers require seed for planting at particular times of the year, while companies produce seed one or more seasons ahead of the selling period. The timely availability of seeds prior to planting time is considered one of the important factors influencing the farmers' buying decisions. In the seed industry a quantity gap exists; seed companies produce large quantities of seed while individual farmer customers only buy small package sizes.

The informal seed system is dominant over the formal system because the seed offered is readily available in the farmers' villages when the seed is needed (Atilaw & Korbu, 2011). Often, the formal seed systems in Ethiopia do not supply seed at the right time and in sufficient quantity to farmer customers. The ineffectiveness of the public seed demand planning, distribution and marketing mechanisms have been identified as major limitations (Alemu, 2010; Alemu et al., 2010). The formal seed system often does not respond to demands for different package sizes (Alemu, 2010; Atilaw & Korbu, 2011; Tripp, 2006; Tripp & Rohrbach, 2001).

Promotion and communication as customers' awareness

Customers need to be aware of the existence and availability of products, which involves two-way communication and feedback between suppliers and buyers. Farmer customers seek information to make a decision to purchase a product or service, while seed supply systems provide information to try to increase demand (Shahhosseini & Ardahaey, 2011). In the seed industry, customers have certain preferences and requirements regarding the seed they wish to plant, while seed companies have information about the varieties in their assortment. The farmer may be ignorant of what the seed company has on offer (MacRobert, 2009). Thus, farmers need to have information about the seed products available to determine whether the offer meets their demand.

Social capital is an important factor for the seed sourcing decisions of farmers in relation to informal seed systems (Almekinders et al., 1994; Badstue et al., 2006; Batt & Rexha, 2000; McGuire, 2005; Winters et al., 2006). The exchange of products and information occurs within networks of families and communities. Thus, networks influence the farmers' access to seed. Different forms of social capital with indigenous social networks and family relationships in the informal system have a differential impact on the farm level choice of crop and variety to plant in Ethiopia (Seboka & Deressa, 1999). Therefore, the informal seed systems provide more varietal information and have seeds available in more accessible places than the formal systems.

3.4 Methodology

The present study adopts a qualitative approach to the understanding of customer satisfaction at the level of seed supply systems in Ethiopia. Seed value chains, which are the unit of analysis in this research, occur in a wide variety, but the study specifically focuses on seed supply chains for maize and teff and does so across three regions of Ethiopia: Amhara, Oromia, and the Southern region.

As the end customers of seed supply systems, 30 farmers, 10 from each region, were selected to participate in personal interviews to voice their opinions on the offer they (could) receive from different seed supply value chains. The personal interviews were conducted between November 2013 and January 2014 at the farmers' personal fields. The respondents, a priori informed about the purpose of the research, the confidentiality, and anonymity of the data, gave their verbal consent to be audio recorded. The personal interviews took, on average, approximately 50 minutes to complete, for which the interviewee received a daily allowance of 250 *birr* (1 € = 26 ET birr) to show our appreciation for their participation.

The *personal interviews (PIs)* followed a semi-structured research protocol, which was developed in the local languages of each region as a guide for the researcher during the interviews. Open-ended questions were used to allow respondents to express their views and insights in their own words until they were unable to give more answers. The personal interviews covered three main parts.

The first part was partly an introduction to relate the topic to the farmers' own practices. Respondents indicated what crops and varieties are prevalent in the region/locality and are grown by themselves. For each of the crops grown, the respondents indicated which seed supply chain they obtain their seeds from, and which alternative seed supply channels would be available to them. To identify the end customer *expectations and decision criteria* for the seed supply, the first part ended with the critical question, "what criteria do you use to evaluate the offers of the different seed suppliers?" The respondents were probed to list as many relevant considerations as possible.

The second part focused specifically on the *evaluations* of alternative seed supply chains. Respondents were asked to express what they *like and dislike* about seed supply chains that they have experience with or see as a viable alternative for their seed supply. Four questions were asked for every crop that the farmer grows, and seed supplier mentioned: "What do you like about the seed that you purchased for crop 1?"; "What do you dislike about the seed that you purchased for crop 1?"; "What do you like about the alternative seed suppliers for crop 1?"; and "What do you dislike about the alternative seed suppliers for crop 1?"

The third part of the personal interview focused on the *farmers' satisfaction* with the seed supply systems. It included four open-ended questions related to satisfaction ("Are you satisfied with seed system 1?"), trust ("Do you trust seed system 1?"), repeat purchase ("Do you expect to buy again from seed system 1?"), and positive words of mouth ("Would you recommend seed system 1 to other farmers?"). After each question, the respondents were asked to explain why and were prompted to give more reasons until they were unable to provide any additional reasons. These four questions were repeated for each seed system mentioned.

All answers from the personal interviews were audio-recorded, transcribed, and translated from the local languages into English. The data for two of the dominant crops, maize and teff, were analyzed using ATLAS.ti. Text fragments (cues) related to the research questions were assigned codes using a 'bottom-up' approach. The texts were examined line by line in search of cues related to what farmer customers (dis-) like about the offers of the seed supply systems. For example, if a respondent farmer would say, "I like Ethiopia Seed Enterprise (ESE) as they offer the high yielding BH-660 maize variety of seed," this part would be given the code 'LIKE ESE BY OFFERED PRODUCTIVE VARIETIES.' Codes were not assigned to one interviewee more than once but could be used again for another interview if the content of the quote were similar. After identifying the elements or benefits, which were perceived by farmers, the data were further reduced by combining several codes into "families." The purpose was to aggregate the related codes to a more abstract level. Continuing the above example, the code 'PRODUCTIVE VARIETIES' would form the family "RIGHT VARIETY," together with codes such as 'MARKET DEMANDED VARIETIES,' 'VERIFIED VARIETIES (TESTED AND DEMONSTRATED SEED),' and 'BASKETS OF VARIETAL OPTIONS/PRODUCT DIFFERENTIATION.' In a similar way, the other families were created.

After coding and categorizing, frequencies were computed for each family that indicates what farmer customers (dis-) like about the offers of the seed supply systems. This result shows differences in performance between seed supply chains from a customer perspective. This analysis is restricted to maize and teff because only for these crops are a variety of different seed systems present in the regions, and together the two crops account for the lion share both in area and volume of crop production across the regions and the country in general. In addition to their significant contribution to food security and agricultural growth of the nation, the two major crops by very nature, hi-bred (maize) vis-à-vis self-pollinated (teff), can potentially describe the nature and extent of the Ethiopian seed systems.

3.5 Results

The results will be organized around the two research questions: What criteria do farmers use to evaluate a seed supply system, and to what extent do different seed supply systems meet farmers' criteria. The respondents reported a wide variety of crops that they grow and seed supply chains that they see as viable options. Seed supply chains were clustered into five categories: (1) the national (ESE) seed supply system, (2) the regional (RSE) seed supply systems, (3) multinational companies (MNCs), (4) domestic private producers (DPPs), and (5) the informal seed system (ISS). Table 3.1 shows the number of respondents that reported on the different seed supply chains. It reveals that, for maize, the respondents perceive wider access to alternative seed supply chains than for teff, where MNC and DPP were not seen as viable options.

Table 3.1: Number of respondents reporting about the different seed supply chains for maize and teff.

	ESE	RSEs	MNCs	DPPs	ISS	Total
Maize	28	16	29	12	19	30
Teff	22	12	0	0	29	30

3.5.1 End customer criteria

The customer criteria to evaluate seed supply systems were extracted from the response to the question, "what do you (dis-)like about the offers of seed supply chains?" From the primary codes, 28 criteria were extracted for maize and 30 for teff, which could be summarized into seven major themes for maize and eight for teff supply chains. The analysis reveals that for farmer customers, the key evaluation criteria are that the seed supply systems deliver seed 1) of the right variety, 2) at the right quality, 3) easily available, 4) in the right quantity, 5) at an affordable price, 6) with adequate supporting services, 7) with limited production uncertainty, and, specific to teff, 8) with an appreciation of cultural heritage.

3.5.1.1 Meaning/content of the criteria

Table 3.2 shows examples of quotes related to the identified customer criteria.

Right variety as an evaluation criterion is related to the supply of productive (high yielding) varieties that meet market demand of the farmers' customers. Varieties should be tested under local conditions and/ or demonstrated in field trials. Moreover, farmer customers like to have an assortment of varieties available to them. Right variety was mentioned frequently and seems to reflect an important theme.

Right quality was expressed in considerable detail in the individual quotes. It is related to purity, uniformity, size, and color of the seed. Seed should be dry, fresh, clean, and treated against pests and diseases. Finally, after planting seed should show high germination and vigor. Rights quality was mentioned frequently and emerged as a dominant theme. Farmers think that quality depends on activities within the supply chains and has a strong influence on their household income and food security, because it increases food quality, animal fodder, and production efficiency.

Availability was expressed in terms of having physical access to seed, timely, and convenient. It reflects physical access to seed, at the right time, and in the most accessible places consistent with the farmers' purchasing patterns, which are related to local growing conditions. It was mentioned more frequently than any of the other themes. Several respondents shared the opinion that they like seed supply chains if they offer seeds at low sacrifice in terms of monetary, time, effort, and search costs.

Right quantity means sufficient quantities of seed to ensure that every customer can obtain the demanded amount. The respondents expressed dislike for the extra sacrifice that they have to make because not enough seed is available in the local market. It was mentioned frequently but less dominant than the criteria mentioned above.

Price as an evaluation criterion was expressed as affordable seed in terms of *'provision of affordable seed to the market.'* However, it was mentioned less frequently than most of the other themes, but about equally as often as quantity. Several respondents agreed that the price must be right to make the variety affordable to the market and to reflect the value of the benefits provided.

Supporting services occur before during and after sales. It related to the provision of varietal information, the right packaging formats (strong material, color appearance, and volume), quality assurance through certification by seed laboratories and added services, such as trainings, demonstrations, experience sharing and in-house activities. Responsiveness and assurance contribute positively to farmer's evaluation of supporting services.

Production uncertainty relates to the adaptation to local conditions, such as maturing under local conditions, resistance to (local) diseases and pests, drought or a prolonged rainy season, and animal attacks. Risk diversification was mentioned only for teff. Production uncertainty emerged as an evaluation criterion but was mentioned less frequent.

Cultural heritage emerged as a criterion only for teff seed supply chains. It reflects maintaining and conserving local (landrace) varieties to safeguard against extinction from production, and for social responsibility. Several respondents emphasized that landraces are most adapted to local conditions, a sustainable input for farmers, important for risk diversification, and food quality.

Table 3.2: Major themes and customer criteria for maize and teff supply chains

Customer criteria	Examples of quotes
1. Right variety	"We like seed supply chains when they offer high yielding varieties of seed." "We like the supply of varieties that match market demand. . .because we buy seed that meet our felt needs . . . we also benefit by selling surplus production to consumers in the market." "Provision of tested and demonstrated seed under local conditions," and "Provision of wide ranges of varieties for customers."
2. Right quality	"We like seed supply chains when they deliver quality seeds that are pure and well graded . . . because it enhances uniform germination, growth, and maturity . . . hence we benefit as it increases production, productivity and income . . . moreover, it reduces additional costs for cleaning and grading (i.e., before planting)." "We dislike the supply of ungraded seeds . . . because non-uniformly germinated seeds can increase cost during harvesting . . . some seeds mature early while others mature late, which increases the farmer's cost of performing double and separate harvesting operations."
3. Availability	"We like seed supply chains when they deliver the demanded seeds at low cost and on time, unlike the disadvantages of late delivery, which increases the farmer's cost to obtain seed from different sources, localities and often from distant places." "Availability [of seed] helps us to adjust varieties in response to the prevailing weather conditions . . . long maturing crop varieties can be planted if the rainfall starts too early, and early maturing varieties can be planted if the rainfall starts too late."
4. Right quantity	"I dislike the lack of availability of seed in the required amount. Most of the time we did not get sufficient quantities of maize varieties like BH-660, BH-540, and Pioneer. As a result, farmers are incurring costs due to all the ups and downs they are suffering to obtain the demanded seed quantity from different localities and sources."
5. Price	"I will buy seeds from the different suppliers if they ensure the availability of high yielding varieties and superior quality seed at a fair seed price." ". . . even if the price of the maize offered from the MNCs is much higher than that of public seed enterprises, we are willing to buy. . .because the benefit obtained from the MNC's maize seed offers are much higher than the others in terms of grain production and profitability by selling the surplus to consumers in the maize market."
6. Supporting service	"Certification tags attached to the inside and outside of the seed package provide information about varietal characteristics, productivity, quality standards, warranty, year of production, packed time, suppliers' name, brand and address . . . we are satisfied because it builds a good image and brand . . . as well as helps during purchase decisions, trust and loyalty." "We like product services during sales, such as information, one stop shopping, full time [over 12 hours] sales per day, repeat availability and sales, and assurance." "We like services before sales, such as customer responsiveness . . . services after sales, such as provisions of chemicals and fertilizers, risk taking (compensation), and joint monitoring and evaluation of product field performance."
7. Production uncertainty	"We like varieties that mature early under local conditions . . . because other crops can be planted early, which increases the efficient utilization of farm plots . . . moreover, bi modal production of crops in a season increases farmer's income and food security, unlike the disadvantages of using long maturing varieties, such as maize, for a single year production." "I am very much satisfied with farm-saved seeds [informal seed system]. I always use my own saved seeds mainly of two local varieties; these are, black finger millet and red teff. These varieties are well adapted to our environment. We inherited them from our ancestors. I grow both varieties every year on my farm field because they are important to avert risk and for diversification. When there is a prolonged rainy season, the black finger millet variety provides high yield, while the red teff variety provides low yield since it is an early maturing variety. When the rainy season is short, I get high yield from the teff crop and low yield from the finger millet crop variety. Therefore, whether the rainy season is short or long, I am on the safe side as I grow these [teff and finger millet] varieties simultaneously. I will grow these varieties in the future for the sake of risk diversification."
8. Cultural heritage	". . . even if the formal supply chains offer improved seeds, we keep on producing and saving our traditional landrace varieties . . . because they are transferred from generation to generation, which increases the farmer's prestige, ownership, and long tradition of sharing, keeping, and consuming, and value in use. . .. moreover, the local varieties are important for risk diversification, which increases optimal production, farmer's income, and food security."

3.5.2 Perceptions and evaluations of alternative seed supply systems

Having identified the end customer's evaluation criteria, Figures 3.1 (for maize) and 3.2 (for teff) summarize the customers' perceived likes and dislikes regarding the alternative seed supply chains available to them. The nature of the data (qualitative) and the differing numbers of observations per chain, only allow for qualitative interpretation of the perceived satisfaction (i.e., the balance between expressed likes and dislikes on the key themes) of alternative seed supply systems. However, three important observations emerge from the comparisons within and between Figures 3.1 and 3.2.

First, the result shows profound similarities and differences in seed supply chain evaluations between maize and teff. For example, supporting services provided by the ESE and RSE are evaluated mostly positive for both crops, as is the production certainty provided by RSE. However, although both the ESE and RSE are believed to deliver the right quality and quantity of teff, the quality and quantity meet with much more mixed responses in the case of maize. The informal system is perceived to have specific strengths for teff, in terms of availability, price (affordability), and quantity, but not for maize, where for perceived quality, quantity, and variety, the dislikes dominate over the expressed likes.

Second, the results confirm the strong dominance of the informal seed system for teff. This is primarily due to the availability, the price (affordability), and right quantity of the seed that can be obtained from this supply system compared to the ESE and RSE channels. However, the variety, quality, and the provision of supporting services generated mixed responses from the end customer.

Third, for maize where a wider variety of seed supply systems is available to the end customer, in terms of their profiles of likes and dislikes, the public (ESE and RSE) and private (MNC and domestic) systems all outperform the informal system, which is perceived to be rather weak in providing the right varieties and quality. The private seed systems (MNC and domestic) stand out in terms of the positive end customer associations with the quality and right varieties that these systems provide. The supporting services of all private and public seed systems are evaluated relatively positively, whereas this is seen as a shortcoming of the informal system. For the public systems, the ESE is evaluated positively on price, responses for which are more mixed for the RSE. However, the RSEs are appreciated more in terms of production certainty. The end customers see availability as a relative strength for the ESE and domestic private producer supply chains.

From the mixed likes and dislikes that farmer customers associate with the offer, we found that farmer customers trade-off perceived quality against perceived costs. We found that medium and large-scale farmers choose to pay high prices for the hybrid maize seed of MNCs and teff seeds from public enterprises. The MNC's maize offer satisfies their felt needs and demands, but farmers indicate that they often obtain it by making a sacrifice in terms of time, search costs, and effort.

The private seed system tends to be liked more in terms of supporting services. An interesting insight was that farmers identified packaging as a key evaluation criterion. Packaging received more likes from the private systems than from the public and informal seed systems. Customers seemed to dislike the public enterprises and informal traders compared with private suppliers. As interviewees stated:

> *'I dislike the ASE [an RSE] because the seeds in the package are less than the required amount. For example, one pack should contain 12.5 kg of seed [maize], but most of the time the amount of seed in the package is below 12.5 kg, for example between 9 and 11 kg. Moreover, they offer poor packaging and packaging material that is damaged by rodents.'*

> *'I am dissatisfied with the poor seed packaging thread at the upper side. This is their [ESE] major weakness because the thread is easily untied and, as a result, all the packs of the improved seed [maize] that are brought have leaks. Due to this, farmers dislike them because once the package is untied, we believe that it might be adulterated or contain faked seeds.'*

> *'I dislike traders since they might sell adulterated or a mixture of seed by packing and selling local varieties of maize.' 'I dislike them [traders] because they might sell [seed pack] below the required amount by cheating [farmers] via the weight balance.'*

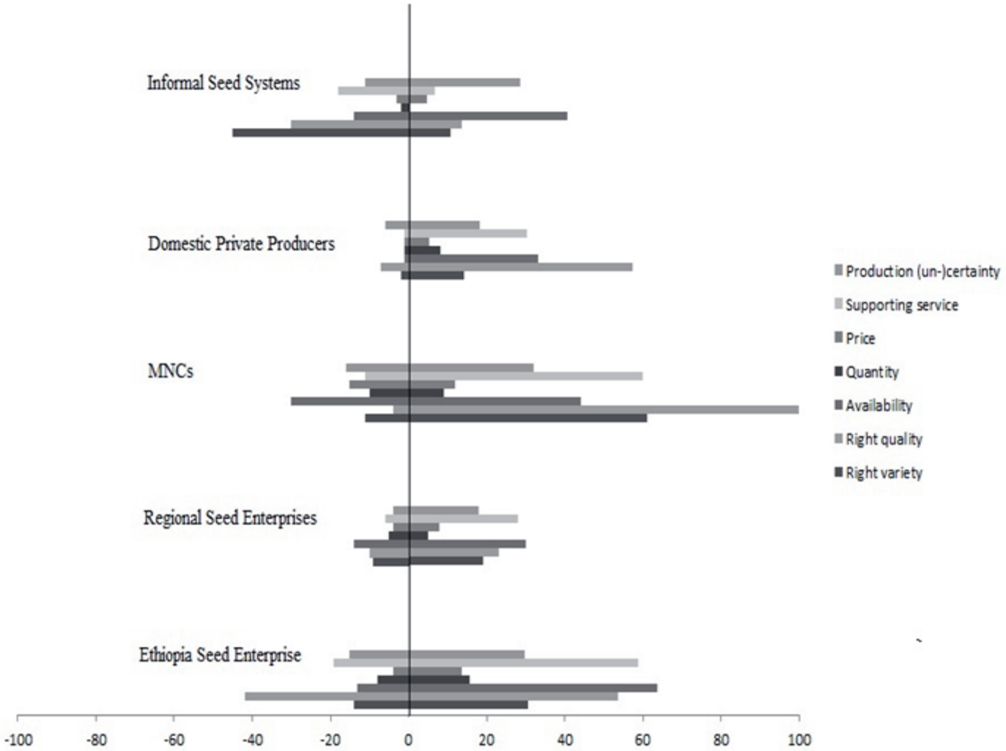

Figure 3.1: Farmer customers' (dis-)likes about the offers of maize seed supply systems.

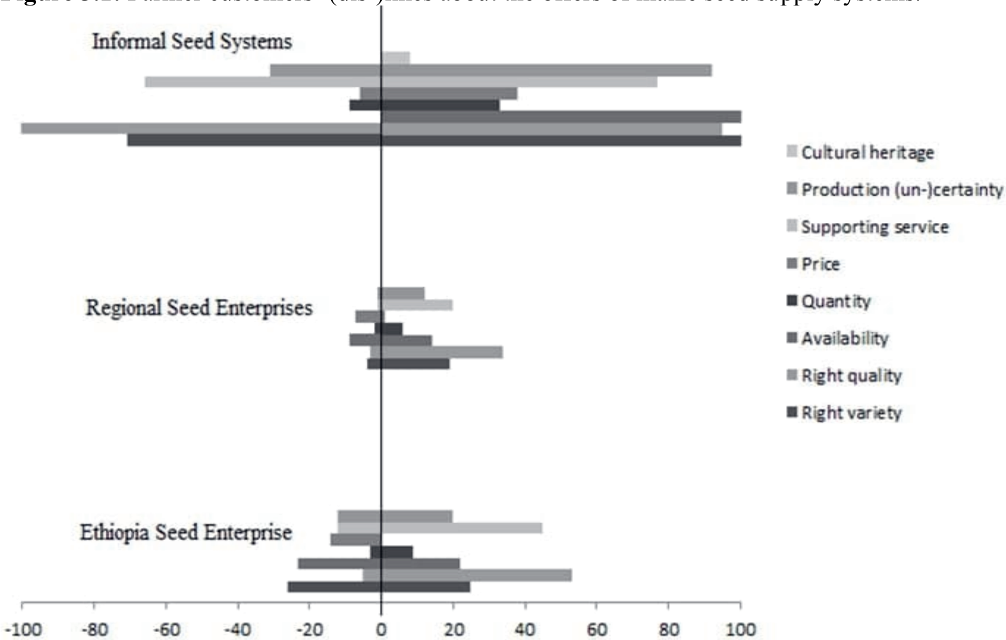

Figure 3.2: Farmer customers' (dis-)likes about the offers of teff seed supply systems.

3.5.3 End customers' level of satisfaction

Farmers' satisfaction with the seed supply systems was obtained from the responses to the four questions regarding "satisfaction," "trust," "repeat purchase," and "positive word of mouth." The interviews showed that the differences in likes, and dislikes associated with alternative seed supply systems translate into end customer/farmers *satisfaction*, and satisfaction related behaviors such as trust, repeat purchase (loyalty) and positive word of mouth. For example, several customers who were satisfied with the productivity (the right variety) and the right quality of seeds (as in the case of MNCs for maize and public enterprises for teff), indicated that this increased their trust, turned them into loyal customers, and generated positive words of mouth. For maize and teff, several respondents shared their dissatisfaction about the quality of seed from informal seed systems (such as for local traders and farmer-to-farmer exchange), leading to distrust and negative word of mouth. The end customers frequently mentioned supporting product services, including quality guarantees, as a trigger to becoming trusting and loyal customers.

3.6 Conclusions

This study qualitatively explored the performance of Ethiopian seed systems from a customer's perspective. Using individual interviews with 30 farmers, the central research questions that this paper aims to address are (1) what criteria farmers use to evaluate a seed supply system, and (2) to what extent do different seed supply systems meet these criteria. Together, these two research questions provide a perspective on the level of customer satisfaction with alternative Ethiopian seed supply systems, as a basis for potential improvement.

Seven criteria that farmer customers use to evaluate a seed supply system were identified. These can be summarized as: (1) making available to, and (2) affordable for farmers, (3) the right variety of seed, (4) at the right quality level, and (5) in sufficient quantities. In addition, (6) production uncertainty and (7) supporting services are criteria from the perspective of farmer customers. Supporting cultural heritage is a unique criterion for teff.

In examining to what extent different seed supply systems meet these criteria, there are profound similarities and differences in the evaluations between maize and teff, and between formal and informal seed supply systems. The customer's evaluations of the market offerings of the maize and teff seed supply systems shows that each of these supply chains have their own specific strengths and weaknesses. Moreover, there are differences in the evaluations of seed supply systems between farmer customers, for example between small and medium sized farmer customers.

For maize, the formal seed systems, both public and private, outperform the informal seed systems, but the evaluations of the formal systems differ considerably between and within the public and private supply systems. The private seed systems (MNCs and domestic producers) stand out in terms of right variety, quality, and supporting services, while the public seed systems (ESE and RSEs) outperform the private systems in terms of product availability, quantity (specific to ESE), price affordability (specific to ESE), and production certainty (specific to RSEs). For teff, the informal seed systems tend to dominate the formal systems (public seed enterprises) on availability, price (affordability), and quantity, but not for quality and supporting services, where the formal system outperforms the informal seed system. The informal seed systems also perform better than the formal systems in terms of providing production certainty and enhancing cultural heritage.

3.7 Discussion

Although the (formal) seed supply systems exist to serve the needs of local farmers as their end customers, the results of this study suggest that their performance needs to be improved. The findings from this study confirm the research that emphasized the farmers' dissatisfaction with the quality of seed received from public enterprises (Alemu, 2010; Alemu et al., 2010; Thijssen et al., 2008). From the mixed likes and dislikes that farmers express with the alternative supply systems as well as their level of (dis-)satisfaction, it seems that there is much to be gained by incorporating the "voice of the customer"/farmer more centrally in the development and provision of seeds. This is central to Ethiopian Agricultural policy and is a cornerstone of the recent ISSD initiative to strengthen the process of direct seed marketing from the different suppliers to end customers (Astatike et al., 2012; Benson et al., 2014).

The findings of this study provide important building blocks for increased performance in seed supply systems. The farmers' key performance criteria, as identified in this research, confirm that end customer satisfaction can be enhanced by providing "the right variety, at the right quality level, available at the right time and accessible place, in sufficient quantities, and for affordable prices". However, it also identifies the provision of supporting services and production (un-)certainty as criteria relevant to end users.

Coming from a centrally led economy, the Ethiopian government is gradually moving towards a more liberal market. For maize and teff, as the key crops addressed within the present study, there is a choice for farmer customers between alternative seed supply systems, although more so for maize than for teff. Farmers now have the choice to obtain their seeds from a variety of seed systems, both public (ESE and RSE) and private (MNCs and domestic systems), although not for all crops to the same extent. This allows seed systems that satisfy customers to prosper and grow, while other systems that farmers dislike may disappear. Under pressure of competition, seed systems are stimulated to deliver more improved seed, of the right variety and quality in the right quantities, at the right time, at accessible places, and at affordable prices.

Seed systems have advantages and disadvantages as is evidenced by the mix of likes and dislikes that they associate with different seed supply systems. Farmer customers do not agree about the seed system that satisfies their needs best. Consequently, there are opportunities for a variety of seed supply systems that meet the heterogeneous needs of farmer customers. For example, the largely dominant informal system ensures that the seed offered is readily available in the farmers' villages when the seed is needed (Atilaw & Korbu, 2011; Batt & Rexha, 2000; Seboka & Deressa, 1999). As a result, the informal system provides a broad range of crops to a wide variety of customer segments that often operate in risk prone and diverse agro-ecologies of Ethiopia (Louwaars et al., 2013; Mekbib, 2007).

Identifying and communicating the drivers of customer satisfaction from the customer's viewpoint is likely to lead to more vivid perceptions of quality (Zeithaml, 1988). Seed suppliers may benefit from this research because it identifies the drivers of customer satisfaction about seed systems from the farmer customers' perspective. Research and development strategies based on customer value and perceptions channel resources more effectively, and will meet customer expectations more, than those based only on supply chain standards (Zeithaml, 1988). Research that investigates how customers form their impressions of quality based on experiences, expectations, technical, and objective cues is necessary (Oude Ophuis & Van Trijp, 1995; Steenkamp, 1990; Zeithaml, 1988).

Customer value and satisfaction is a source of competitive advantage (Parasuraman, 1997; Rodriguez Cano, Carrillat, & Jaramillo, 2004; Woodruff, 1997). This research shows strengths (i.e., likes) and weaknesses (dislikes) of different seed supply systems, which shows how they can improve their offer to better satisfy their customers. Supply systems can enhance customer satisfaction and customer value by improving functions within value chains. Further research is needed to show which functions within seed supply systems need to be improved to improve their offer in the market.

3.8 Implications

The present study has contributed a lot to seed supply systems, and to the African agribusiness and supply chain research. To the researcher's knowledge, to date, no systematic empirical studies have investigated and reported the triggers that contribute to the customer satisfaction of market offerings in D&E markets and seed supply systems. The paper fills this existing literature gap by contributing to the research on how customers make evaluations of offers specifically in the context of D&E markets and for seed systems. We built a view on the future of scientific research in value creation in seed systems. We extracted this view from farmers, which together signify how the performances of each seed supply system contributed to the different perceptions of farmer customers. An understanding of the customer satisfaction criteria offers the premise of developing a market-oriented seed system that meets the farmers' complex and diverse product and service requirements. Thus, our research contributes to two disciplines: marketing and seed systems.

Our research advances the knowledge on the customer satisfaction and customer value literature on five grounds. First, in examining the customer satisfaction of supply systems, we add to the literature that examines customer satisfaction in the context of D&E markets and supply systems by providing the Ethiopian seed supply systems as a case. Second, in addressing the lack of standard measures of seed supply chain performance, we fill the existing literature gap by identifying the key customer satisfaction criteria for seed. Third, we add knowledge on Burgess & Steenkamp (2006) four stages through which research on emerging markets contributes to the growth of marketing science, namely: theory development, acquisition of meaningful data, data analysis and theory test, and learning. Our findings expand the knowledge on theory development, data acquisition, analysis, and learning stages by providing guidance on how customers perceive and evaluate market offerings in seed systems. Hence, we contribute by extending the theory development, learning, and methodological marketing literature to D&E markets (Burgess & Nyajeka, 2007; Burgess & Steenkamp, 2006; Ingenbleek et al., 2013). Fourth, in investigating supply systems from the perspectives of customers, we add knowledge on customer value creation (Bharti, Agrawal, & Sharma, 2014; Gummesson & Mele, 2010; Prahalad & Ramaswamy, 2004b; Teklehaimanot, Ingenbleek, & van Trijp, 2017) by showing the customer value creation process in complex chains (i.e., seed supply systems) in emerging markets. Moreover, the evaluations of producers/marketers' performance from the viewpoint of customers enables us to assess organizational performance and customer satisfaction, hence adding knowledge to marketing science. Fifth, we add knowledge on the existing marketing mix by showing that the marketing mix is extended beyond and should be adapted to the context of complex chains because of climatic factors, and as well as for risk diversification and management. Our findings also add to the literature that examines the effects of various packaging characteristics on customer perceptions, volume, buying behavior, and consumption experience. The packaging research may benefit from the inclusion of other indicators apart from size as the extrinsic quality indicator.

As we still know very little about how African smallholders perceive and evaluate their supply chains, more qualitative study is needed across different contexts and complex chains. We also suggest future studies testing customer satisfaction and (supply chain) performance relationship in a wide variety of African smallholder contexts.

3.9 Limitation and future research

The present study provides a first and unique qualitative perspective on end customer / farmer perceptions regarding the performance of seed supply systems. The finding of this study suggests the need for future research that sheds more light on how marketing channel functions influence the evaluation of complex (seed) supply systems.

The present study has explored only maize (hybrid) and teff (self-pollinated) crops. Therefore, the results may be different for different types of crops and varieties.

By its very nature, qualitative research has its strengths and weaknesses. Despite its strength of providing more in-depth and contextualized insight at the individual level, it does not allow for quantification. Future research, building on these initial insights needs to be done in larger and representative samples of farmers to provide external validity. Moreover, it allows for the identification of heterogeneity between farmer customers and thus the identification of market segments.

CHAPTER 4

Influence of Market Channel Function Proficiency on Customer Satisfaction with Supply Systems: The Case of Ethiopian Seed Supply Systems

This chapter will be submitted as: Shimelis Altaye Bogale, Frans J.H.M. Verhees, and Hans C.M. van Trijp.
Influence of Market Channel Function Proficiency on Customer Satisfaction with Supply Systems: The Case of Ethiopian Seed Supply Systems.

Abstract

This study quantitatively explores the proficiency of Ethiopian seed supply chains from a farmer customer's perspective. It shows how market channel functions performed by independent organizations in a supply chain contribute to end-customer satisfaction about value chain performance. This paper contributes to research on supply chains in the context of D&E markets and specifically to seed supply chains in Ethiopia. Based on interviews with 170 end customers (i.e., farmers), we examined the influence of market channel function proficiency on overall customer satisfaction. Seed supply chains for maize, teff, and beans in three regions of Ethiopia, Amhara, Oromia, and the Southern were evaluated. Results revealed that the seed multiplication, distribution, R&D, price, marketing service, and quality control and certification functions contribute to the end customer overall satisfaction. However, considerable variations exist between crops. This suggests that a good execution of these functions influence customer satisfaction. Our research contributes to developing seed chains that meet farmers' diverse product and service requirements.

Keywords: Marketing Channels, Marketing Functions, Customer Satisfaction, Seed Systems, Supply Chains, Proficiency/ Performance, Emerging Markets

4.1 Introduction

Seed is supplied by complex supply chains that perform a variety of market channel functions. Most market channel functions are conducted by a diversity of channel partners. Substantial differences exist in the constellation of seed supply chains in Ethiopia and their performance, as perceived by farmer-customers, varies widely. To improve the performance of Ethiopian seed supply chains, it is paramount to understand how market channel functions conducted by channel partners contribute to the performance of overall seed supply chains. This allows marketing channels to improve their performance by improving the market channel functions performed by a channel partner or by changing the constellation of the supply chain (i.e., choosing new partners). Previous research of Bogale, Verhees, and Van Trijp (2018) identified the key performance criteria adopted by end-users and provided an initial perspective on seed supply chains at their disposal. The present paper extends these findings and sheds more light on why farmer customers are satisfied about seed supply chains and how this relates to the perceived proficiency of market channel functions performed within supply chains.

Supply chains are conceptualized as a network of companies from suppliers to end-users, which have the intention to match supply and demand via coordinated efforts (Gundlach et al., 2006). Effectiveness and efficiency of supply chains increases customer satisfaction and business performance because it allows firms to create and pass along value to end-customers. This places marketing at the center of supply chain strategy and operations (Kozlenkova et al., 2015). Firms that effectively manage the supply chain combine all functions seamlessly within and across organizations (Stock et al., 2010). Deficiencies in any one of the functions will undermine the effectiveness of the supply chain as a whole (Stock et al., 2010).

Supply chains call for coordinated and effective Supply Chain Management (SCM). Identifying market channel functions for supply chain performance is based on value chain de-construction and re-construction (Porter, 1980). That is, identifying supply chain functions [as in Porter's primary and secondary functions] and identifying ways to execute functions more proficiently. This study adopts a functional approach to marketing and considers a supply chain as a constellation of organizations that perform market channel functions, which effectively is a SCM approach. Functions and organizations are at the core of marketing thought. Market channel functions need to be performed, and so organizations emerge and evolve to perform them (Rosenbloom, 2013).

Most studies on supply chains are conducted in high income markets, often involving large multinational companies with abundant resources, competencies and capabilities, and many functions under one-roof. Supply chains in D&E markets face specific contextual challenges, often including organizations with limited resources, competencies, and capabilities, and with most functions dispersed over different organizations. However, research on supply chains with multiple actors that perform different roles in the context of D&E markets does not exist to the best of our knowledge. Thus, it is not clear how market channel functions contribute to customer satisfaction in such contexts.

Methodologically, most studies are based on firm-level data. Very few studies examine triadic relationships (e.g., supplier–supplier–buyer) (Choi & Wu, 2009) or focus on the complex relationships between marketing functions in different organizations (Palmatier, Scheer, Houston, Evans, & Gopalakrishna, 2007). In addition, there is also a lack of multiple channel studies. Currently the use of multiple channels to get to the same market has become the norm in many industries (Palmatier, Louis Stern, & Anderson, 2014). End users enjoy the ability to buy the same product through different channels, and suppliers can increase market penetration via multiple channels. Hence, multiple channel research is needed (Kozlenkova et al., 2015). The present study explores customer satisfaction and proficiency of seed supply chain functions from the perspective of end customers in the context of D&E markets. Our specific context is that of seed supply chains in Ethiopia.

The central research questions that this paper addresses are: (1) what are dominant value chain constellations in Ethiopian seed supply chains? (2) How does perceived function proficiency contribute to overall chain satisfaction? (3) Do different value chain constellations matter for farmers' overall satisfaction? (4) How are different organizations assessed in terms of function proficiency? And (5) What are implications of these findings for more optimal seed supply chain design?

From the mainstream SCM literature and practice, the study provides an empirical contribution to the literature on the following grounds:

First, a context-based contribution. In optimally functioning markets supply chain constellations can be expected to evolve towards efficiency and effectiveness, through the processes of "optimal" partner selection (on the basis of complementarity), and through backward and forward integration if that reduces transaction costs. However, many of these assumptions are based on insights from western High-Income Economies, and it is not self-evident that in emerging markets such optimality in supply chain constellations is achieved. So, our first contribution is that we explore supply chain constellations in D&E markets, specifically in the case of Ethiopian seed supply chains.

Second, a supply chain management research approach. Where previous studies have tended to focus on dyadic relationships within supply chains (often also at the firm level) we extend that perspective across the whole seed supply chain as a special and specific case. This is because such supply chains stretch all the way from seed R&D to actual price and service-related activities once the resulting food/seeds (as supply chain output) are ready to be marketed. So, we explore a high level of complexity in value chains.

Third, in terms of research approach, we build on seminal research in the field of new product development (Cooper & Kleinschmidt, 1987a, 1987b, 1995). By analogy, we adopt the approach of sub-process proficiency to better understand the truly critical success factors in overall value chain performance.

Fourth, in terms of marketing approach, we take an end (i.e., farmer) customer perspective on the supply chain. That is, we assume that value chain constellations are there to be designed to serve the end customer (farmer in our case) that benefit from it. As such we take a co-creation perspective in which we approach value chain performance from the perspective of farmer / end customer perception in terms of perceived proficiency of functions performed and overall satisfaction.

Overall, this paper aims to fill the knowledge gap on the identification of value chain constellations or supply chain configurations as they have emerged in the Ethiopian seed supply chain in terms of “who” (i.e., which actor / organization), does “what” (i.e., in terms of marketing functions), “how well” (i.e., in terms of perceived proficiency), and resulting in “what level of overall satisfaction” (i.e., for the farmer / end-customer).

Such insight is of managerial and policy relevance as it provides the necessary (bottom-up) input for co-creation to further optimize value chains, not only from an economic and marketing perspective for organizations in supply chains, but also from a food security perspective to ensure sufficient quantity of food of sufficient quality.

In the present paper, we identify (dominant) value chain constellations within the Ethiopian seed supply chain, in terms of actors and their marketing functions/market channel functions performed. From an end-customer perspective we analyze overall satisfaction with these alternative value chains for maize, teff and beans. These analytical insights enable us to disentangle the end customer needs and preferences in terms of value chain constellations as a basis for commercial and public policy implications.

The paper is organized as follows. First, it describes the research context. Then the influence of market channel function proficiency on customer satisfaction is tested quantitatively across respondents and supply chains. The implications of our conclusions for supply chain organization and management are discussed.

4.2 Research context

Our specific research context is that of seed supply chains in Ethiopia. In Ethiopia, there is a substantial gap between the supply of and demand for seed (Alemu, 2010, 2012; Atilaw & Korbu, 2011; Thijssen et al., 2008). Supplying the right quantity and quality of seed at the right time and place and at an acceptable price is an Ethiopian development objective. Well performing seed systems that effectively and efficiently provide customer value are important also for food security and economic growth of a developing nation, like Ethiopia.

Seed supply chains include all organizations, individuals, institutions and legal frameworks involved in the development, multiplication, storage, processing, quality control and certification, and distribution and marketing of seeds (Maredia et al., 1999). The Ethiopian seed chains are classified into three types: the informal, formal, and intermediate.

The informal (or traditional) system/chain is comprised of individual farm households that carry out all functions, including seed development, multiplication, storage, processing and marketing for land races and sometimes for improved varieties (Cromwell et al., 1992). The formal (or non-traditional) system/chain is comprised of organizations specialized in one or several functions for improved varieties. The specialized public and private entities (e.g., research organizations, public and private companies, and farmers seed unions) in the formal seed system have more abundant resources and capacities than the individual farm households in the informal seed system to perform the marketing functions. The informal seed system is not regulated by law and operates without legal certification of the process (Alemu, 2010; Louwaars et al., 2013).

An intermediate seed system, also known as the community-based seed system exists between the formal and informal system. It involves farmer seed producing organizations/ cooperatives and local seed businesses. These organizations perform marketing functions for improved varieties obtained from the formal supply chains and for local varieties from the informal chain. The intermediate seed chain in Ethiopia is supported by governmental (e.g., extension, certification, and research organizations) and non-governmental programs to meet local demand for seed via local production schemes.

The major players in the seed system/chain in Ethiopia include institute of biodiversity, public agricultural research institutes and universities, public extension organizations, public seed enterprises, domestic and multinational private companies, private producers or out growers, farmers' cooperative unions, farmers' cooperatives, seed quality control and certification authorities, and individual farm households (of informal seed chains).

Public agricultural research institutes, universities, and multinational companies (MNCs) perform R&D functions. Individual farm households do some selections for local landrace varieties. Seed multiplication is a multi-generation process of three to five years. Public agricultural research institutes, universities, and MNCs multiply from breeder to pre-basic. Public seed enterprises, domestic and MNCs, private producers or contract growers, and farmers' cooperative unions multiply from pre basic to basic and to certified seed for farmer customers. Individual farm households multiply seed of local landrace and improved varieties for cash and household consumption. Storage and processing functions are performed by public research organizations, public seed enterprises, domestic and MNCs, and farmers' cooperative unions. Private producers store seed but leave processing mostly to public seed enterprises (i.e., the contracting party). Farmers' cooperatives also store seed, but leave processing mostly to cooperative unions (i.e., the contracting party). Farm households use traditional techniques to store and process seed. Quality control and certification is performed by public seed certification laboratories. Seed producers have their own internal quality control or inspection experts but leave external quality control and certification to public seed certification laboratories/ quarantine authority. Farmers use their own experience to judge quality, purity, germination, moisture content, uniformity, and seed health, but quality control and certification is often lacking (Alemu, 2010). Distribution and marketing of the certified seed is performed by public seed enterprises, domestic private and MNCs, farmers' cooperatives, cooperative unions, multipurpose farmers cooperatives, public extension organizations and private agro dealers or company's sales agents. Distribution and marketing also are carried out by individual farm households, through their long-lasting relationship with other farmers, informal networks, bartering or purchasing from local markets.

Farmers in Ethiopia see themselves confronted with an ambivalent and complex task of selecting their seed. This is reflected in different perceptions of seed supply chains (Bogale et al., 2018). Bogale et al. (2018) studied customer evaluations of Ethiopian seed supply chains for maize and teff. They identified "prototypical" supply chains for maize: (1) Multinational seed companies (MNCs), (2) the national level Ethiopia seed enterprise (ESE), (3) Regional seed enterprises (RSEs), (4) Domestic private seed producers (DPPs), and (5) the informal seed systems (ISSs). For teff these were: (1) the national level Ethiopia seed enterprise (ESE), (2) regional seed enterprises, and (3) the informal seed system.

Bogale et al. (2018) provide a qualitative evaluation of seed supply chains in Ethiopia. Customer satisfaction with seed supply chains is enhanced by providing "the right variety, at the right quality level, available at the right time and right place, in sufficient quantities, and for affordable prices". Provision of supporting services and production certainty also increases customer satisfaction. Moreover, cultural heritage was identified as a determinant of customer satisfaction for teff supply chains (Bogale et al., 2018).

To assess sources of customer (dis-)satisfaction across the different stages of the value chain, we analyze different seed supply chains as bundles of market channel functions. Such functions may be performed by different actors in the value chain without much central governance.

Marketing functions/Market channel functions

Market channel functions are those operations and activities which are necessary for the movement of products from producer to end-customer (i.e., farmer). Marketing channel functions performed in seed systems include research and development (R&D), multiplication, storage and processing, quality control and certification, and distribution and marketing.

The R&D function develops improved varieties. The goal is to provide varieties that offer solutions for farmer-customers. New varieties need to be approved for release on the Ethiopian market. The National Variety Release Committee (NVRC) evaluates the performance, and the Ministry of Agriculture and Rural Development (MoARD)[3] formally approves and registers new varieties. Thus, they are added to the formal seed registration list of approved varieties. Approved varieties are multiplied within the R&D function to quantities sufficient for large-scale multiplication.

The seed multiplication function is a multi-generation process. Multipliers start with breeder seed and multiply to pre-basic, basic, and ultimately certified seed. The goal is to produce quantities sufficient to meet market demand.

The storage function spans the time between harvest and demand while maintaining the quality of the seed. The seed needs to be ventilated, and protected from insects, diseases, pests, rain, and heat. The goal is to make seed available at the right time for farmer-customers while maintaining the quality.

The processing function provides clean seed, treated against pests, and packaged and labeled with the required information. The goal is to add value to the seed by solving problems that farmer-customers have when using the seed.

Quality control and certification provide guarantees and transparency about genetic characteristics, purity, germination, moisture content, and seed health.

The distribution function spans the location between harvest and demand. It provides seed to accessible locations and on time. The goal is to make seed available at the place and time where and when farmer-customers want to use it.

The marketing function communicates the offer to farmer-customers: benefits of varieties and qualities, availability at times and places, and prices. Moreover, the marketing function

[3] The name of the Ministry of Agriculture-MoA (at national) and Bureau of Agriculture-BoA (at regional), and Woreda office of Agriculture-WoA (at local) in Ethiopia have changed several times. Since 1991, the ministry was referred to as the Ministry of Agriculture (MoA); in 2004, it became the Ministry of Agriculture and Rural Development (MoARD); in 2010, it was changed back to the Ministry of Agriculture (MoA); and recently in 2017 it was renamed the Ministry of Agriculture and Natural Resources (MoANR). In this thesis, for consistency we refer to it as the Ministry of Agriculture (MoA), Bureau of Agriculture (BoA), and Woreda office of Agriculture (WoA).

provides businesses with feedback from the market and thus serves as a coordinating function for the responsiveness of seed supply chains.

4.3 Methodology

This study analyzes how performance of different market channel functions influences customer satisfaction by adopting approaches used in the new product development (NPD) literature (Cooper & Kleinschmidt, 1987a, 1995; Ernst, 2002). The NPD process is a series of interrelated activities that need to be performed. The ultimate success of the new product is affected by all these activities and particularly the proficiency with which these are performed. The influence of market channel functions on customer satisfaction can be analyzed in a similar vein.

A quantitative approach using a cross sectional study design is adopted. Data are obtained from individual farmer-customers. Seed value chains and market channel functions within seed value chains are the units of analysis. Specifically, individual farmer-customers evaluate seed supply value chains for maize, teff, and beans, across three regions of Ethiopia: Amhara, Oromia, and the Southern region.

Data were collected between March and December 2016. Farmers/end customers grow crops in a mixed cropping system with a diversified crop portfolio (i.e., there are farmers that grow all three crops, a combination of any of the two crops, and/or specialization in a single crop depending on their localities). A total of 170 farmers were interviewed on their farm fields by trained enumerators. As different farmers have different experiences with supply chain actors and some actors may be more prominent, the number of evaluations differs per supply chain organization.

All respondents were informed about the confidentiality of their responses and the academic purpose of the study.

The questionnaire started with a general introduction on the functions performed in seed supply chains of maize, teff, and haricot bean. To bring the topic close to the respondents' own practices, respondents indicated what crops and varieties they grow themselves. For each of the crops grown, farmers indicated from which seed supply channels they obtain their seeds, and which organization performed each of the market channel functions involved.

Participants then assessed the proficiency of the market channel functions in each seed supply chain that they obtain seed from. Farmers were asked to evaluate the proficiency of the (a) R&D, (b) Multiplication, (c) Storage and Processing, (d) Quality Control and Certification, e) Distribution, and f) Marketing Functions. Afterwards, farmers were asked to provide their overall satisfaction with each crop supply chain, based on end customer satisfaction criteria (Bogale et al., 2018).

Measures

Most variables included in this study are measured on multi-item scales drawn from previous research.

Proficiency was measured for each market channel function within a seed value chain. An existing scale from the NPD literature to measure proficiency was adapted (Cooper & Kleinschmidt, 1987a, 1987b, 1995). We measured the proficiency of each function provided by each actor, through 3 questions: (1) [MNC R&D] function develops excellent seed for maize. (2) [MNC R&D] function is superior to competitors in developing seed varieties for maize. (3) [MNC R&D] function performs poorly in developing seed varieties for maize. In a similar way, the other 5 functions were measured.

Overall Customer Satisfaction was measured on a seven-point Likert scale for each "multi-actor" value chain constellation that a farmer buys from. Customer satisfaction was measured through the end customer satisfaction criteria, captured by fourteen items identified in previous research on seed supply chains in Ethiopia (Bogale et al., 2018). Customers farmers evaluated their satisfaction about each channel on: (1) product performance, (2) quality, (3) affordability, (4) costs, (5) availability, (6) timely delivery, (7) place convenience, (8) quantity, (9) varietal information provided, (10) added services (e.g., quality guarantees and packaging applied), (11) production (un-)certainty, (12) risk diversification, (13) supporting cultural heritage, and (14) overall satisfaction with seed offers (see Appendix 4.1).

Data analysis

Scale reliability is assessed through Cronbach's alpha and principal component analysis (PCA) using SPSS 23. The relation between market channel functions' proficiency and overall customer satisfaction with supply chains was assessed through multiple regression.

The 14-item overall customer satisfaction measures show adequate internal reliability in terms of Cronbach's alpha = 0.89 (Table 4.1.) when estimated across all cases.

Reliability of the 3-item proficiency measure was assessed per market channel function. For all channel function's reliability is confirmed (Table 4.1). The PCA result shows that the proficiency of the (1) R&D, (2) multiplication, (3) storage and processing, (4) quality control and certification, and (5) distribution functions are one -dimensional. However, according to the PCA the marketing function proficiency (i.e., price, varietal information, and services) is not one- dimensional. We have extracted 2 factors, the one related to (a) product pricing, and the other related to (b) product information and services. Thus, we use the proficiency of 7 market channel functions for further analyses: R&D, multiplication, storage and processing, quality control and certification, distribution, marketing-price, and marketing-service.

Table 4.1: Reliability of overall customer satisfaction and proficiency of market channel functions

Cronbach's Alpha

	Overall Customer Satisfaction	R&D Function	Multiplication Function	Storage and Processing Function	Quality Control and Certification Function	Distribution Function	Marketing _price Function	Marketing _Service
Alpha	0.89	0.87	0.91	0.90	0.93	0.85	0.86	0.93

Analysis strategy is based on both the individual level (N=864) data (across crops and farmers) and on the unique chain configuration level (K=43). Analyses are based on proficiency scores of performed market channels functions as well as on (dummy coded) specific actors performing the different market channel functions.

To analyze "what are dominant value chain constellations in Ethiopian seed supply chains?" (RQ1), we map the diversity of supply chain configurations in terms of their occurrence in the sample, report frequencies of their occurrence, and the average level of overall farmer-level satisfaction within the sample.

To analyze "how does perceived function proficiency contribute to overall chain satisfaction?" (RQ2), we regress individual farmer level satisfaction with the value chain configuration on the set of seven proficiency ratings for the market channel functions executed, both across crops (n=864), for the three crops separately (maize; n=389, teff;

n=355, beans; n=120), and for the unique value chain configurations identified under RQ1 (maize; k=16; teff; k=18; beans; k=9).

To analyze "do different value chain constellations matter for farmers' overall satisfaction?" (RQ3), we regressed overall satisfaction ratings for the value chain configuration onto the dummy coded actors performing each of the market channel functions. Again, these analyses were conducted overall, for different crops separately, as well as for the unique value chain configurations.

To analyze "how are different organizations assessed in terms of function proficiency?" (RQ4), we calculate mean proficiency ratings of the various actors executing each market channel function and conduct F-tests to compare proficiency ratings between actors for each market channel function.

In the analyses, seven *market channel functions* are distinguished: R&D, multiplication, storage and processing, quality control and certification, distribution, marketing (price), and marketing (services). Value chain *actors* were coded into seven categories for all of the market channel functions except R&D which has unique actors involved: (1) Multinational Companies (MNC), (2) The National level public seed enterprise (ESE), (3) Regional level public seed enterprise (RSE; including BoA and WoA), (4) Domestic private companies (including individual private dealers), (5) Farmers' cooperative union (including seed union and multipurpose unions), (6) Farmers' seed producing cooperative (SPC; including primary farmer cooperatives), and (7) Informal seed supply chains. The market channel function of R&D is performed by only four specialized actors, namely (1) the national (EIAR) and (2) regional (RARIs) level public research institutes, (3) Multinational Companies (MNC), and (4) the Informal Seed System.

The *value chain configuration* is thus defined as a set of 6*7 (all other functions) + 4 (for R&D) = 46 dummy variables. In our analyses, the National level public seed enterprise (ESE) serves as baseline category for all market channel functions except R&D function in which case National Research Organization serves as reference category. No dummy variables were included for National (Ethiopian) Seed Enterprise (ESE) to avoid multicollinearity.

Before running the analysis, we check for multicollinearity problems. We check for perfect correlation between independent variables and maintain not perfectly correlated variables. For example, we maintained the dummy variables for the R&D and distribution functions performed by MNCs, but removed the dummy variables for the multiplication, storage and processing, and quality control and certification functions by MNCs to avoid perfect multicollinearity. MNCs often operate with vertically integrated supply chains. Consequently, coefficients should be interpreted with caution, because it is not clear which function influences customer satisfaction. The coefficient for the MNCs R&D function also captures the influence of the MNC's multiplication, storage and processing, and quality control and certification functions. Similarly, as distribution and marketing functions are often performed by the same MNC, we have maintained only the distribution function of MNCs and removed the dummy variable for the marketing function. From the Regional Seed Enterprises' channel functions, we have maintained three dummy variables, i.e., R&D, multiplication, and distribution. Regarding the Seed Multiplying Unions and the domestic private supply chains, we have maintained seed multiplication and distribution functions. We have also maintained three variables related to Seed Producing Cooperatives (SPCs), i.e., multiplication, storage and processing, and distribution. Finally, we have maintained only the R&D (local selection practices) of farmers seed system (FSS) or informal seed supply chains, as all functions are performed by the individual households in the FSS. That means that the influence of the R&D function of informal/farmers seed chains captures the influence of all the other functions (multiplication, storage and processing, quality control and certification, distribution, and marketing).

We have also computed the F change to check added value in predicting satisfaction scores for each of the functions. That is, when the dummy variables for each function are removed from the model. The purpose is to understand whether each function matters to overall customer satisfaction.

4.4 Results

Results are organized around the four research questions.

4.4.1 What are dominant value chain constellations in Ethiopian seed supply chains?

In distinguishing between 7 value chain functions (R&D, multiplication, storage and processing, quality control and certification, distribution, marketing price, marketing service), and 7 types of organizations potentially performing these, there is a huge number of potential supply chain configurations that could have emerged. We have also added two specialized R&D actors (National and regional research institutes).

Ethiopian seed supply chains have developed around a specific set of “prototypical” constellations. We actually “only” find 43 unique supply chain configurations, with varying levels of farmers expressed overall satisfaction and with varying prominence in the market.

16 value chain constellations were identified in maize seed supply chains (Table 4.2A) based on end-customer (N=150) experiences.

The first dominant constellation was evaluated 54 times: R&D was performed by Regional Research Organizations and all the other functions from multiplication to marketing price and service by Regional Seed Enterprises (RSEs). In other words, 36% (54/150) of the respondents were sufficiently familiar with this dominant constellation. The average customer satisfaction score for this dominant value chain was 3.88 on a seven-point-Likert scale.

Table 4.2A: Prominence and overall satisfaction with the different value chain constellations for maize

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A	R&D																
1	Multinational Co.		X		X				X								
2	National Research Org.						X	X		X	X	X	X				X
3	Regional Research Org.	X		X		X								X	X	X	
4	Farmers Seed System																
B	Multiplication																
1	Multinational Co.		X		X				X								
2	National Seed Ent.					X		X					X		X		
3	Regional Seed Ent.	X									X	X		X			X
4	Domestic Private Co.			X						X							
5	Seed Multiplying Union						X									X	
6	SPCS																
7	Farmers Seed System																
C	Storage and Processing																
1	Multinational Co.		X		X				X								
2	National Seed Ent.					X		X					X		X		
3	Regional Seed Ent.	X									X	X		X			X
4	Domestic Private Co.			X						X							
5	Seed Multiplying Union						X									X	
6	SPCS																
7	Farmers Seed System																
D	Quality control& Certification																
1	Multinational Co.		X		X				X								
2	National Seed Ent.					X		X					X		X		
3	Regional Seed Ent.	X									X	X		X			X
4	Domestic Private Co.			X						X							
5	Seed Multiplying Union						X									X	
6	SPCS																
7	Farmers Seed System																
E	Distribution																
1	Multinational Co.		X														
2	National Seed Ent.					X											
3	Regional Seed Ent.	X															X
4	Domestic Private Co.			X	X					X	X		X	X	X		
5	Seed Multiplying Union															X	
6	SPCS						X	X	X			X					
7	Farmers Seed System																
F	Marketing-price																
1	Multinational Co.		X														
2	National Seed Ent.					X											
3	Regional Seed Ent.	X															X
4	Domestic Private Co.			X	X					X	X		X	X	X		
5	Seed Multiplying Union															X	
6	SPCS						X	X	X			X					
7	Farmers Seed System																
G	Marketing-service function																
1	Multinational Co.		X														
2	National Seed Ent.					X											
3	Regional Seed Ent.	X															X
4	Domestic Private Co.			X	X					X	X		X	X	X		
5	Seed Multiplying Union															X	
6	SPCS						X	X	X			X					
7	Farmers Seed System																
	Average overall satisfaction	3.88	3.98	3.82	3.95	3.64	3.38	3.90	3.92	3.63	4.09	3.71	4.26	3.62	3.89	3.45	2.86
	Frequency of value chain constellation	54	42	42	34	30	30	30	30	20	20	19	11	10	10	6	1

Table 4.2B describes 18 value chain constellations identified in teff seed supply chains based on end-customer (N=128) experiences.

The most dominant constellation is evaluated 128 times. All seed related functions were performed by the Farmers' seed supply chains or Farmer Seed Systems (FSSs). In other words, 100% or all those farmers working on teff are sufficiently familiar with this dominant constellation. The average customer satisfaction score is 4.94. For teff the most dominant seed system also satisfies customers most. We have identified some supply chain configurations for teff with high scores on customer satisfaction that are not dominant channels. A value chain configuration where R&D was performed by regional research organization and all the other functions from multiplication to marketing price and service by Seed Producing Cooperatives/SPCs was evaluated with an average customer satisfaction score of 3.98. This chain was evaluated only 20 times.

Table 4.2B: Prominence and overall satisfaction with the different value chain constellations for teff

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A	R&D																		
1	National Research Org.				X	X	X	X	X	X	X	X	X	X					
2	Regional Research Org.		X	X											X	X	X	X	X
3	Farmers Seed System	X																	
B	Multiplication																		
1	National Seed Ent.					X	X							X		X	X	X	
2	Regional Seed Ent.		X									X	X		X				X
3	Domestic Private Co.									X	X								
4	Seed Multiplying Union				X														
5	SPCS			X				X	X										
6	Farmers Seed System	X																	
C	Storage and Processing																		
1	National Seed Ent.					X	X							X		X	X	X	
2	Regional Seed Ent.		X									X	X		X				X
3	Domestic Private Co.									X	X								
4	Seed Multiplying Union				X				X										
5	SPCS			X				X											
6	Farmers Seed System	X																	
D	Quality control& Certification																		
1	National Seed Ent.					X	X							X		X	X	X	
2	Regional Seed Ent.		X									X	X		X				X
3	Domestic Private Co.									X	X								
4	Seed Multiplying Union				X														
5	SPCS			X				X	X										
6	Farmers Seed System	X																	
E	Distribution																		
1	National Seed Ent.													X			X		
2	Regional Seed Ent.		X																
3	Domestic Private Co.										X								
4	Seed Multiplying Union				X		X						X		X	X			
5	SPCS			X		X		X	X	X		X						X	X
6	Farmers Seed System	X																	
F	Marketing-price function																		
1	National Seed Ent.													X			X		
2	Regional Seed Ent.		X																
3	Domestic Private Co.										X								
4	Seed Multiplying Union				X		X						X		X	X			
5	SPCS			X		X		X	X	X		X						X	X
6	Farmers Seed System	X																	
G	Marketing-service function																		
1	National Seed Ent.													X			X		
2	Regional Seed Ent.		X																
3	Domestic Private Co.										X								
4	Seed Multiplying Union				X		X						X		X	X			
5	SPCS			X		X		X	X	X		X						X	X
6	Farmers Seed System	X																	
	Average overall satisfaction	4.94	3.63	3.98	3.65	3.46	3.40	4.66	3.30	3.72	4.38	3.46	3.11	2.71	3.69	3.66	3.03	3.38	3.24
	Frequency of value chain constellation	128	43	20	20	20	20	10	10	10	10	10	10	10	10	10	7	4	3

Table 4.2C presents the 9 unique constellations for beans based on end-customer (N=60) experiences. In the first chain all seed related functions were performed by the Farmers' seed supply chains or Farmer Seed Systems (FSSs). The average customer satisfaction score is 4.42, which is the highest customer satisfaction score for bean seed supply chains.

Table 4.2C: Prominence and overall satisfaction with the different value chain constellations for beans

		1	2	3	4	5	6	7	8	9
A	R&D									
1	National Research Org.		X							X
2	Regional Research Org.			X	X	X	X	X	X	
3	Farmers Seed System	X								
B	Multiplication									
1	National Seed Ent.								X	X
2	Regional Seed Ent.			X						
3	Domestic Private Co.							X		
4	Seed Multiplying Union		X			X	X			
5	SPCS				X					
6	Farmers Seed System	X								
C	Storage and Processing									
1	National Seed Ent.								X	X
2	Regional Seed Ent.			X						
3	Domestic Private Co.							X		
4	Seed Multiplying Union		X			X	X			
5	SPCS				X					
6	Farmers Seed System	X								
D	Quality control& Certification									
1	National Seed Ent.								X	X
2	Regional Seed Ent.			X						
3	Domestic Private Co.							X		
4	Seed Multiplying Union		X			X	X			
5	SPCS				X					
6	Farmers Seed System	X								
E	Distribution									
1	National Seed Ent.									
2	Regional Seed Ent.									
3	Domestic Private Co.							X		
4	Seed Multiplying Union						X			
5	SPCS		X	X	X	X			X	X
6	Farmers Seed System	X								
F	Marketing-price function									
1	National Seed Ent.									
2	Regional Seed Ent.									
3	Domestic Private Co.							X		
4	Seed Multiplying Union						X			
5	SPCS		X	X	X	X			X	X
6	Farmers Seed System	X								
G	Marketing-service function									
1	National Seed Ent.									
2	Regional Seed Ent.									
3	Domestic Private Co.							X		
4	Seed Multiplying Union						X			
5	SPCS		X	X	X	X			X	X
6	Farmers Seed System	X								
	Average overall satisfaction	4.42	3.90	3.86	3.89	3.84	3.21	3.76	3.84	3.81
	Frequency of value chain constellation	20	20	20	10	10	10	10	10	10

While considering the different value chain constellations or supply chain configurations across the three crops, we found some dominant value chain constellations.

The most dominant value chain constellation for maize, with an average customer satisfaction score of 3.88, was emerged: R&D was performed by Regional Research Organizations and all the other functions from multiplication to marketing price and service by Regional Seed Enterprises (RSEs). The policy direction and mandate of regional research organizations and regional seed enterprises to serving their own regional farmer customers as their end users, in addition to the high political support they are receiving from their respective regional governments, tend to be the major factors accounting to the dominance of this value chain configurations for maize.

Some value chain constellations for maize with high scores on customer satisfaction are not dominant channels. Only 11 respondents report experience with the constellation with highest overall satisfaction (M=4.26). Similarly, a supply chain configuration, with an average customer satisfaction scores of 4.09, was evaluated only 20 times. Less dominant channels, despite the higher scores on customer satisfaction, may exist because the constellation was established only recently. Another reason is that they target a small market segment with specific demands. The targeted market segment is highly satisfied, but there is still room to grow. For example, the involvement of private dealers in seed distribution and marketing functions is a recent phenomenon in the seed industry of Ethiopia. Most seeds are distributed via public extension offices, farmers' cooperatives, and cooperative unions, but not very proficient. The private agro-dealers and/or agents of private and public companies are perceived to be proficient in the seed distribution and marketing functions. Thus, it is expected that channels about which customers are highly satisfied will become more dominant.

The informal seed system/ISS is the most dominant value chain constellation for teff. The self-pollinated nature of teff and the ability of farmers to select, multiply and distribute these seeds at farm local level are the key factors accounting for the dominance of this constellation. Farmers through their own traditional knowledge and practices do perform all seed related functions for teff, ranging from local selection to distributing and marketing related tasks. The ease availability of local seeds in the hands of farmers (i.e., farmers saved seeds) and in the local market, as well as farmer-to-farmer exchanged seeds of important crops also contributed to the high dominance of this channel.

The informal seed system is equally dominant with another two-value chain constellations for beans (see Table 4.2C). These two chains were evaluated only 20 times. However, for beans the informal seed system satisfies customers most.

The prominence of the ISS for teff and beans is also related to the nature of these crops (i.e., self-pollinated crops). In addition, the limited emphasis given by policy makers and seed chain actors for self-pollinated crops such as for teff and beans, as opposed to hybrid maize, and the limited profitability and commercialization of these crops on the sides of seed companies also account for the high prominence of the ISS for teff and beans.

4.4.2 How does perceived market channel function proficiency contribute to overall end-customer satisfaction?

The effects of the proficiency of 7 market channel functions on the overall customer satisfaction (i.e., performance of supply chains) were examined using multiple regression analyses (Table 4.3A). The overall model fit was good (R^2 = 0.74, F (9, 854) =262.94, p < 0.001). That is, when the proficiency of the 7 market channel functions was used as predictors (and 2 constants for teff and beans), about 73.5% of the variance in farmer's customer satisfaction could be explained.

Results confirm that six market channel functions make a positive contribution to customer satisfaction. The relationship between the proficiency in storage and processing and overall customer satisfaction was not significant (β = -0.01, p =0.67). This holds across crops. The reason for this may be the little variation between respondents on the proficiency scores of the storage and processing function, including seed cleaning, grading, packaging (e.g., packaging characteristics such as size, volume, appearance, and color), and treatment of seeds.

The seed multiplication, distribution, and R&D functions contribute more to overall customer satisfaction than the other functions. Proficiency in seed multiplication increases customer satisfaction most (β = 0.33, p<0.001), followed by proficiency in distribution (β = 0.26, p<0.001) and R&D (β = 0.24, p<0.001). The result also shows the positive and significant influence of price, services, quality control and certification functions on overall customer satisfaction.

Table 4.3A also shows the relationships between market channel functions and overall customer satisfaction for value chains for each crop separately. The overall regression was statistically significant for maize (R^2 = 0.75, F (7, 381) = 163.85, p < 0.001), teff (R^2 = 0.77, F (7, 347) = 169.88, p < 0.001), and bean (R^2 = 0.55, F (7, 112) = 19.63, p < 0.001). The results confirm the significant and positive influence of R&D, multiplication, and marketing price functions across the three crop value chains. R&D has a more positive and significant influence for maize than for teff and beans. Multiplication has a more positive and significant influence for maize and beans than for teff. Proficiency in price/affordability has a more positive influence on customer satisfaction for beans than for teff and maize. In addition, distribution and marketing services have a positive and significant effect on the performance of maize and teff supply chains.

Across the three crops, there is little variation in the effect of proficiency in storage and processing and overall customer satisfaction; it is low for all supply chains. Proficiency in quality control and certification has a positive influence on customer satisfaction for maize ($\beta = 0.30$, $p<0.001$), but not for teff and beans. For teff and beans there is little variation in the effect of proficiency in quality control and certification and overall customer satisfaction. In particular, the lack of quality control and certification in the informal seed supply chains for teff and beans explain farmers' dissatisfaction with the quality of seed they are receiving from informal supply chains. Farmers themselves, using traditional techniques, control the seed quality as compared to the formal and systematic quality control and certification practices in the formal and intermediary seed systems.

Table 4:3A: Influence of proficiency of market channel functions on overall customers satisfaction with seeds of maize, teff, and beans

Overall farmer customer satisfaction	**Overall**	**Maize**	**Teff**	**Beans**
(Constant)				
R&D Function proficiency	0.24***	0.22***	0.19***	0.19**
Multiplication Function proficiency	0.33***	0.35***	0.30***	0.34***
Storage and Processing Function proficiency	-0.01	0.05	0.02	0.15
Quality Control and Certification Function proficiency	0.10***	0.30**	-0.01	-0.06
Distribution Function proficiency	0.26***	0.15***	0.31***	0.16
Marketing Price Function proficiency	0.16***	0.16***	0.15***	0.30***
Marketing Service Function proficiency	0.15***	0.08**	0.16**	0.18
Teff01	0.08	-	-	-
Bean01	-0.01	-	-	-
R^2	0.74	0.75	0.77	0.55
F	262.94***	163.85***	169.88***	19.63***
N	**864**	**389**	**355**	**120**

*Significance level: ***: p<0.01, **: p<0.05, *: p<0.10.*

The effects of proficiency of market channel functions on the overall customer satisfaction of supply chains was also examined using aggregated data. Multiple regression analysis was conducted across unique channels using average proficiency scores across respondents for channel functions and average proficiency scores per unique channel for customer satisfaction (Table 4.3B).

Coefficients are estimated based on 43 unique channels, 16 for maize, 18 for teff, and 9 for beans (regression was not performed for beans due to limited cases). In the overall model, proficiency in storage and processing (β = 0.04, p =0.70), marketing service (β =0.09, p=0.40), and quality control and certification function (β = 0.04, p =0.69) were not significant predictors. Limited variation on proficiency of these functions, when considering the average score across respondents for a channel, explains this result. Using averages plays down the influence of individual farmers' perceptions of proficiency. Functions, like R&D, distribution, multiplication, and marketing price have an influence on customer satisfaction that goes beyond perceptions. However, considerable variations exist between crops. Regression analysis on the 16 unique maize channels shows that all the functions were insignificant except for the R&D of maize (β =0.64, p=0.03). However, the overall model fit was significant (R^2 =0.90, F (7, 8) = 10.24, $p < 0.005$). In contrast, distribution, R&D, and marketing price functions for teff, have a positive and significant contribution to overall customer satisfaction.

Table 4.3B: Influence of proficiency of unique cases market channel functions on overall customers satisfaction

Overall farmer customer satisfaction	**Overall**	**Maize**	**Teff**	**Beans**
(Constant)				
R&D Function proficiency	0.50***	0.64***	0.27***	
Multiplication Function proficiency	0.27**	0.28	0.24	
Storage and Processing Function proficiency	0.04	-0.04	0.13	
Quality Control and Certification Function proficiency	0.04	0.47	-0.08	
Distribution Function proficiency	0.46***	0.39	0.39**	
Marketing Price Function proficiency	0.24***	0.50	0.16**	
Marketing Service Function proficiency	0.09	-0.38	0.24	
Teff01	0.16	-	-	
Bean01	-0.06	-	-	
R^2	0.93	0.90	0.97	
F	49.83***	10.24**	51.44***	
N	**43**	**16**	**18**	**9**

*Significance level: ***: p<0.01, **: p<0.05, *: p<0.10.*

4.4.3. Do different value chain constellations matter for farmers' overall satisfaction?

The effect of value chain's constellation on customer satisfaction of supply chains was examined using dummy variables in multiple regression analyses instead of proficiency scores

(Table 4.4A and 4.4B). Table 4.4A below shows the influence of specific organizations performing market channel functions on overall customer satisfaction.

In the analysis, we have maintained four functions out of the 7 due to perfect multicollinearity problem with other functions. For example, we maintained the dummy variables for the R&D and distribution functions performed by MNCs, but removed the dummy variables for the multiplication, storage and processing, quality control and certification, and marketing-price and service functions by MNCs to avoid perfect multicollinearity. We follow similar producers for the other functions.

Our result is organized around four regression models predicting overall customer satisfaction. The first model is based on all supply chains and crops. While the second to the fourth models examine maize, teff, and bean seed supply chains, respectively[4].

The first model presents 13 dummy variables after dropping variables with multicollinearity problems (2 constants for teff and beans were added, thus making maize the reference). National Seed Enterprise (for all the functions except R&D) and the National Level Research Organization (EIAR) (for R&D function) are the baseline categories. Dummy variables represent MNC, Regional Seed Enterprise, Domestic Private Company, Seed Union, Seed Producing Cooperatives, and Farmers Seed Chains. The overall model fit was good (R^2 =0.31; F (15, 848) = 25.12; $p < 0.001$).

When predicting the influence of R&D function on overall customer satisfaction, we have computed the F change, when the three dummy variables for the R&D function are removed from the model. The F change was significant F (13, 850) = 28.72; $p < 0.001$). For the R&D Function of Farmers Seed Systems, the coefficient for the dummy variable is significant for teff and beans. The overall customer satisfaction with teff and bean goes up by 0.70 units when R&D is performed by the Farmers' Supply Chain. However, R&D has a more positive and significant influence for teff than for beans. The dummy of the farmers' seed chain however, also captures the influence of other functions.

[4] Before the analysis, we have checked and maintained those variables that are not perfectly correlated in the overall and each model for maize, teff and beans. Moreover, we have excluded and/or the analysis excluded variables and supply chains that do not perform channel functions in maize, teff, and beans seed supply chains. For example, the farmers seed supply chain does not perform any function related to maize (Hybrid maize), unlike to teff and bean value chains. Similarly, for SPCs/ Seed Producing Cooperatives.

Concerning seed multiplication function, our study results reveal that seed multiplication function of Seed Multiplying Cooperative Unions have a negative and significant (β =-0.23, p<0.05) effect on overall customer satisfaction of maize supply chains compared to Seed Multiplying by National Seed Enterprise/NSE. We conclude that customer satisfaction goes down when maize seed multiplication is done by Seed Multiplying Unions instead of the National Seed Enterprise. The seed multiplication function contributes to overall customer satisfaction with supply chains. However, for teff and beans value chains, the seed multiplication function does not contribute to overall customer satisfaction if we change the constellation of actors performing seed multiplication. Changing the constellation offers little opportunities to improve customer satisfaction, but that proficiency of multiplication should be improved for all crops, channels, and organizations. The multiplication function needs to produce enough seed to ensure that every customer can obtain the demanded amount.

Concerning storage and processing function, our study results reveal that storage and processing function of SPCs, the t-statistic is significant (p<0.001), and the beta value has a positive value (β =0.22). We conclude that customer satisfaction improves if storage and processing in teff supply chains is done by SPCs instead of National Seed Enterprise.

The F change for distribution is significant (p<0.001), when the five dummy variables for the distribution function are removed from the model. This implies that it matters for farmer customer satisfaction which organization performs the distribution function. The F change was significant for teff and beans (p=0.01). Our dummy regression results show that there was a change in customer satisfaction when teff seed is distributed by Regional Seed Enterprises, Domestic Private Seed Companies, Seed Unions, and Seed Producing Cooperatives supply chains, as compared to the National Seed Enterprise supply system. It further confirms that farmer satisfaction can be enhanced if we change the constellation of actors performing the distribution function for beans. Distribution by Seed Multiplying Unions decreases customer satisfaction compared to the National Seed Enterprise (β=-0.32, p<0.05).

Table 4.4A: Influence of specific organizations performing market channel functions on overall customer satisfaction with seeds of maize, teff, and beans

Overall farmer customer satisfaction	Overall	Maize	Teff	Beans
(Constant)				
R&D Function				
R&D of Multinational Companies	0.01	-0.04	-	-
R&D of Regional Research Organizations	-0.03	-0.02	0.01	-0.05
R&D of Farmers Seed Systems	0.70***	-	0.99***	0.41***
Seed Multiplication Function				
Multiplication of Regional Seed Enterprises	-0.06	-0.10	-0.03	0.03
Multiplication of Private Seed Companies	-0.05	-0.15*	0.01	-0.03
Multiplication of Seed Cooperative Unions	-0.04	-0.23***	0.04	0.04
Multiplication of Seed Producing Cooperatives	-0.10	-	-0.05	0.28
Storage and Processing Function				
Storage and Processing of Seed Producing Cooperatives	0.22***	-	0. 24**	-
Seed Distribution Function				
Distribution of Multinational Companies	0.13**	0.17	-	-
Distribution of Regional Seed Enterprises	0.26***	0.19*	0.29**	-
Distribution of Private Seed Companies	0. 28***	0.28**	0.24**	-
Distribution of Seed Cooperative Unions	0.06	0.06	0.25**	-0.32**
Distribution of Seed Producing Cooperatives	0.18**	0.17	0.25**	0.22
TEFF01	-0.07	-	-	-
BEAN01	-0.05	-	-	-
R^2	0.31	0.06	0.48	029
F	25.12***	2.51**	28.45***	6.49***
N	**864**	**389**	**355**	**120**

*Significance level: ***: p<0.01, **: p<0.05, *: p<0.10.*

The influence of the proficiency of market channel functions on customer satisfaction with supply chains was also examined by using aggregated data for unique channels in a multiple regression analysis (Table 4.4B). The F change was significant for the R&D ($p<0.001$), storage and processing ($p=0.02$), and distribution ($p=0.03$) functions, which suggests that changing the constellation of organizations in the supply chain can increase farmer customer satisfaction.

The results confirm that the R&D of the farmers' seed chain, storage, and processing of SPCs, and distribution of regional seed enterprises, private companies and SPCs increases customer satisfaction compared to the National Research Organization and National Seed Enterprise. Particularly for teff customer satisfaction can be improved by switching from the National Research Organizations to the R&D of farmers seed supply chain ($\beta=0.87$, $P<0.05$), distribution of private seed companies ($\beta=0.63$, $P<0.05$), and storage and processing of SPCs ($\beta=0.58$, $P<0.05$).

Table 4.4B: Influence of unique channels performing market channel functions on overall customer satisfaction with seeds of maize, teff, and beans

Overall farmer customer satisfaction	Overall	Maize	Teff
(Constant)			
R&D Function			
R&D of Multinational Companies	0.04	-0.04	-
R&D of Regional Research Organizations	-0.04	0.16	0.12
R&D of Farmers Seed Systems	0.75***	-	0.87**
Seed Multiplication Function			
Multiplication of Regional Seed Enterprises	-0.20	-0.30	-0.08
Multiplication of Private Seed Companies	-0.90	-0.35	0.10
Multiplication of Seed Cooperative Unions	-0.04	-0.56	0.60
Multiplication of Seed Producing Cooperatives	-0.26	-	-0.08
Seed Storage and Processing Function			
Storage and Processing of Seed Producing Cooperatives	0.53**	-	0.58**
Seed Distribution Function			
Distribution of Multinational Companies	0.27	0.36	-
Distribution of Regional Seed Enterprises	0.58**	-0.10	0.49
Distribution of Private Seed Companies	0.84**	0.77	0.63**
Distribution of Seed Cooperative Unions	0.35	0.27	0.53*
Distribution of Seed Producing Cooperatives	0.59**	0.53	0.50*
TEFF01	0.00	-	-
BEAN01	-0.02	-	-
R^2	0.63	0.57	0.91
F	3.11**	0.66	5.22**
N	**43**	**16**	**18**

*Significance level: ***: p<0.01, **: p<0.05, *: p<0.10.*

4.4.4 How are different organizations assessed in terms of function proficiency?

This section shows how market channel functions, conducted by different organizations, are evaluated by farmers.

Table 4.5 shows respondents' mean evaluation of the proficiency of market channel functions performed by categories of organizations in seed supply chains for Maize, Teff and Beans.

The analysis reveals that there is room to improve the proficiency of market channel functions. On a seven-point scale market channel functions rarely score above 4.0. The proficiencies of functions show also that seed chains of different crops have specific strengths and weaknesses. Different organizational forms have strengths and weaknesses, specifically for one crop. This is further elaborated, below.

Out of the seven market channel functions investigated in the study, our results reveal that proficiency scores of maize, teff, and beans are different between organizations for the 6 market channel functions: For R&D, Multiplication, Storage and Processing, Quality control and Certification, Marketing-price, and Marketing-service proficiency scores of maize, teff, and beans are different between organizations (see Table 4.5). Similarly, for these six market channel functions, our result shows that proficiency scores of organizations are also different between crops.

For distribution proficiency scores of maize there are no differences between organizations (F=2.07; p=0.09). It implies that there are limited variations in the scores of distributions (timely deliver and place) between organizations participating in the maize seed chains. For teff and beans proficiency scores are different between organizations. The distribution proficiency scores of organizations are only different between crops for the national seed enterprise (F=8.44; p<0.001). The national seed enterprise scores higher for maize than for teff (p<0.001).

In general, Table 4.5 shows the F values, together with number of data points per cell, and report the post hoc comparisons (indicated in the table with (dis)similar letters to indicate which are similar and which are different). Overall, our study results reveal that proficiency scores are different between organizations and crops with only a few exceptions.

Table 4.5: Mean Proficiency of value chain functions

	Channels Per Function	# Of Chains Per Crop and Proficiency (PROF), and F value across observations								
		#Maize	PROF	F value	#Teff	PROF	F value	# Bean	PROF	F value
A	R&D	No of Org.	Scores	F (2, 386) = 55.30; $p<0.001$	No of Org.	Scores	F (2, 352) = 15.00; $p<0.001$	No of Org.	Scores	F (2, 117) = 12.75; $p<0.001$
				Post Hoc Sig.			Post Hoc Sig.			Post Hoc Sig.
1	MNC	1	**4.91**	a***	-	-	-	-	-	-
2	NRO	1	3.65	b	1	3.23	B	1	**4.32**	a***
3	RRO	2	**3.81**	b	2	3.12	B	2	**4.00**	a***
4	FSS	-	-	-	1	**3.88**	a***	1	3.00	b
B	Multiplication			F (5, 383) = 3.82; $p<0.001$			F (6, 348) = 15.27; $p<0.001$			F (5, 114) = 8.67; $p<0.001$
1	MNC	1	4.02	a	-	-	-	-	-	-
2	NSE	1	3.98	a	1	3.16	C	1	3.65	b
3	RSE	3	**4.17**	a	4	3.77	B	2	3.95	b
4	DPC	5	**4.12**	a	1	4.43	A	1	3.60	b
5	Seed Union	2	3.25	b	2	3.73	B	3	3.58	b
6	SPCS	-	-	-	3	4.28	A	1	**5.03**	a
7	FSS	-	-	-	1	**4.61**	A	1	**4.67**	a
C	Storage & Processing			F (5, 383) = 3.54; $p<0.001$			F (6, 348) = 8.76; $p<0.001$			F (5, 114) = 3.16; $p<0.05$
1	MNC	1	3.61	a	-	-	-	-	-	
2	NSE	1	**3.86**	a	1	3.75	C	1	4.15	b
3	RSE	3	3.75	a	4	4.04	B	2	3.62	c
4	DPC	5	3.75	a	1	**4.53**	A	1	4.30	b
5	Seed Union	2	3.06	b	2	4.38	A	3	3.54	c
6	SPCS	-	-	-	3	4.33	A	1	**4.53**	a
7	FSS	-	-	-	1	3.11	C	1	3.78	c
D	Quality Control & Certification			F (5, 383) = 17.06; $p<0.001$			F (6, 348) = 4.06; $p<0.001$			F (5, 114) = 7.78; $p<0.001$
1	MNC	1	**4.87**	a***	-	-	-	-	-	-
2	NSE	1	4.07	b	1	4.00	B	1	4.05	b
3	RSE	3	4.03	b	4	4.47	A	2	3.68	b
4	DPC	5	3.86	b	1	**4.57**	A	1	4.80	a
5	Seed Union	2	2.94	c	2	3.78	B	3	3.63	b
6	SPCS	-	-	-	3	4.38	A	1	**5.17**	a
7	FSS	-	-	-	1	3.30	B	1	3.70	b
E	Distribution			F (5, 189) = 1.7; $p=0.13$			F (5, 255) = 33.82; $p<0.001$			F (3, 45) = 13.59; $p<0.001$
1	MNC	1	3.67	a	-	-	-	-	-	-
2	NSE	1	3.95	a	1	3.25	C	1	-	-
3	RSE	3	3.97	a	4	3.76	B	2	3.82	c
4	DPC	5	**4.02**	a	1	4.27	B	1	4.33	b
5	Seed Union	3	3.82	a	3	3.70	B	1	3.73	c
6	SPCS	6	3.61	a	5	3.81	B	3	3.92	c
7	FSS	-	-		1	**5.07**	a***	1	**4.93**	a***
F	Marketing-price function			F (5, 189) = 10.27; $p<0.001$			F (5, 255) = 31.58; $p<0.001$			F (3, 45) = 78.98; $p<0.001$
1	MNC	1	2.89	d	-	-	-	-	-	-
2	NSE	1	**4.50**	a	1	3.61	C	1	4.22	c
3	RSE	3	4.04	b	3	3.89	B	2	3.80	c
4	DPC	5	3.56	c	1	3.83	B	1	4.07	b
5	Seed Union	3	4.41	b	3	2.95	D	1	3.58	d
6	SPCS	6	3.82	c	5	3.60	C	3	3.37	d
7	FSS	-	-	-	1	**5.07**	a***	1	**4.92**	a***
G	Marketing-service function			F (5, 189) = 3.30; $p<0.05$			F (5, 255) = 21.30; $p<0.001$			F (3, 45) = 14.22; $p<0.001$
1	MNC	1	**3.53**	a	-	-	-	-	-	-
2	NSE	1	3.25	c	1	3.28	D	1	3.40	c
3	RSE	3	3.29	b	3	3.21	D	2	3.60	c
4	DPC	*5*	3.05	c	1	3.83	B	1	3.74	c
5	Seed Union	*3*	3.05	c	3	3.63	C	1	3.20	d
6	SPCS	*6*	3.08	c	5	3.53	C	3	4.10	b
7	FSS	-	-	-	1	**4.59**	a***	1	**4.70**	a***

*Significance level: ***: p<0.01, **: p<0.05, *: p<0.10.*

NB: The letters below the F-values report the post hoc comparisons (indicated with (dis) similar letters to indicate which are similar and which are different).

Abbreviations: MNC-Multinational Companies; NRO/EIAR-Ethiopian Institute of Agricultural Research (National Research Organization); RRO/RARIs-Regional Agricultural Research Institutes (Regional Research Organization); FSS-Farmers Seed System or Informal Seed System (ISS); NSE/ESE-National (Ethiopia) Seed Enterprise; RSEs-Regional Seed Enterprises; DPC-Domestic Private Companies; SPCs-Seed Producing Cooperatives

4.5 Conclusions and discussion

This study quantitatively explored the performance of Ethiopian seed systems from a farmer customer's perspective. Across the three crops (maize, teff, and beans), six key market channel functions that contribute to customer satisfaction were identified: (a) the R&D, (b) the seed multiplication, (c) the seed quality control and certification, (d) the seed distribution, (e) the seed pricing, and (g) the marketing service function.

This study includes the whole seed supply chain, where previous studies have tended to focus on dyadic relationships within value chains. So, we explore value chains at a higher level of complexity. This paper identifies value chain constellations used and perceived by end customers in terms of "who" (i.e., which actor / organization), does "what" (i.e., in terms of marketing functions), "how well" (i.e., in terms of perceived proficiency), and resulting in "what level of end customer satisfaction" (i.e., of farmers / end-customers).

RQ (1) What are dominant value chain constellations in Ethiopian seed supply chains?

In distinguishing dominant value chain constellations in Ethiopian seed supply chains, we found that 43 unique supply chain configurations, 16 for maize, 18 for teff, and 9 for beans. This suggests that there is something to be gained if we could provide farmers broader access to a value chain constellation of their preference. For example, some channels are less dominant, but scored higher on customer satisfaction as compared to the dominant channels.

RQ (2) How does perceived function proficiency contribute to overall chain satisfaction?

In examining the influence of market channel functions on customer satisfaction, we found that the seed multiplication, distribution, R&D, price, marketing service, and quality control and certification functions contribute to the end customer overall satisfaction. However, considerable variations exist between crops. The unique channel analysis also reveals the significant and positive influence of R&D, distribution, multiplication, and pricing functions. This suggests that a good execution of these functions influence customer satisfaction.

RQ (3) Do different value chain constellations matter for farmers' overall satisfaction?

In examining the effect of value chain's constellation on customer satisfaction of supply chains, the dummy analysis shows that different value chain constellations influence farmers' overall satisfaction, specifically, R&D, storage and processing, and distribution functions. This suggests that changing the constellation of organizations in the supply chain can increase farmer customer satisfaction. However, considerable variations exist between crops. For teff, the results show that customer satisfaction will increase if R&D is performed by the farmers' seed chain or farmers' selection practices, storage and processing by SPCs, and distribution by regional seed enterprises, private companies or SPCs.

RQ (4) How are different organizations assessed in terms of function proficiency?

We have also shown how different organizations are assessed in terms of function proficiency. The proficiency with which the market channel functions are executed differs considerably. This shows that each seed system has its own strengths and weaknesses. Improving the market channel functions performed by channel partners seems one way to delivering superior customer value and satisfaction.

RQ (5) What are implications of these findings for more optimal seed supply chain design?

In optimally functioning markets supply chain constellations evolve towards efficiency and effectiveness, through the processes of partner selection (Mentzer et al., 2001). However, many of these assumptions are based on insights from western High-Income Economies. Our results show that in emerging markets supply chain constellations remain, despite inferior customer satisfaction.

This study identified critical success factors for supply chain performance and quantified the effects of market channel function proficiency on customer satisfaction within a supply chain. To the best of our knowledge, this is the first paper to examine the influence of market channel functions on customer satisfaction within the context of D&E markets. We show that the proficiency of most market channel functions contributes positively to overall customer satisfaction, but that there are substantial differences in the contribution of market channel functions to end customer satisfaction.

We have also shown how different organizations are assessed in terms of function proficiency, and how proficiency contributes to overall chain performance. Improving the market channel functions performed by channel partners can increase customer satisfaction. From a farmer customer's perspective there is room for improvement for all market channel functions. This study reveals the significant and positive influence of R&D, distribution, multiplication, and pricing functions proficiency on overall customer satisfaction. The seed multiplication function predominately contributes to the end customer's overall satisfaction with seed offers, followed by distribution, R&D, price, marketing service, and quality control and certification functions. This suggests that improving the execution of these functions will increase customer satisfaction.

In examining the effect of supply chain's constellation on customer satisfaction with supply chains, the dummy analysis shows that different value chain constellations matter for farmers' overall satisfaction. Changing the constellation of marketing channels to increase the proficiency of market channel functions also can increase customer satisfaction. However, the differences in proficiency of market channel functions between organizations are still limited, which limits the empirical support for this conclusion to some market channel functions. Almost the proficiency scores of functions do not vary much between organizations. There is little variation in the scores of proficiencies between organizations, except for the higher proficiency scores of MNCs for maize, and the informal seed system for teff, according to the evaluation of farmers.

4.6 Practical relevance

Insights in supply chain performance are of managerial and policy relevance as it provides bottom-up input to further optimize value chains. This is important from an economic and marketing perspective of organizations in supply chains, and from a food security perspective to ensure sufficient quantities of food of sufficient quality. By investigating market channel functions performed in seed systems, seed value chain actors and managers will have a better understanding of the influence of market channel functions (proficiency) on customer's satisfaction. Further, we provide useful recommendations for managers and policy makers to enhance end customer satisfaction.

Particularly, improvements in the R&D function of the public seed chain for teff and bean warrant attention. Equally, improvements in the storage and processing function of the different seed supply chains (public, private, MNCs, seed unions, informal system) offer opportunities to increase performance and customer satisfaction. Increasing performance of the MNCs seed chain, especially in seed storage and processing, distribution, and pricing functions also enhances overall customer satisfaction. It further calls for improvements in performance of the seed multiplying unions in various functions such as multiplication, quality control and certification, storage and processing, distribution, and marketing services.

The development of quality declared seed (i.e., improved quality control and certification proficiency) in the informal or farmers seed system can also enhance customer satisfaction with a wide range of market offerings. Equally the storage and processing function of the informal system should be improved, for example by strengthening community-based seed production entities such as farmers' seed enterprises, local seed business and/or community-based organizations.

Informal, intermediary, and formal seed systems are complementary. Pluralistic and integrated development of alternative seed systems provides the diversity of demand for different crops, farming systems and farmer customers. Marketing functions performed in public and private seed chains can be complementary. Developing seed policies to balance public and private seed sector roles and responsibilities can enhance customer satisfaction.

Changing the constellation of actors in a supply chain performing market channel functions can be an alternative to improving the market channel functions conducted by channel partners. Reorganizing seed systems based on the proficiency of functions performed within seed supply systems can create more effective and efficient seed system. It may also stimulate actors in a supply chain to become more proficient and this avoid becoming obsolete.

The next paragraphs try to contextualize and position our key findings within the existing literature. This can help supply chains how to improve market channel functions conducted by channel partners.

We have shown that the R&D function proficiency is one of the biggest contributors to customer satisfaction. For teff supply chains, farmers' local selection practices (informal systems) contribute more to customer satisfaction than public R&D of formal and intermediary seed systems. It implies that the formal breeding program/R&D is not developing varieties that offer solutions for farmer customers. The finding supports earlier research, which reported the lack of interest or capacity of the research system to develop genotypes that are adapted to farmers' specific production environment (Altaye, 2012a; Louwaars & de Boef, 2012; Tripp & Rohrbach, 2001).

Public and private investment in agricultural R&D will result in new technologies and production techniques with significant promise in improving yields, to boost productivity, and sustainability. This provides the means for meeting the food needs of the wide range of consumers/customers. But to reach this goal, both the public and private sectors will need to keep the R&D pipeline flowing and make investments and commitments to ensure that innovative technologies and techniques are widely and rapidly adopted by farmers. The relationship between public and private R&D has been less studied, but it seems probable that the two are complements rather than substitutes. Moreover, integrating scientific knowledge (formal R&D) with indigenous farmers selection practices (of informal seed systems) can offer opportunities for the development of right varieties that offer solutions to customers.

The quality control and certification function significantly and positively contribute to customer satisfaction for maize, but not for teff and beans. The absent quality control, testing, and certification in the informal seed systems (e.g., teff, beans) is the key failure factor contributing to low quality of the offers than from formal systems (Alemu, 2010; Louwaars et al., 2013). The development of quality declared seed can enhance certification and improve quality-controlling operations for a wide range of crop seeds catered by the informal system. The MNCs for maize, and the private companies and SPCs for teff and beans were perceived to be more proficient. We found that for maize, seed unions scored lowest, lower than all the alternative suppliers in terms of quality control and certification proficiency. The seed unions need to improve their proficiency. High quality seed is critical to increase crop yields and to boost both agricultural productivity and food security. However, the result shows that the public and domestic private companies, and seed unions are less proficient in executing and delivering high quality seeds of maize to local farmers. This can negatively affect the agricultural growth of the nation. In contrast the private MNCs are perceived to be better in executing and delivering assured quality seeds with the required genetic characteristics, purity, uniformity, germination, etc. This indeed satisfies customers' needs for high quality seeds, which will ultimately increase agricultural production and productivity and livelihood of farmers. Accreditation of larger seed companies (e.g., MNCs) can help to increase efficiency and reduce the burden on certification by formal certification agencies (Louwaars et al., 2013).

The distribution function contributes to customer satisfaction with maize and teff supply chains. The farmers seed system/FSS tends to dominate the formal and intermediary systems by offering seeds of teff and beans at the right time and at accessible places. The FSS is more reliable and guaranteed than the formal system by making available diversity of crop varieties on time and low cost (Almekinders et al., 1994; Atilaw & Korbu, 2011; Badstue et al., 2006; McGuire, 2005; Seboka & Deressa, 1999; Winters et al., 2006). It implies that the government would have to focus on regulatory and supportive role for the active involvement of different suppliers in direct seed marketing to meet the evolving needs of customers for seeds.

The marketing price/affordability function contributes to overall customer satisfaction. Price is usually one of the factors that affect purchase decisions. For teff and beans, farmers claimed that the informal seed chains are proficient by providing seed at the right affordability level. The MNCs are perceived to be lesser in proficiency of maize pricing as compared to alternative suppliers. However, considerable variations exist between classes of farmers and supply chains. For example, most of the small-scale farmers often encode the price at purchase as "expensive" or "cheap," but the respondent medium and large-scale farmers notice the exact price of seeds and encode price as the cost of obtaining benefit. These farmer customers emphasized the benefits they received from the product as the most important components of value than monetary price. This shows that farmer customers' trade-off perceived quality against perceived costs or consider pricing as quality signal (Rao, 2005; Shahhosseini & Ardahaey, 2011; Zeithaml, 1988).

Marketing service (e.g., varietal information, reliability, warranties, about competitor offers) contributes to overall customer satisfaction for maize and teff supply chains. The FSS for teff, and the MNCs for maize are perceived to be more proficient than alternative suppliers. Therefore, customers should be provided with right information/service to make purchase decisions. Continuous monitoring and follow up of product information and customers' feedback may also help suppliers to upgrade products or services to meet the changing needs of its customer overtime (Raharjo, Xie, & Brombacher, 2011).

4.7 Limitations and future research

This research opens several avenues for future research that can further our knowledge. From a methodological perspective, future research could apply the proposed modeling framework to other emerging markets, products, and supply chains.

Longitudinal studies are needed to explore whether market channel function proficiency varies over time and how this influences customer satisfaction. Moreover, changes in the constellation of supply chains and its impact on customer satisfaction can be studied in longitudinal studies, an especially relevant aspect given the dynamics of relationship and networks within and between firms or public and private sectors operating in a value chain.

Further research is also needed to identify the relationship between market channel function proficiency and organizational performance, to check whether there is sufficient incentive for organizations to become more proficient. In addition, future research should identify drivers of market channel function proficiency to help organizations to become more proficient. For example, it could explore whether market orientation increases the proficiency of market channel functions in emerging markets.

Researchers should explicitly model customer heterogeneity and allow for marketing channels with different strengths and weaknesses in terms of market channel function proficiency to prosper simultaneously.

Two limitations of the present study should also be kept in mind. First, we explored the issue from the perspective of end user perceptions and evaluations, not necessarily the economic performance of the supply chain constellations. Second limitation is that our analysis is limited to constellations that currently exist in the Ethiopian context, not necessarily covering all possible constellations.

Finally, findings in an emerging market setting should be contrasted with findings from developed markets, for a more comprehensive perspective on marketing channel research.

CHAPTER 5

Market Orientation of Supply Chains: The Case of Ethiopian Seed Supply Systems

This chapter will be submitted as: Shimelis Altaye Bogale, Frans J.H.M. Verhees, and Hans C.M. van Trijp.
Market Orientation of Supply Chains: The Case of Ethiopian Seed Supply Systems.

Abstract

This study explores the market-oriented performance of Ethiopian seed systems from a chain actor's and customer's perspective. The study builds on the view that seed supply systems should become market-oriented on each market channel function performed within seed supply systems. This study's contribution is two-fold. First, market orientation (MO) theory is applied to complex chains (i.e., seed supply systems) in emerging markets with their specific contextual challenges. Second, MO theory is assessed from different perspectives, from upstream actors to downstream actors until the end customers served by a particular value chain. Results revealed that the seed quality control and certification, distribution and marketing, and multiplication functions are more market oriented than the R&D, and storage and processing functions. However, there are no significant variations exist between crops and organizations in executing the same functions. The finding has also shown how the overall MO significantly differs between perspectives. It revealed that both suppliers and customers are more negative about the MO of a focal organization (i.e., the organization performing a function) than the focal organizations own evaluation. Customers are more negative about the MO of the focal organization than suppliers. However, a focal organization perceives MO of the function performed by themselves higher than their suppliers and customers. Our research contributes to developing market-oriented seed supply chains that meet farmers' diverse product and service requirements. It also contributes to the literature by adapting measures of MO in (seed) supply chains.

Keywords: Market Orientation, Multi-Actor Value Chains, Seed Systems, Supply Chains, Emerging Markets

5.1 Introduction

Market orientation (MO) is seen as the operationalization and implementation of the marketing concept (Greenley, 1995; Kohli & Jaworski, 1990; Narver & Slater, 1990; Shapiro, 1988), which stipulates that to achieve sustained success, firms should identify and satisfy customers' needs more effectively than their competitors do (Kirca et al., 2005). In terms of organizational culture, MO has been operationalized as an orientation on customers, competitors and inter-functional coordination to achieve competitive advantage; integration of company competencies and strengths to deliver customer relevance in a way that outperforms competitor delivery (Narver & Slater, 1990). It is recognized that this requires a number of specific behaviors, specifically the organization-wide generation of market intelligence pertaining to current and future customer needs, dissemination of the intelligence across departments, and organization-wide responsiveness to the intelligence (Kohli & Jaworski, 1990; Kohli et al., 1993).

MO manifests itself in a higher-than-competitor level of customer satisfaction as a result of inter-functional coordination (Narver & Slater, 1990). As its success relies on the organization-wide coordinated response to shared market intelligence (Kohli & Jaworski, 1990), this also implies that the degree of MO can be undermined at any level of the organization. This is particularly challenging if the MO concept applies to multi-actor value chains rather than to large multinational companies, having all the resources, competencies, and capabilities under "one roof". MO in supply chain management has received only limited attention so far (Martin & Grbac, 2003; Min, Mentzer, & Ladd, 2007), but it is clear that MO relies on contributions from all value chain actors and that these activities need to be managed in line with the overall MO concept.

MO has been viewed from a dyadic perspective, i.e., as a characteristic of a company dealing with a set of current and potential customers. As a result, research on MO from a value chain perspective is still limited but gradually emerging (Baker et al., 1999; Elg, 2000; Grunert et al., 2005; Grunert et al., 2002; Langerak, 2001; Siguaw et al., 1998; Simpson et al., 1999).

MO can be seen as a value creation process in which capabilities are combined, integrated, and synergized across different functions, such that the outcome creates customer-recognized value. This is a challenge to supply chains because being market-oriented requires a focus on shared goals and a willingness to align activities (Kohli & Jaworski, 1990). The challenge becomes even bigger if the MO concept applies to multi-actor value chains, where channel leaders are rare. In such situations, the value creation process (Gummesson & Mele, 2010; Horvath, 2001) becomes more complex because subtasks and functions are more isolated. The key challenge is how the different actors that are executing value creation functions together perform the task of generating intelligence on end-user needs and use it to guide their overall value-creating activities. This should contribute to the competitiveness of the whole value chain in serving end-users.

Most MO studies focus on the firm's internal processes and activities and ignore firms' increasing dependence on their suppliers for the processes and activities to satisfy customer demands (Deshpandé & Farley, 1998; Kohli & Jaworski, 1990). Hence, firms need to obtain knowledge of downstream customer markets also to direct the resources and capabilities of their supply chain partners to create superior value (Jacobides, 2005; Joshi, 2009). Moreover, suppliers' knowledge and intelligence has become essential to develop the proper responses to changing customer needs (Roy, Sivakumar, & Wilkinson, 2004).

This paper extends MO research to supply chains in the context of developing and emerging (D&E) markets with their specific contextual challenges. In doing so, it explores MO of value chain functions from the perspective of channel partners. We explore the MO of supply chains from four perspectives: (1) the organization performing a function, (2) customers, (3) suppliers, and (4) the final customers. It studies the Ethiopian seed supply systems as a relevant case. MO is an emerging concept in the Ethiopian government's ambition to restructure its seed supply systems. The study takes a quantitative approach. It considers all channel partners' perception of MO to understand whether processes or activities are executed in a market-oriented way.

Organizations may perform one function or a range of functions in seed systems. This study focuses on market channel functions and assesses the MO of functions. This should be reflective of the extent to which functions respond to the market. The MO of organizations is measured for every function it performs. A particular organization in a value chain will focus primarily on its immediate customers, but also on customers further down the chain and especially on the end-users. When functions within organizations are market oriented, value chains should be able to respond to the final customers' needs with an integrative offering.

The research questions that this paper aims to address are: 1) Does market orientation differ by function, in the eyes of supply chain actors and end farmer customers? 2) What differences in market orientation exist between crop supply chains? 3) How does market orientation differ by perspectives? 4) How does the market orientation of value chain functions differ by supply chain organizations? Answering these questions enables us to understand how market orientation is perceived by supply chain actors until the end customer served by a particular value chain. It also provides a valid measure for MO in seed supply systems.

The remainder of this paper is organized as follows. The next section presents the research context followed by an overview of the literature on MO in supply chains. The paper then describes the study's methodology, followed by a presentation of the results and conclusion sections. The paper ends with a critical reflection of the findings: implications for managers and literature, limitations, and directions for further research.

5.2 Research context

The specific research context of this study is that of seed supply systems in the Ethiopian economy. Seed is one of the most economical and efficient inputs to agricultural development (FAO, 2006). It is crucial for improving crop production and productivity. Use of quality seed of improved varieties contributes up to 50% increases in yield per hectare (Islam et al., 2010). Quality seed also makes the use of other accompanying agricultural inputs worthwhile such as fertilizers and pesticides. Thus, seed is farmers' most precious resource. Concerns about the viability of traditional agricultural systems center around the diversity and stability of seed supply (Tripp, 2001).

Agriculture is the mainstay of the Ethiopian economy. It accounts for 43 percent of GDP, 70 percent of exports, and 85 percent of employment (UNDP, 2014). Despite its significant contribution to the economy, the performance of Ethiopian agriculture is below its potential. One important reason is the use of poor quality seed and a lack of demand focus in production, distribution, and marketing of seed (Alemu, 2010; Thijssen et al., 2008).

Seed systems represent the entire complex of organizations, individuals and institutions associated with the development, multiplication, storage, processing, quality control and certification, distribution, and marketing of seeds in any given country (Maredia et al., 1999). The seed system includes the traditional (or informal) system in which individual farm households carry out all seed functions for landraces, including seed development, multiplication, storing, processing, and marketing (Cromwell et al., 1992), and the non-traditional (or formal) systems comprised of specialized organizations (e.g., public, private, farmers unions) with distinct roles in supplying seeds of new varieties. An intermediate seed system, also known as the community-based seed system exists between the formal and informal system. It involves seed producing farmer organizations, and local seed businesses. Legal institutions such as variety release procedures, intellectual property rights, certification programs, seed standards, contract laws, and law enforcement are also an important component of the seed system (MoA, 2018b). They help determine the quantity, quality, and cost of seeds passing through the seed system.

Effective and efficient seed supply is important for food security and economic growth of a nation. Effectiveness and efficiency come from the extent to which seed supply systems deliver seeds in line with the needs of society, in ensuring the right quantity of the right quality seed at the proper moment to the right customers, at an acceptable price (Bogale et al., 2018). What is right quality, demanded quantity and affordable price differs between farmers and over time (e.g., climate and market demand), making this a challenging task. Also, what is the best quality changes as a result of agricultural research that improves seed quality (i.e., innovation).

Local farmers play crucial roles both as customers and producers of seed. In Ethiopia, local farmer-customers have a choice from a broad range of seed supply systems ranging from informal to formal. These systems are differently organized and operated in terms of delivery and responsiveness. The contribution of each system to total seed supply differs considerably, with approximated 10% from the formal and 90% from the informal system, which is indicative for market preference (Atilaw & Korbu, 2011; CSA, 2011). However, the formal system supplied roughly 14.6 % of the total seed supply in 2015–16 (CSA, 2015/2016a, 2015/2016b) compared to 10% in 2010 (Atilaw & Korbu, 2011; CSA, 2011) and only 4.7% in 2007-2008 (CSA, 2009). This suggests that the formal seed system has only been partly successful in fulfilling customer demand and providing access to affordable and high yielding varieties of good quality seed. The Ethiopian government and various development programs try to address the relationship between formal and informal seed systems and develop seed policies for guiding the simultaneous development of both seed systems. Thus, providing for the diversity of demand related to different crops, farming systems, and farmers (Louwaars & de Boef, 2012; Louwaars et al., 2013).

In a nutshell, the total "seed system" of Ethiopia involves many stakeholders carrying out different roles, but its effectiveness and efficiency lags far behind farmers' demand for improved and high yielding varieties of good quality seed (Bogale et al., 2018). One important reason is the limited availability / lack of systematic studies on MO and performance in complex chains (of informal economies) in D&E markets.

Effective seed systems enhance customer satisfaction and result in superior performance of firms and/or public and private sector organizations. However, effectiveness and efficiency will come from the extent to which the functions are performed in a more market-oriented way across the different stages of a seed value chain. MO contributes to effective seed systems, but measures for the MO of functions do not exist. Measuring the MO of seed systems is also difficult because measures of MO may not be comparable across functions and different perspectives. This paper contributes to the literature gap on measuring supply systems by assessing MO from the perspectives of all channel actors and the end customers. It measures the MO of a focal organization (the organization performing a function), evaluated by itself, its suppliers, customers, and end customers (farmers).

In a seed supply chain, a variety of functions has to be performed to deliver, and add value to, seed. Such functions center on the key tasks of (1) R&D, (2) multiplication, (3) storage and processing, (4) quality control and certification, and (5) distribution and marketing.

5.3 Literature review and conceptual frameworks

Market orientation

Market orientation (MO) literature emphasizes creating superior customer value to increase performance of the business (Kirca et al., 2005; Kohli & Jaworski, 1990; Kohli et al., 1993; Lings, 1999; Narver & Slater, 1990; Slater & Narver, 1994a). It is recognized that this requires the execution of organization-wide core processes: generation, dissemination, and responsiveness to market intelligence (Kohli & Jaworski, 1990), and manifestation of the three pillars of the marketing concept-customer orientation, competitor orientation, and inter-functional coordination (Narver & Slater, 1990). So, MO is related to achieving competitive advantage by delivering higher (end) customer value than competitors can, and this is achieved by "smartly" acting on the intelligence. Sources of intelligence suggested by Narver and Slater (1990) are a customer and competitor orientation. Hence, customer and competitor orientation reflect the focus of the behaviors associated with the generation, dissemination, and responsiveness to market intelligence, while the manner in which these activities are undertaken is captured by the coordinating mechanism, which steers the entire process, and thus reflects an 'organization-wide responsibility' (Kohli & Jaworski, 1990) for market-oriented activities. Thus, behaviors are information generation and dissemination across all functional disciplines within the organization, so that their efforts are aligned with one and the same goal: delivering unique and superior end-customer value and satisfaction.

MO can be seen as a value creation process in which the company combines, integrates, and synergizes its capabilities across the different functional departments, such that the final outcome creates customer recognized value. It extends beyond the pure product as the ultimate offering to the consumer involves all the marketing mix elements.

Being truly market-oriented is a challenge to many companies, as it requires to focus on a shared goal and a willingness to align activities. This is a challenge for large companies in the integration of functional departments. However, the challenge becomes even bigger if the value chain becomes fragmented between different actors. In such situations, the value creation process (Gummesson & Mele, 2010; Horvath, 2001) becomes more complex than that from an integrated company as subtasks/function become more isolated. The key challenge is how to manage the different actors in the value chain that are executing value creation functions.

To ensure optimal alignment between different functions, functional departments involve MO as a secondary function overarching the various primary functions involved in the value chain, from primary inputs all the way through to the final offering to the end customer. Integrated chains achieve this by involving "closer to the end customer" departments and by setting very detailed input material requirements. Suppliers are then not integrated into the chain, but rather get involved based on contractual agreements.

Market orientation in supply chains

MO has mainly been studied in the context of large-scale businesses in the western context, and this may partly explain why there has been limited attention for MO across complex supply chains. Except for a few studies (e.g., Siguaw et al., 1998), the conceptualization and implications of MO to date have been mainly in the context of individual firms, in spite of the growing importance of supply chain management (SCM). Market-oriented firms aim to better serve customer requirements based on market information obtained by and shared inside the firm in a coordinative manner (Kohli & Jaworski, 1990). Social network literature (Lee, Lee, & Pennings, 2001) suggests that external networks with suppliers and other partners (a supply chain) provide a firm with information on new technological and market opportunities, and collaboration to exploit opportunities. Thus, firms interact with supply chain partners to acquire external resources and the necessary information to offer products that attract and retain customers and, accordingly, perform superior to competition (Lee et al., 2001). However, the value of supply chain social ties is contingent on such firm internal capabilities as market sensing through a MO (Day, 1994). That is, although SCM concepts as the source of additional resources may mediate the MO-performance relationship, MO as the impetus for SCM concepts may still have direct, positive impact on firm performance (Min & Mentzer, 2000).

Mentzer et al. (2001) describe a supply chain as “a set of three or more organizations directly linked by one or more of the upstream and downstream flows of products, services, finances, and information from a source to a customer.” Thus, the nature of a supply chain is comprehensive, and membership is open to any firm that performs a flow function. Each firm must be selective in managing relationships with a limited set of partners. As such, managed supply chains are organized and operated through agreed-upon goals and activities of the partners. Since the focal firm is inseparable from its managed supply chain, but not necessarily from supply chains as natural phenomena, SCM phenomena—overt and collective efforts of supply chain partners—should be examined in the context of managed supply chains (Mentzer et al., 2001).

Thus, supply chains exist as a wide variety of combinations of actors, that each perform specific functions as part of the value chain. Supply chains can be analyzed as bundles of functions performed. Hence, company’s managers and all employees of the functional departments need to understand marketing and their role in creating customer value, and hence should carry out value-creating activities to design, produce, market, deliver, and support the firm's products. A company's value chain is only as strong as its weakest link. Success depends on how well each department/ actor performs its work of adding customer value and on how the company coordinates the activities of various departments (Horvath, 2001; Kohli & Jaworski, 1990; Kotler & Armstrong, 2009; Porter, 1980).

Market orientation in developing and emerging (D&E) markets

D&E markets are typically characterized by more fragmented supply chains, in which relationships between actors often have a transactional basis, often without too much alignment and overall management. This sets an important challenge to MO, because there does not necessarily exist a strong channel leader to guide the secondary function of MO. Such specifics in business and chain organization, together with the specifics of the D&E market system in terms of socio-economic, regulatory and cultural subsystem has stimulated research attention into the tenability of the MO theory across such different contexts (Burgess & Nyajeka, 2007; Burgess & Steenkamp, 2006; Ingenbleek et al., 2013; Prahalad & Hammond, 2002; Zebal, 2003). A framework delineating four stages through which emerging markets research contributes to the growth of marketing science is proposed (Burgess & Steenkamp, 2006): 1) theory development, 2) acquisition of meaningful data, 3) analysis of the data to test one's theories, and 4) learning.

Market orientation of value chain functions

Research on MO from a value chain perspective is still limited but gradually emerging (Grunert et al., 2005). Companies interact in value chains to create value for the end-user, and while a particular company will often primarily focus on its immediate customers in its market-oriented activities, it will often also be able to make profitable use of market intelligence about customers further down the chain and especially on the end-users served by the chain. The degree of MO of one chain member may thus be influenced by the degree of MO of other chain members. Consequently, the competitiveness of the whole value chain in serving end-users will be related to how the various chain members together perform the task of generating intelligence on end-user needs, wants, and use it to guide their value-creating activities (Grunert et al., 2005). In this paper, we adopt the process-driven model of MO of Kohli et al. (1993): intelligence generation, dissemination, and responsiveness to the intelligence. We measure MO at the level of the different functions involved in the seed value chain.

Hence, MO of a value chain is value chain members' generation of intelligence pertaining to current and future end-customer needs, dissemination of the intelligence across chain members, and chain wide responsiveness to the intelligence. Intelligence generation refers to the sum of activities of all chain members pertaining to information on end-users, typically farmer customers' current and future needs/preferences, competitors' actions, and the forces (i.e., task and macro environments) that influence the development and refinement of those needs. Importantly, multiple organizational departments operating in a value chain should engage in this activity because each has a unique market lens. Hence, market intelligence is not the exclusive responsibility of the chain leader (marketing department in a value chain), but it is the responsibility of all organizations/departments in the value chain. Dissemination includes all exchange of information on end-users and competitors between chain members. This dissemination of market intelligence is important because it provides a shared basis for concerted actions by the different organizations operating across the value chain. Finally, responsiveness refers to the action taken by chain members in response to the generated and disseminated intelligence about the end-users. Generation and dissemination of market intelligence have no value if the actors in a value chain are not able to respond to market intelligence and the market needs. All chain members need to be responsive by selecting the appropriate target markets, designing, producing, promoting, and distributing products that meet current and anticipated needs (Kohli & Jaworski, 1990).

Measurement invariance

Measurement equivalence (invariance) is a pre-requisite to be able to make comparisons across groups (Nam, Kim, Arthurs, Sosik, & Cullen, 2016). In this paper testing measurement invariance (MI) across perspectives and marketing functions will be conducted. The issue of invariance is specifically concerned with the fundamental question of the "comparability" of measures across contexts. If latent factor means are to be meaningfully compared, the measurement structures of the latent factor and their survey items should be stable that is "invariant." This test determines whether the measures had the same meaning and structure for different respondent groups/functions.

Many studies examining MI of survey scales have shown that the MI assumption is very hard to meet. In particular, strict forms of MI rarely hold, i.e., a situation in which measurement parameters are exactly the same across groups or measurement occasions, that is enforcement to zero tolerance with respect to deviations between groups or measurement occasions (Nam et al., 2016).

Models and hypothesis

Market-oriented seed value chains require the responsiveness of market channel functions to the market demand. Actors need to understand their roles (i.e., the market channel functions performed) in the seed systems, sense the needs for the market channel functions they perform, and respond accordingly. Our model investigates the degree of MO of different functions performed in seed supply value chains. MO of seed value chains is assessed by analyzing how these functions are guided by (1) information generation, (2) dissemination across actors, and (3) coordinated response to serve customers better (Figure 5.1a). However, these market-oriented activities need not be evenly distributed across the chain. All intelligence-generation might be concentrated at the downstream level closer to the end customer, and responsiveness could be concentrated entirely upstream in primary production. Only dissemination would then have to involve all members of the chain. However, the more we go down the chain, we expect a greater intelligence generation on end-users. We also expect that there will be differences in the extent to which end-user intelligence is disseminated further up the chain, and in the extent to which responsiveness is not only concentrated upstream but also distributed more equally across the chain.

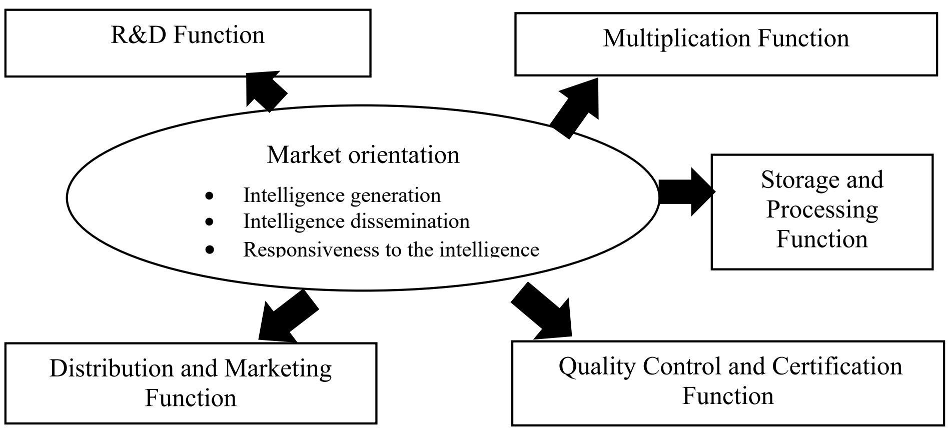

Figure 5.1a: Conceptual model of market orientation of seed value chain functions

5.4 Methodology

Sample

The study adopts a quantitative approach to the understanding of MO at the level of seed supply systems in Ethiopia. This study focuses on seed supply chains for maize, teff, and beans and does so across three regions of Ethiopia: Amhara, Oromia, and the Southern region. The study focuses on these three different crop value chains for four main reasons. First heterogeneity of the raw materials (seeds) used. For example, seeds of hybrid maize cannot be used for subsequent cropping/production, as opposed to self-pollinated or open pollinated crops such as teff and beans where farmers can produce seed for the coming season by saving from the previous harvest. Thus, farmers should necessarily buy seeds of hybrid maize each year as compared to self-pollinated crops. Second, the degree of commercialization of crops, that is from staple food to export. Cereals (maize and teff) and pulses (beans) also represent the main grain crops of Ethiopia, with varying contributions to food security and agricultural growth of the nation. Third, due to the nature of crops, different configurations of actors performing functions in the maize, teff, and bean seed systems exist. For example, most private companies concentrate on high value crops (e.g., maize, horticulture) as compared to public companies that focus both on commercial, and most other categories of crops that have limited commercial interest for the private sector. Hence, it helps to understand and compare the performance of each crop/function vis-à-vis organizations. Fourth, heterogeneity of the end users served, resulting from differences in agro-ecology.

The chapter builds on data from Chapter 4 as end customers/farmers [N=170] evaluate the MO of the functions performed in different seed supply value chains that they obtain seed from. It is the same data collection as reported on in Chapter 4, but with and extension of 114 chain actors. A total of 114 actors performing market channel functions were selected to evaluate the MO of functions performed by themselves. In addition, these 114 actors evaluated the MO of their suppliers and their customers. Data were collected from a total of 284 respondents between March and December 2016. Moreover, one respondent may evaluate different functions for one to three crop types. For those actors that evaluate many functions and/or crops, we scheduled the interview at different time and period, just to avoid any feelings of being tired. Together, a total of 7447 evaluations were collected, which will be used for our analyses and results.

Procedure

Nine interviewers (2-4 per region) were trained by the lead authors for the personal interviews with respondents. Multiple respondents (2-3) were selected as informants for functions performed for a crop by a supply chain organization based on the role they perform. However, for functions performed in small firms (e.g., domestic private producers), single informants (managers) were used. End customers were selected with the help of local, governmental, agricultural offices. Respondents first were contacted by telephone to solicit their cooperation. They were informed about the confidentiality of their responses and the academic purpose of the study.

The questionnaire started off with a general introduction about the functions performed in seed supply chains, organized around a) R&D, b) multiplication, c) storage and processing, d) quality control and certification, and e) distribution and marketing. To bring the topic close to the respondents' own practices, respondents then indicated what crops and varieties are grown/produced in their own organization and which supply value chain they are engaged with. For each of the crops grown, respondents indicated which seed supply channels (organizations) they obtain their seeds from, and which market channel functions are performed by themselves, their suppliers, and their customers. Participants then provide an assessment of the MO of functions performed in each seed value chain. Specifically, they were asked to evaluate the MO of (a) functions performed by themselves, (b) their suppliers, and (c) direct customers. End customers/farmers, however, evaluate the MO of all functions performed in each crop value chain (Figure 5.1b).

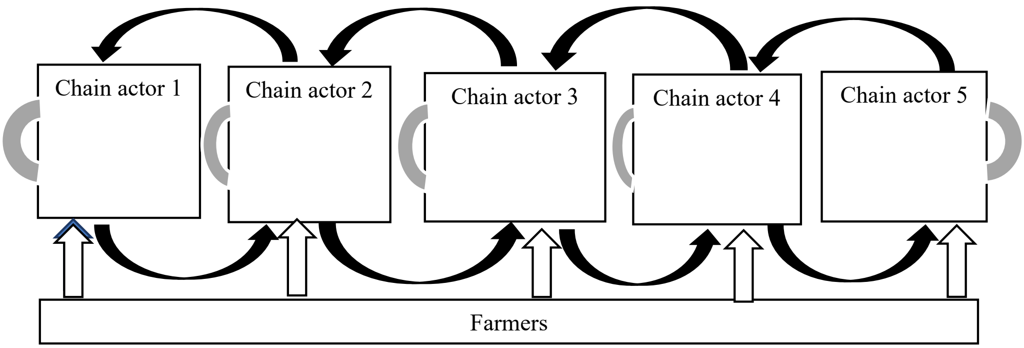

Figure 5.1b: Evaluations of supply chain's market orientation by supply chain partners

Measures

Most variables included in this study are measured on multiple-item scales drawn from previous research.

Market orientation was measured using the scale first reported by Jaworski and Kohli (1993). This scale later was labeled MARKOR with 20 items of MO. They propose that MO is a function of (1) the extent to which a firm generates intelligence about the market, (2) the dissemination of that information throughout the firm, and (3) the extent to which an organization responds to the information gathered and disseminated. We have adapted these constructs to the level of each market channel function performed in seed systems. The items were adapted to span the domain of the construct. All items were answered on a 5-point Likert-type scale.

The MO statements were pretested with key seed stakeholders in two stages. First, the questionnaires were pretested with 40 stakeholders each executing specific functions as part of a seed value chain. The respondents include senior experts in marketing and sales, R&D, and production, who have substantial expertise in the agricultural sector and Ethiopian seed supply systems. Feedback from this process was used to improve the instrument, to weed out those items least related to the constructs, to suggest additional items, and to improve the wording of the statements. Recommendations were adhered to. This procedure resulted in 20 candidate items to measure MO of marketing functions. Second, we piloted the questionnaire with these 20 items through personal interviews with top managers or executives in 20 seed companies and their channel partners. This led to further refinement of the items, and changes to the questions to improve understanding. Thus, we obtained 20 items for the MO of value chain functions. These are included in the survey questionnaire for organizations participating in the Ethiopian seed value chain. The dimensions of MO were measured with 6 items for intelligence generation, five items for intelligence dissemination and 9 items for responsiveness to the intelligence (see Appendix 5.1 for the final items). The wording of the items was slightly adjusted for use of the scale in the various value chain functions. Moreover, the wording of the items will be adjusted to whether the respondent evaluates his/her own organization, suppliers, or customers. The word “we” will change to “they” when the respondent evaluates his/her supplier’s or customer’s MO. For example, the Table below shows how we adapted one scale item of the intelligence/ information responsiveness construct of Kohli et al. (1993) to each function in a value chain. The original item was *"The different activities in this business unit are well coordinated"*.

Value chain functions	How we adapted the above item at a focal organization own role
R&D	The different activities in this breeding department are well coordinated.
Multiplication	The different activities in this seed multiplication department are well coordinated.
Storage and Processing	The different activities in this seed storage and processing department are well coordinated.
Distribution and Marketing	The different activities in this seed marketing department are well coordinated.
Quality control and Certification	The different activities in this seed quality control and certification department are well coordinated.

Thus "MO components" were measured at the level of each market channel functions in which the participant is engaged.

Scale reliability is assessed through the usual procedures of Cronbach's alpha and Confirmatory factor analysis (CFA) using STATA. Model fit was evaluated using several indexes: exact fit (i.e., the Chi-square value), RMSEA, incremental Fit index (CFI, GFI, TLI, IFI) and SRMR. It is recommended that RSMEA should be below 0.08, SRMR should be below 0.1, and CFI, GFI, TLI, and CFI should be above 0.9 (with a measure of 1 indicating a perfect fit (Hair, Anderson, Tatham, & Black, 1995). Coefficients were estimated using Maximum Likelihood (ML) and STATA. The factor scores of the MO items were calculated to understand the perceptions of channel partners towards the MO implementation of their value chain functions. Factor scores are composite variables which provide information about an individual's placement on the factor(s). Correlations were calculated to assess the association between MO components. Although each of the MO scales has been reported in the literature, a scale validation procedure was accomplished using (1) the analysis of item inter-correlations, (2) the analysis of item-total correlations, and (3) confirmatory factor analysis (CFA). The purpose of this stage of the analysis was to identify and eliminate poorly performing items for reflective measures.

As MO measures are already validated in the extant literature, we employed a CFA with the three components of MO (information generation, dissemination, and responsiveness). We compute the factor scores for each of the three MO dimensions, i.e., we perform a CFA with 3 components. However, factor scores of the three MO dimensions were extracted from two separate factor analysis: One is from the perspective of chain actors, and the other from the perspective of farmer customers[5]. Then we calculate the overall mean MO scores based on the CFA scores of these components (i.e., MO= (IG+ID+IR)/3)). These resulted in the best model fit both for the chain actors and farmers. The result also indicate that it is a "zero game" per construct (both for chain actors and farmers) as the overall mean per construct is set to be zero and the standard deviation to 1. So, what is reported is standard deviation-size differences from the overall mean (=zero). See Appendix 5.2 for the detail data analysis, procedure, and measurement model results.

5.5 Results

The results will be organized around the four research questions. We present the MO results from the perspective of (a) chain actors-organizations participating on the Ethiopian seed systems, and (b) the end farmer customers, separately.

5.5.1a: Does MO differ by function (the chain actor's perspective)?

Table 5.3 shows chain actors' perceptions of the level of MO of each market channel function in the seed supply chain. It includes the aggregate scores for the MO of a function from three perspectives: the own organization, the suppliers', and the customers. In short, it shows chain actors evaluations of the MO of market channel functions.

MO scores are different between functions ($F(4, 3528) = 6.73$, $p < 0.001$). The quality control and certification function score highest, higher than R&D ($p<0.001$) and storage and processing ($p<0.001$). The seed distribution and marketing function score higher than R&D and storage and processing ($p<0.05$). The difference between quality control and certification, distribution and marketing functions is not significant ($p=0.59$). The multiplication function scores higher than R&D ($p<0.001$), but the difference between multiplication and quality

[5] However, the researchers initially tried to calculate the factor scores per construct across all observations (farmers and chain actors). However, the model (STATA-CFA) did not run or perform across all observations. It takes long iteration period and did not yield any results with the associated model fitness test results. As a result, the researchers performed two separate factor analysis from the perspective of chain actors and farmers, separately.

control and certification (p=0.16), and multiplication and distribution (p=0.38), and multiplication and storage and processing (p=0.06) is not significant.

Table 5.3: Supply chain actors mean perceptions of MO of value chain functions.

Scales	N	R&D	Multiplication	Storage and processing	Quality Control and certification	Distribution and marketing	F	Sig.
IGeneration	3528	-0.17	-0.02	-0.08	0.07	0.03	5.41	0.00
IDissemination	3528	-0.23	0.00	-0.10	0.05	0.07	8.53	0.00
IResponsiveness	3528	-0.21	0.03	-0.10	0.07	0.01	6.80	0.00
Overall MO	3528	-0.20	0.00	-0.09	0.06	0.04	6.73	0.00

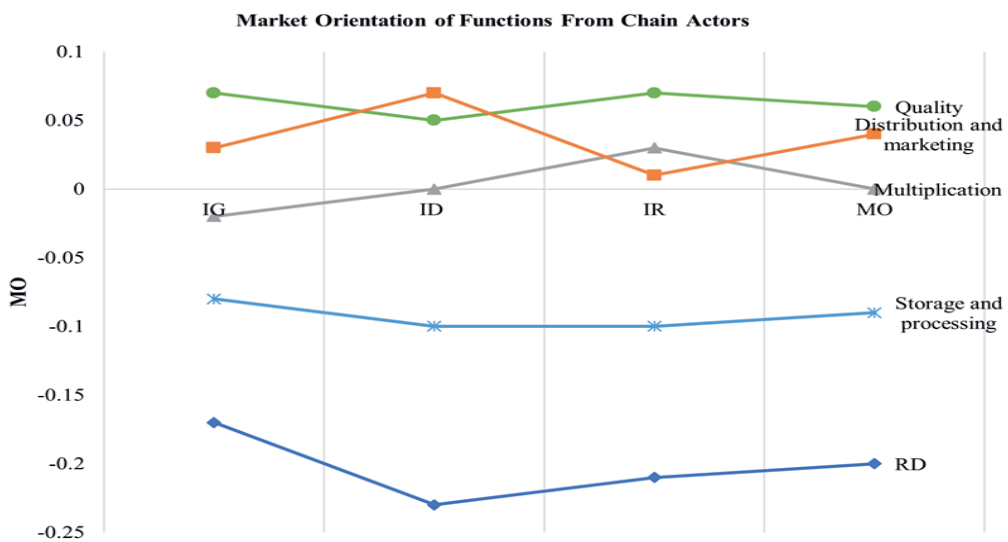

Figure 5.7: Market orientation of functions evaluated by chain actors.

5.5.1b: Does MO differ by function (the farmer's perspective)?

Table 5.4 shows farmer customers' perceptions of the level of MO of each market channel function performed by their suppliers. Overall MO scores are different between functions; F (4, 3919) =20.51, p<0.001. The distribution and marketing function scores highest, higher than any of the other functions (p<0.001). It implies that farmer customers do recognize the MO activities of those actors performing distribution and marketing of seed offers. It is also related to the proximity of end customers to the marketing function because the distribution and marketing function is much closer to the farmers than the other functions are. The quality control and certification function also score higher than storage and processing ($p<0.001$) and R&D ($p=0.02$) functions. The seed multiplication function also scores higher than R&D and storage and processing functions ($p<0.01$). The difference between quality control and certification and multiplication function is not significant ($p=0.06$). The storage and processing, and R&D functions score lowest, lower than any of the other functions, except the insignificant difference between them ($p=0.16$).

Table 5.4: Farmer customers' mean perceptions of the MO of value chain functions

Scales	N	R&D	Multiplication	Storage & processing	Quality Control & certification	Distribution & marketing	F	Sig.
IGeneration	3919	-0.13	0.07	-0.25	-0.03	0.24	31.42	0.00
IDissemination	3919	-0.16	0.07	-0.22	-0.01	0.22	27.53	0.00
IResponsiveness	3919	-0.05	0.04	-0.07	0.01	0.02	2.71	0.00
Overall MO	3919	-0.11	0.06	-0.18	-0.01	0.16	20.51	0.00

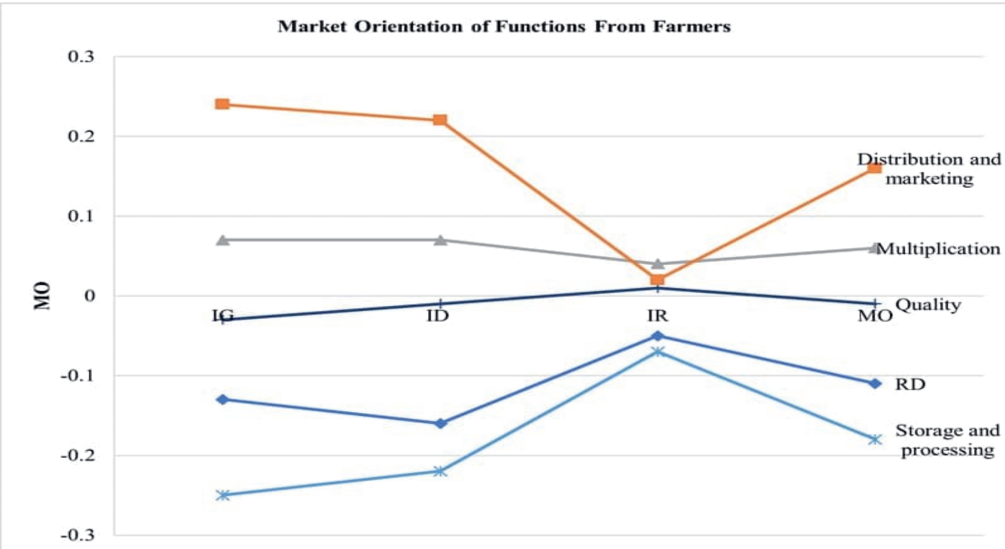

Figure 5.8: Market orientation of functions evaluated by farmer customers.

5.5.2a: How does the MO of market channel functions differ between crops (the chain actors' perspective)?

Table 5.5 shows chain actors' perceptions of MO of three crop value chains, maize (M), teff (T), and beans (B). In doing so, we take all evaluations of MO by chain actors and see whether there are differences between crops. The overall MO does not significantly differ between crops; F (2, 3528) =2.69, $p = 0.07$.

When we compare the three components of MO, there are significant differences for responsiveness to information (F=4.83; p=0.01), but not for information generation (F=1.21; p=0.30), and information dissemination (F=2.78; p=0.06). Maize scores higher than teff and beans (p=0.01). The difference between beans and teff is not significant (p=0.86). It implies that channel actors give much emphasis for the most commercial crop, maize, as opposed to the lesser ones.

Table 5.5: Chain actors mean perceptions of MO by crops.

Scales	IG			ID			IR			MO			F	Sig.
	M	T	B	M	T	B	M	T	B	M	T	B		
R&D	-0.06	-0.28	-0.23	-0.11	-0.33	-0.29	-0.10	-0.31	-0.27	-0.09	-0.31	-0.26		
Multiplication	-0.01	-0.01	-0.07	0.04	-0.02	-0.06	0.12	-0.01	-0.04	0.05	-0.01	-0.05		
Storage and processing	-0.11	-0.07	-0.04	-0.11	-0.10	-0.07	-0.08	-0.14	-0.08	-0.10	-0.11	-0.06		
Quality Control and Certification	0.06	0.10	0.06	0.06	0.05	0.03	0.10	0.04	0.06	0.07	0.06	0.05		
Distribution and marketing	0.10	0.01	-0.06	0.14	0.04	-0.01	0.08	-0.03	-0.06	0.11	0.01	-0.04		
Overall MO										0.04	-0.02	-0.04	2.69	0.07

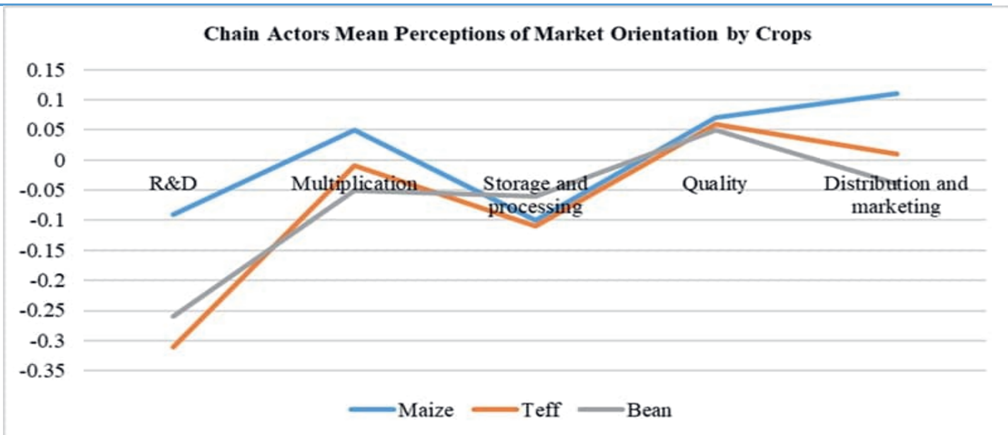

Figure 5.9: Market orientation of crops evaluated by chain actors.

5.5.2b: How does the MO of market channel functions differ between crops (the farmer's perspective)?

Table 5.6 shows farmers' perceptions of MO for three crop value chains. The overall MO significantly differs between crops; $F(2, 3919) = 29.60$, $p < 0.001$. The MO for teff chains scores highest, higher than maize ($p<0.001$) and beans ($p<0.05$) chains. The MO for beans chain scores higher than maize ($p<0.05$).

When comparing the three components of MO, there are significant differences between crops in information generation ($F=36.60$; $p<0.001$), dissemination ($F=25.15$; $p<0.001$), and responsiveness ($F=49.30$; $p<0.001$). For information generation, the scores for beans and teff are higher than maize ($p<0.001$), but the difference between beans and teff is not significant ($p=0.91$). For information dissemination, the scores for teff and beans also are higher than maize ($p<0.001$), but the difference between teff and beans is not significant ($p=0.57$). For information responsiveness, the scores for teff are highest, higher than maize and beans ($p<0.001$). The scores for maize are higher than beans ($p<0.001$), despite the scores for beans is higher than maize on intelligence generation and dissemination. It implies that for beans, information generation and dissemination contribute more to the overall MO than information responsiveness.

Table 5.6: Farmer customers' mean perceptions of MO by crops

Scales	IG			ID			IR			MO			F	Sig.
	M	T	B	M	T	B	M	T	B	M	T	B		
R&D	-0.19	-0.14	0.10	-0.21	-0.13	0.01	-0.05	0.07	-0.30	-0.15	-0.06	-0.06		
Multiplication	-0.05	0.20	0.18	-0.02	0.17	0.14	0.05	0.13	-0.19	-0.01	0.17	0.05		
Storage and processing	-0.33	-0.11	-0.23	-0.28	-0.09	-0.25	-0.09	0.13	-0.42	-0.23	-0.03	-0.30		
Quality Control and Certification	-0.15	0.10	0.12	-0.11	0.09	0.09	0.00	0.16	-0.24	-0.09	0.12	-0.01		
Distribution and marketing	0.08	0.41	0.57	0.07	0.37	0.49	-0.13	0.25	0.10	0.01	0.35	0.39		
Overall MO										-0.08	0.13	0.00	29.60	0.00

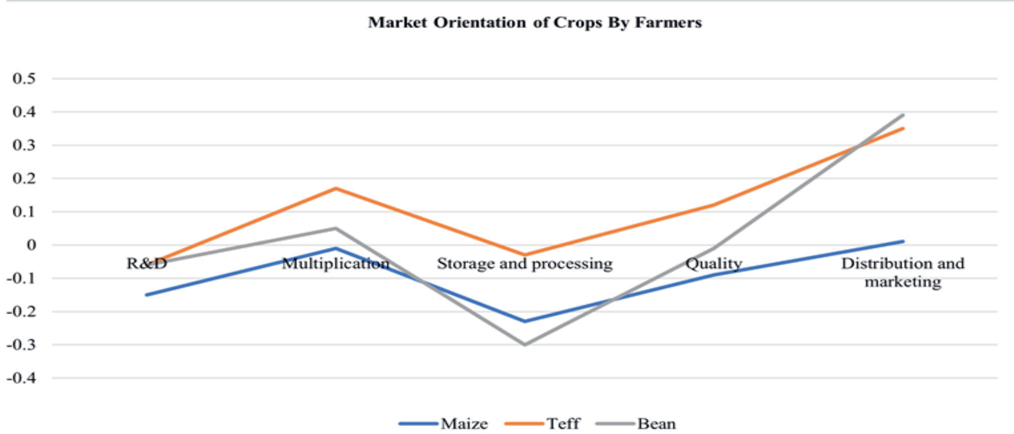

Figure 5.10: Market orientation for different crops evaluated by farmers.

5.5.3: Does market orientation differ by perspectives?

Table 5.7 shows channel actors' perceptions of the level of MO of its own function, how suppliers perceive the channels actor's function, and how customers perceive the channels actor's function. These scores represent how the MO of a function is evaluated by themselves, their suppliers, and their customers.

From the chain actors' perspective, the overall MO scores significantly differ between the three perspectives: $F(2, 3526) = 189.13$, $p < 0.001$. Chain actors evaluate their own MO higher than their suppliers and customers do, both overall and for each component of MO ($p<0.001$). Both suppliers and customers are more negative about the MO of a focal organization (i.e., the organization performing a function) than the focal organizations own evaluation ($p<0.001$). Customers are more negative about the MO of the focal organization than suppliers ($p<0.001$).

Table 5.7: Channel actors' MO as perceived by themselves, their suppliers, and their customers.

Scales	Own	Supplier	Customer	F	Sig.
IGeneration	0.55	0.06	-0.25	186.51	0.00
IDissemination	0.57	0.05	-0.24	208.67	0.00
IResponsiveness	0.52	0.04	-0.22	153.09	0.00
Overall MO	0.55	0.05	-0.24	189.13	0.00
N	581	1296	1649		

5.5.4: How does the MO of value chain functions differ by supply chain organizations?

Table 5.8 shows chain partners' (actors and farmers) mean evaluation of the MO of market channel functions performed by categories of organizations in seed supply systems. We have developed a MO of a focal organization by taking the average scores of own evaluation, suppliers, customers, and farmers. The analysis is to show whether there exist differences between supply chains/organizations on MO of each market channel function. This enables us to understand which organizations are performing a given function more market oriented than others. Overall, the key finding shows that there are no significant differences between the wide range of organizations in executing each function.

The analysis reveals that there is room to improve the MO of market channel functions. The MO of market channel functions shows also that seed systems of different crops have specific strengths and weaknesses. This is further elaborated, below.

For R&D MO scores are not different between organizations for maize (F=1.10, DF=2; p=0.39), teff (F=0.01, DF=1; p=0. 92) or bean (F=0.94, DF=1; p=0.38). For maize, R&D is performed by the national and regional research organizations, and by the MNCs. However, for teff and beans the R&D is performed by the national and regional research organizations. We assessed the MO of each function from four perspectives (i.e., the organization performing a function, suppliers, customers, and farmer customers). See Table 5.8 for the detailed results or differences in MO of R&D between the public research organizations and MNCs.

For multiplication MO scores are not different between organizations for maize (F=1.30, DF=7; p=0.30), teff (F=1.12, DF=7; p=0.39) nor beans (F=1.46, DF=7; p=0.24).

For storage and processing MO scores are not different between organizations for maize (F=0.83, DF=6; p=0.56) or beans (F=1.28, DF=6; p=0.32). For teff MO scores are different between organizations. The SPCs score highest, higher than national and regional research organizations and private companies (p<0.05). The differences between SPCs and national seed enterprise (p=0.10), SPCs and regional enterprises (p=0.06), and SPCs and seed unions (p=0.39) are not significant.

For quality control and certification MO scores of maize (F=0.62, DF=8; p=0.75), teff (F=0.55, DF=8; p=0.81), and beans (F=0.49, DF=8; p=0.85) are not different between organizations.

There are no differences between any of the organizations in the MO scores for distribution and marketing functions for maize (F=0.56, DF=10; p=0.83) or teff (F=0.52, DF=10; p=0.86) or beans (F=0.56, DF=10; p=0.83).

The distribution and marketing MO scores of organizations are not different between crops (F= 0.68; p= 0.43).

Table 5.8: Chain partners' perceptions of MO of value chain functions by supply chain organizations

Channels Per Function		# Of Respondents/chain actors and farmer/ or channel partners evaluated MO of value chain functions per crop and organization																	
		# of chain actors	Overall MO Scores, & scores of each perspectives					# of chain actors	Overall MO Scores, & scores of each perspectives					# of chain actors	Overall MO Scores, & scores of each perspectives				
		#Maize	MO	Own	Supplier	Customer	Farmer(N)	#Teff	MO	Own	Supplier	Customer	Farmer(N)	# Bean	MO	Own	Supplier	Customer	Farmer(N)
A	R&D																		
1	MNC	16	0.79	1.91	-	0.70	-0.23(106)	-	-	-	-	-	-	-	-	-	-	-	-
2	EIAR	45	0.08	1.02	-	-0.55	-0.24 (69)	42	0.05	0.95	-	-0.55	-0.24 (69)	27	0.37	1.78	-	-0.42	-0.25(20)
3	RARI	36	-0.02	-0.03	0.39	-0.46	0.02(80)	24	0.10	0.37	0.50	-0.59	0.13(58)	25	-0.22	-0.07	-0.34	-0.50	0.03 (40)
B	Multiplication																		
1	MNC	26	0.70	1.68	-	0.55	-0.13(105)	-		-	-	-	-	-	-	-	-	-	-
2	EIAR	43	0.21	0.95	-	-0.54	-	39	-0.02	0.68	-	-0.51	-0.23(10)	30	0.05	0.40	-	-0.31	-
3	RARI	30	-0.34	-0.04	-0.09	-0.88	-	27	0.04	0.14	-0.08	-0.32	0.41(21)	30	-0.43	-0.16	-0.70	-0.42	-
4	ESE	48	0.12	0.30	0.31	0.26	-0.40(80)	35	0.02	0.41	0.29	-0.18	-0.45(61)	28	-0.05	0.28	0.14	0.06	-0.67(20)
5	RSE	58	0.17	0.68	0.09	0.18	-0.26(104)	36	-0.02	0.09	0.19	-0.19	-0.16(55)	33	-0.10	0.22	-0.35	0.17	-0.45(20)
6	DPSP	64	0.12	0.55	0.31	-0.20	-0.18(62)	36	-0.08	0.45	0.58	-0.75	-0.61(20)	33	0.07	0.39	0.55	-0.08	-0.58(10)
7	Seed Union	22	-0.02	0.42	-0.40	0.14	-0.22(36)	22	0.40	0.57	0.24	0.04	0.75(20)	30	0.07	0.40	0.13	-0.24	-0.02(40)
8	SPCS	-		-	-	-	-	19	0.78	1.30	0.32	-	0.72(40)	13	0.72	1.00	0.18	-	0.99(10)
9	BoARD	36	0.22	0.55	-0.72	0.35	0.71(113)	28	0.09	0.08	-0.97	0.68	0.55(92)	26	-0.09	0.18	-1.16	0.09	0.52(50)
C	Storage and processing																		
1	MNC	17	0.55	1.79	-	0.04	-0.19(106)	-		-	-	-	-	-		-	-	-	-
2	EIAR	29	-0.13	0.69	-	-0.95	-	32	-0.20	0.28	-	-0.64	-0.23(10)	21	-0.13	0.11	-	-0.36	-
3	RARI	21	-0.49	0.04	-0.26	-1.26	-	19	-0.16	-0.54	-0.01	-0.45	0.38(21)	23	-0.32	-0.05	-0.59	-0.63	-
4	ESE	38	0.07	0.13	0.30	0.23	-0.38(81)	31	0.04	0.52	0.34	-0.36	-0.34(61)	21	0.05	0.73	0.25	-0.13	-0.65(20)
5	RSEs	44	0.12	0.76	-0.06	0.02	-0.24(104)	29	-0.06	0.34	-0.09	-0.23	-0.27(55)	25	-0.07	0.31	-0.23	0.19	-0.56(20)
6	DPSP	44	0.04	0.49	-0.05	-0.15	-0.13(62)	28	-0.31	0.63	-0.04	-1.24	-0.59(20)	27	-0.24	0.57	0.07	-0.97	-.64(10)
7	Seed Union	19	-0.12	0.34	-0.46	-0.13	-0.23(36)	20	0.37	0.81	0.01	0.07	0.59(20)	20	0.08	0.78	0.03	-0.35	-0.15(40)
8	SPCS	-		-	-	-	-	17	0.71	1.27	0.04	-	0.82(30)	8	0.41	0.42	0.13	-	0.67(10)

Channels Per Function		# Of Respondents/chain actors and farmer/ or channel partners evaluated MO of value chain functions per crop and organization																	
		# of chain actors	Overall MO Scores, & scores of each perspectives					# of chain actors	Overall MO Scores, & scores of each perspectives					# of chain actors	Overall MO Scores, & scores of each perspectives				
		#Maize	MO	Own	Supplier	Customer	Farmer (N)	#Teff	MO	Own	Supplier	Customer	Farmer (N)	# Bean	MO	Own	Supplier	Customer	Farmer(N)
D	Quality control & certification																		
1	MNC	27	0.86	1.92	-	0.96	-0.30(106)	-	-	-	-	-	-	-		-	-	-	-
2	EIAR	41	0.34	1.37	-	-0.70	-	42	0.01	0.79	-	-0.52	-0.23(10)	28	0.04	0.31	-	-0.23	-
3	RARI	34	-0.34	-0.14	0.25	-1.12	-	33	0.03	-0.06	0.24	-0.34	0.28(21)	36	-0.34	-0.38	-0.04	-0.59	-
4	ESE	50	0.18	0.80	0.24	0.12	-0.45(81)	42	0.14	1.01	0.35	-0.38	-0.41(61)	30	0.17	1.13	0.36	-0.09	-0.73(20)
5	RSEs	62	0.14	0.86	-0.03	0.08	-0.37(104)	43	0.05	0.45	0.28	-0.22	-0.31(55)	38	-0.07	0.45	0.01	-0.09	-0.65(20)
6	DPSP	65	0.24	0.86	0.44	-0.20	-0.15(62)	44	-0.11	0.91	0.47	-1.21	-0.61(20)	36	-0.03	0.94	0.55	-0.97	-0.62(10)
7	Seed Union	14	-0.02	0.75	-0.45	-0.19	-0.20(36)	31	0.43	0.80	0.14	0.08	0.70(20)	29	0.00	0.46	0.18	-0.58	-0.06(40)
8	SPCS	-	-	-	-	-	-	23	0.71	1.34	0.11	-	0.67(40)	19	0.59	0.66	0.26	-	0.86(10)
9	BoARD	27	0.29	0.62	-0.74	0.51	0.77(103)	17	0.09	0.24	-1.18	0.76	0.53(82)	18	0.10	0.48	-1.13	0.51	0.52(50)
10	Quality Quarantine Authority	42	0.45	0.97	-	-0.08	-	39	0.43	0.84	-	0.02	-	33	0.27	0.75	-	-0.21	-
E	Distribution and marketing																		
1	MNCs	34	0.63	1.78	-	0.24	-0.14(39)	-	-	-	-	-	-	-		-	-	-	-
2	EIAR	32	0.12	0.69	-	-0.46	-	34	0.54	1.35	-	-0.27	-	25	0.30	0.69	-	-0.10	-
3	RARI	22	-0.24	0.16	0.03	-0.92	-	18	0.17	0.52	0.07	-0.29	0.36(20)	22	-0.52	-0.18	-0.75	-0.63	-
4	ESE	49	0.13	0.43	0.40	0.08	-0.40(30)	42	0.15	0.60	0.43	-0.19	-0.25(18)	32	0.14	0.42	0.18	-0.17	-
5	RSEs	56	0.20	0.59	0.17	0.20	-018(55)	34	-0.09	-0.18	0.32	-0.28	-0.23(23)	31	-0.18	-0.19	-0.14	-0.21	
6	DPSP	55	0.06	0.78	0.23	-0.58	-0.19(62)	23	-0.13	0.61	0.51	-1.09	-0.54(10)	23	0.02	0.54	0.40	-0.26	-0.59(10)
7	Seed Union	26	0.08	0.69	-0.01	-0.01	-0.37(7)	27	0.29	0.54	0.13	-0.38	0.85(21)	27	0.17	0.36	-0.21	-0.50	1.02(10)
8	SPCS	-	-	-	-	-	-	18	0.49	1.27	0.43	-0.56	0.80(37)	15	0.80	1.10	0.32	-0.27	0.98(10)
9	BoARD	43	0.34	0.72	-0.20	-0.06	0.89(17)	34	0.09	0.31	-0.35	0.14	0.25(25)	29	0.17	0.51	-0.31	0.09	0.39(30)
10	Mul.Unions	22	0.21	0.65	0.03	-0.44	0.58(30)	22	0.01	0.76	-0.18	-0.72	0.17(60)	12	-0.02	0.93	-0.09	-0.98	-
11	COOP	30	0.16	0.84	-0.12	-0.37	0.28(120)	17	0.30	0.83	-0.34	-	0.70(49)	13	0.21	0.76	-0.16	-	0.25(20)
12	Dealers	33	0.51	0.99	0.54	0.77	-0.25(88)	3	-0.26	-	-0.26	-	-	3	0.42	-	0.42	-	-

Abbreviations:

MNC-Multinational Companies; EIAR-Ethiopian Institute of Agricultural Research (National Agricultural Research); RARIs-Regional Agricultural Research Institutes; ESE-Ethiopia Seed Enterprise (National); RSEs-Regional Seed Enterprises; DPSP-Domestic Private Seed Producers or Companies; SPCs-Seed Producing Cooperatives; BoARD-Bureau of Agriculture and Rural Development; Mul.Unions-Multipurpose Farmers Unions; COOP-Primary Farmers Cooperatives.

5.6 Conclusions

This study quantitatively explored the MO of supply systems from the perspective of chain actors and farmer customers. In doing so, it provides insight into how market-oriented channel functions are performed by supply chain organizations. To our knowledge, this study is the first to explore MO quantitatively in a multi-actor value chain. Moreover, MO is analyzed from different perspectives and in the context of D&E markets. Finally, it is the first study to explore MO in seed supply systems. We have also shown how an existing MO scale can be applied in such contexts. We conclude our research by answering the four research questions.

In examining the MO of market channel functions, we found that out of the 5 market channel functions, both supply chain actors and farmers agree on the higher MO of seed distribution and marketing, and quality control and certification functions than the R&D and the storage and processing functions. Farmers also agree on the higher MO of seed multiplication function than the R&D and the storage and processing functions. The MO of seed multiplication function is higher than the R&D function, when evaluated by chain actors.

From the perspective of chain actor's MO does not significantly differ between crops (maize, teff and beans), but from the perspective of end farmer customers MO for the teff supply chain is higher than for maize and beans. Moreover, the MO of the bean supply chain is higher than the maize supply chain from the perspective of farmers.

We have also shown how the overall MO significantly differs between perspectives. We found that both suppliers and customers are more negative about the MO of a focal organization (i.e., the organization performing a function) than the focal organizations own evaluation. Customers are more negative about the MO of the focal organization than suppliers in terms of MO. However, a focal organization perceives market orientation of the function performed by themselves higher than their suppliers and customers.

In examining the MO of organizations performing the same market channel function, we found that the MO of functions does not differ much between crops, and organizations. This implies that there is room for every organization to improve the MO of functions.

5.7 Discussion

This section reflects on the findings of our research, provides theoretical and managerial implications for the market-oriented performance of seed supply systems.

5.7.1 Practical relevance

Improving the MO of seed systems is one of the Ethiopian government's ambitions to improve for production and economic growth of a nation. Increasing the rate of introduction of new seed varieties and its adoption is essential to achieving inclusive agricultural sector growth and improved nutrition outcomes. However, the results of our study show that much improvement is needed to incorporate the voice of the customer more central in the development and provisions of seed. This is central to market orientation theory.

In the present paper, we applied the existing measurement scale of MO at a value chain level, as recommended in prior studies (Grunert et al., 2005). In doing so, we have adapted the existing scales to market channel functions performed in seed systems. The scale measures the level of MO within the seed supply chains for maize, teff, and beans. The scale can also help supply chain organizations to monitor how their market-orientation changes. Thus, it can be used as a diagnostic tool for supply chain organizations to identify their strengths and weaknesses and take appropriate actions when needed. The scale can also help supply chains to benchmark their level of MO against competing suppliers.

Insights in supply chain market-oriented performance are of managerial and policy relevance as it provides bottom-up input to further increase effectiveness and efficiency in seed value chains. This is important from an economic and marketing perspective of organizations in supply chains, and from a food security perspective to ensure sufficient quantities of food of sufficient quality. Hence, managers and stakeholders of the seed systems should recognize the importance of engaging customers in the creation of market offering and value (co-creating) for superior and sustainable customer value, and better performance of seed supply systems. By co-creating, sellers receive inputs: for new offerings (Mustak et al., 2013; Saarijärvi et al., 2013), to customize their offerings (Prahalad & Ramaswamy, 2004a), to enhance customer loyalty (Rosenbaum et al., 2005), to increase trust (Dabholkar & Sheng, 2012), to enhance satisfaction (Grönroos, 2008), and for new product development (Hoyer et al., 2010).

By investigating the degree of MO of market channel functions performed in seed systems, seed value chain actors and managers will have a better understanding of the current level of MO. We also provide useful recommendations for managers and policy makers to enhance effectiveness and efficiency in seed supply systems. Specifically, chain actors' and farmers' understanding of the lesser MO of the R&D and the storage and processing functions offer important theoretical and managerial implications. First, increasing the MO of organizations performing these functions should be prioritized. R&D should have a clear understanding of the requirements of various market segments and work on breeding programs to meet these requirements. Similarly, storage and processing should try to understand the needs for processed seeds (e.g., cleaned, graded, pest control, purification, etc.) and storage facilities (maintaining quality and bridging time between harvest and delivery).

Changing the constellation of actors in a supply chain can be an alternative to improving the market-oriented performance of actors performing market channel functions. However, the finding of this study shows that there is hardly any difference in the MO of organizations that perform a specific function for a specific crop. So, changing the constellation is hardly an option, and hence supply chains should give emphasis or focus on increasing the MO of all organizations participating in the Ethiopian seed value chains. Under pressure of competition, supply chains are more stimulated and understand the role of competitive markets and changing their constellation based on efficiency and effectiveness. It suggests that the first organization to become more market oriented can capture more market share and ultimately changing the constellation may become an option. Hence, the finding of this study provides an initial insight for the need of reorganizing seed systems based on the MO of each market channel function performed within seed supply systems. It may also stimulate actors in a supply chain to become more market-oriented and innovative than being obsolete.

Market orientation of market channel functions

Seed systems should become market-oriented in all market channel functions performed within the seed systems to ensure the development of customer value, and to increase the performance of seed supply systems. Currently, there is plenty of room for seed supply systems to increase their MO. Particularly, improvements in the R&D and the storage and processing functions for maize, teff, and bean warrant attention.

We have shown that the MO of the R&D and storage and processing functions is limited, which results in little response to the needs and demands of direct customers and the final farmer customers. From the perspective of chain actors and farmers, the R&D function is not performed in a market-oriented way, possibly due to the distant position of organizations performing R&D from their direct customers and especially from the majority of rural farmers. This was reflected by the limited information generation and responsiveness to the current market demand. As part of the formal system, the R&D has all the necessary resources to develop new and superior varieties for customers. But our result shows that they are less responsive to meeting the growing demand for new, adaptable, and superior varieties that offer solutions for their customers. The differences in R&D between the three crops investigated in this study do not differ in terms of MO and between public and private MNCs (for maize).

The finding supports earlier research which reported the lack of interest or capacity of the research system for developing genotypes that are specifically adapted to farmers' production environment, owing to economic and organizational considerations as factors for the dominance of informal seed system (Altaye, 2012a; Louwaars & de Boef, 2012; Tripp & Rohrbach, 2001). It is evident that developing new varieties or conducting R&D function will take much longer period/years (3-5), thus reflecting the more proactive stance than being too responsive or responding to the current market demand of customers. But the current market figure in Ethiopia shows that much of the generated new varieties by the formal R&D remain on the shelf and only limited varieties of major (grain) crops such as maize, teff, wheat, and beans were adopted by farmer customers. The formal system supplies improved seeds that cover less than 10% of the total arable land under major grain (cereals, pulses, and oilseeds) crops in the country (CSA, 2011). This inevitably constrains the agricultural productivity of the country.

We have also shown the limited MO of actors performing the seed storage and processing function. Both chain actors and farmers perceived the lesser MO of actors performing these functions, particularly on the lack of offering the right quality seeds with strong packaging material, color, volume, and varying package sizes (specifically of small sized packs). This suggests an improvement in the current processing and packaging of seeds to the demands of all customers, and often small-scale farmers. Thus, seed supply systems can take advantage of the businesses lack of MO strategies such as smaller package sizes and use it as a source of sustainable competitive advantage. Prior studies have shown that package size can influence consumer perceptions (such as price and quality perceptions), and its implications both for product choice and consumption (Yan, Sengupta, & Wyer Jr, 2014), and the influence of different package shapes and sizes on consumption amount (Do Vale, Pieters, & Zeelenberg, 2008).

We have also shown the higher MO of quality control and certification, distribution and marketing, and the seed multiplication functions. However, our finding shows that there are no significant differences between crops and organizations on the MO of these functions. It shows that there is no variation in MO between actors. There is still a room for improvements in the MO of these functions, though they are more market oriented than the R&D and the storage and processing functions. For example, seed multipliers should have a clear understanding of the demanded quantities of various market segments and work on seed multiplication programs to meet these specific demands. This responsiveness is market oriented if the decision about seed multiplication is based on information about customers' demand for sufficient/specific quantities of the seeds, often breeder, pre-basic, basic, and certified seeds. However, in most cases in Ethiopia there exists critical shortage of quality seeds; often the public seed demand planning practices resulted in either underestimation or overestimation of the real effective demand of farmer customers, which affects the performance of the whole seed system (Alemu, 2010; Atilaw & Korbu, 2011; Bogale, 2015). Provision of room for seed companies to undertake their own market research, demand assessment and forecasts results in the supply of the right quantity of the right quality seed, end customers satisfaction, improved performance of firms and/or public and private sector organizations, and ultimately better performing seed supply chains. It also suggests the development of free markets that encourage all players of the seed system to improve their performance. Prior studies also argue in favor of free markets in the seed sector (Alemu, 2010, 2012).

5.8 Implications for literature

MO contributes to effective seed systems, but measures for the MO of functions do not exist. Measuring the MO of seed systems is also difficult because measures of MO may not be comparable across functions and different perspectives. In doing so our paper contributes to the literature gap on measuring supply systems by adapting measures of MO (at the level of each function) to the perspectives of all channel actors and the end customers.

From the researchers' knowledge, to date no systematic empirical studies have investigated and reported the degree of MO of complex chains in D&E markets. The paper fills the gap by contributing to research on MO of value chain functions from four perspectives. Thus, this study captures evaluations of market-oriented performance from the viewpoint of suppliers, customers, and final customers. Suppliers and buyers view problems or solutions differently. Hence, we contribute to research that investigates the gap between suppliers' and buyers' perceptions of MO of functions in a dyadic approach. This enables us to comprehensively understand the diverse perceptions of MO.

The present study provides a first and unique perspective on the future of scientific research in MO and value creation in seed systems. We have also shown additional issues of importance while applying the MO concept to a multi-actor value chains by examining measurement invariance tests across functions, perspectives, and groups (see Appendix 5.2). This test determines whether the measures had the same meaning and structure for different respondent groups and functions. Our data provides evidence of robustness for measuring MO of supply chain functions in seed supply chains.

Our results show that market-oriented activities are mostly concentrated in the lower parts of the chain, particularly on the seed distribution and marketing function. This is not surprising, given that the more we come down the chain, the more proximity to the customers, particularly end customers. Moreover, the actors receive more direct feedback on the decisions they make, and it has an immediate influence on their performance. This results in a stronger need for end-user intelligence as a basis for their decisions (Grunert et al., 2005).

Relational characteristics facilitate information exchange. Creating trust and commitment are major factors in bringing about market-oriented activities. Especially the dissemination of end user information upstream in the chain should trigger upstream responsiveness to end-user heterogeneity (Grunert et al., 2005). Trust and commitment create openness, which helps in the exchange of information. It reduces hold up problems, which may otherwise prevent upstream chain members from engaging in market sensing activities (Grunert et al., 2005). Bogale (2015) also emphasized the importance of multi-actor stakeholder platforms, forums, and meetings between chain members as the key ingredients contributing to trust, commitment, and joint planning and actions. This ultimately leads to better performance and innovation in the Ethiopian seed sector.

5.9 Limitation and future research

This study's results and contributions must be evaluated considering its limitations. First, our unit of analysis and quantitative data come from the three major regions of Ethiopia that are known for their lion share in crop production, productivity, diversity (crop, classes of farmer customers, agro ecology) and major contributions to the country's GDP and export earnings. These regions may represent Ethiopia, but the finding may not be generalizable to the whole of Ethiopia. Second, although we systematically selected the study contexts (about 28 scattered study sites), the data are obtained from one country, so the findings may be context and country specific. To strengthen the contribution and wide applicability of our findings, the relevance of the methodology with the identified factors could be tested by replicating the study to other emerging markets and seed systems with their specific contextual challenges. Thus, this limitation opens interesting possible avenues for future research. Particularly, combined methods of qualitative and quantitative may track perceptions of MO overtime, data analysis, theory testing, and generalizability of our study. Third, the quantitative insight from this study opens further research that can support quantitative research, theory testing, and quantified insights into the context of emerging markets. We would take this opportunity by extending this research to explore the MO-performance/proficiency relationship in emerging markets and supply systems by providing Ethiopian seed systems as a case.

CHAPTER 6

Influence of Market Orientation on Proficiency of Supply Chains: The Case of Ethiopian Seed Supply Systems

This chapter will be submitted as: Shimelis Altaye Bogale, Frans J.H.M. Verhees, and Hans C.M. van Trijp.
Influence of Market Orientation on Proficiency of Supply Chains: The Case of Ethiopian Seed Supply Systems.

Abstract

A Positive market orientation-performance relationship is usually hypothesized and empirically supported in many studies. However, in the context of developing and emerging (D&E) markets and supply chains it has been under-researched. The purpose of this paper is to examine the influence of market orientation on the proficiency of seed supply systems in Ethiopia. Cross-sectional data are collected with questionnaires from a sample of 284 respondents (chain actors and end customers) from three regional states of Ethiopia. Results show that market orientation contributes to higher proficiency from the perspective of chain actors. From the perspective of end customers, however, the influence of market orientation on proficiency was not confirmed. The influence of market orientation on proficiency is influenced by functions, perspectives, and crops. This study provides a unique quantitative insight in the influence of market orientation on proficiency in a multi-actor value chains in the context of a D&E market. Seed supply chains can improve their performance and increase customer satisfaction by implementing a market orientation, emphasizing intelligence generation, dissemination, and responsiveness to the intelligence.

Keywords: Market Orientation, Proficiency, Performance, Multi-Actor Value Chains, Seed Systems, Supply Chains, Emerging Markets

6.1 Introduction

Market orientation (MO) can be defined as the extent to which an actor in the marketplace uses knowledge about the market, particularly about customers and competitors, as a basis for decision-making on what to produce, how to produce it, and how to market it (Jaworski & Kohli, 1993, 1996; Kohli & Jaworski, 1990). Market orientation is a fundamental prerequisite to create superior customer value, which is a determinant of continuous superior performance for business (Narver & Slater, 1990) and superior competitive advantage for firms (Day, 1994; Day & Wensley, 1988).

A positive MO- performance relationship is frequently hypothesized and empirically supported in many studies in marketing literature. However, most of the MO studies have been viewed mainly from a firm perspective, and a few on dyadic perspectives, i.e., as a characteristic of a company dealing with a set of current and potential customers, often in the context of developed economies and large multinational companies. As a result, research on MO from a value chain perspective is still limited but gradually emerging (Baker et al., 1999; Elg, 2000; Grunert et al., 2005; Grunert et al., 2002; Langerak, 2001; Siguaw et al., 1998; Simpson et al., 1999). Yet, as a concept so central to general marketing theory, it has been argued (Burgess & Steenkamp, 2006) that establishing generalizability of the MO to performance relationship in economical contexts other than that of the developed world is of paramount importance to truly assess the tenability of marketing theory beyond the specific context in which it was developed. However, MO in supply chain management has received only limited attention so far (Martin & Grbac, 2003; Min et al., 2007). Moreover, no systematic studies to date investigate the degree of MO and proficiency of supply chains from the perspective of sellers and buyers in the context of D&E markets.

To explore typical challenges that arise when applying the MO concept to multi-actor value chains, and to suggest appropriate solutions, we present a study on the MO–performance relationship in multi-actor value chains in the food industry of D&E markets. We show how the generalizability of marketing theories can be assessed in this challenging context. The present study explores MO and proficiency of supply systems where independent organizations perform value chain functions in the context of D&E markets. Our specific context is that of seed systems in the Ethiopian market. Using structured questionnaires with end customers, and organizations performing market channel functions across the different stages of the value chain, the present study takes four perspectives to assess the MO and proficiency of each function: (1) the organization performing the function, (2) suppliers, (3) customers, and (4) the final farmer end customers. Thus, we address organizations performing market channel functions in a business- to- business (B2B) context. Market channel functions that do (not) respond to the market are identified in each seed value chain. Then we discuss possible solutions to overcome the lack of market-oriented responsiveness, such as combining seed systems or actors to stimulate supply chains that efficiently meet farmers' evolving demands for quality seeds.

The central research question that this paper aims to address is (1) What is the relationship between market orientation and performance and how is this relationship moderated? The paper aims to identify moderating concepts in the MO and performance/proficiency relationship. For this we build a large and unique database of perceived market orientation and proficiency evaluations by a diversity of value chain actors and farmers, of supply chain functions. Then the crucial analysis is how market orientation increases proficiency of supply chains. We used 7447 MO and proficiency evaluations.

6.2 Literature review and conceptual frameworks

Market orientation

Market orientation has emerged as a central and unifying concept in marketing theory. Mainly building on extant research in the context of large, often multinational companies, within developed economies, there is strong evidence that MO is a good predictor of company performance (Kirca et al., 2005). MO is a key predictor of a firm's performance, in terms of profitability, sales growth, and new-product success (Atuahene-Gima, 1995; Jaworski & Kohli, 1993; Slater & Narver, 1994a). MO, thus, is positively related to (1) perceived quality of products and services, customer satisfaction and customer loyalty (Kohli et al., 1993), (2) firms' innovativeness, that is their ability to create and implement new ideas, products and processes (Hult & Ketchen, 2001; Kirca et al., 2005) and (3) new product performance, in terms of market share, sales, return on investment, and profitability (Jaworski & Kohli, 1993; Kirca et al., 2005; Ruekert, 1992), (4) marketing effectiveness (Pelham, 2000), (5) sales growth and market share (Slater & Narver, 1994b), and (6) return on assets and profitability (Narver & Slater, 1990). Thus, MO is a key ingredient for business successes, reflecting the importance of a market-oriented business culture (Narver & Slater, 1990; Shapiro, 1988) and behavior (Kohli & Jaworski, 1990; Kohli et al., 1993) to managers and scholars alike. Overall, MO facilitates an organization's successful adaptation to changes and challenges as they occur in its environment (Kirca et al., 2005).

Essentially, MO provides a unifying focus and clear vision to an organization's strategy, which is centered around creating superior value for customers. All actors performing functions in a value chain create value for and deliver value to other supply chain actors. In effective supply chains, supply chain actors at least maintain, but preferably add to, value created by other supply chain actors (Kozlenkova et al., 2015). A MO is required to assure that each function creates value demanded by other supply chain actors or the final customers. Besides value creation, value appropriation has a big influence on the firm's performance.

The positive MO-performance relationships have not been empirically investigated in complex chains of multiple actors performing differentiated functions in the context of D&E markets. It is not clear whether MO increases proficiency of supply chains in the context of D&E markets.

Market channel functions

Market channel functions or marketing functions are those operations and activities which are necessary for the movement of products from producer to end-customer (i.e., farmer). Supply chains should become market-oriented in all market channel functions performed within the seed supply chains to ensure the creation of customer value and increase the performance of organizations within seed supply chains. Market channel functions should be market orientated to increase performance. The market orientation of market channel functions enhances these performances because: (a) market oriented firms develop responsiveness to market demand for marketing functions (Urbonavičius, Dikčius, & Kasnauskienė, 2007), (b) market oriented firms manage their own products and brands, and are responsible for product-related decisions, such as price, promotion, and product design and redesign, (c) market oriented firms measure, monitor, and improve customer satisfaction and service delivery, and manage the organization's loyalty and retention programs, and (d) market oriented firms possess customer information system and database management, which is essential to monitor customer profitability and the effect of the firm's product and service delivery initiatives on that profitability (Moorman & Rust, 1999).

Supply chain management (SCM)

SCM is an effort to align objectives and integrate resources across company boundaries to deliver greater value for all supply chain members. Such SCM initiatives are critical as the focus is not only on suppliers' suppliers and customers' customers but also on cross-functional and inter-organizational integration both inside and outside the firm as part of the boundary-spanning activities (Fawcett & Magnan, 2002). SCM includes cooperative efforts between chain members in such areas as marketing research, promotion, sales and information gathering, research and development, product design, and total system/value analysis (Bowersox, 1997; Min & Mentzer, 2000). SCM goes beyond the logistic processes, as it includes all business processes and should be managed as such (Cooper et al. 1997). The process perspective of SCM focuses on the integration of the key SCM functions. It focuses on how supply chain activities and processes can be integrated to maximize performance (Ellram & Cooper, 2014). It views the supply chain as a system of organizations and functions that form a fully orchestrated effort of upstream and downstream process-based activities (Kozlenkova et al., 2015). Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customer.

Successful SCM requires cross-functional integration and marketing must play a critical role (Lambert & Cooper, 2000). Market orientation increases SCM (Martin & Grbac, 2003) and business performance (Min et al., 2007). Effective SCM: (a) can improve a firm's performance by building strong supplier relationships that leverage a firm's market orientation through improved customer responsiveness (Martin & Grbac, 2003), (b) reduces supply chain costs or increases cost advantage over competitors (Flint, 2004; Horvath, 2001), (c) can facilitate marketing strategy and lead to the creation of superior customer value, satisfaction, and loyalty, which in turn lead to improved product profit margins, overall firm profitability, and overall corporate growth (Flint, 2004), (d) can enhance the culture of competitiveness and knowledge development (Hult et al., 2007). Likewise, effective supplier orientation enhances performance by providing, a) intelligence on supplier knowledge which will enable the focal firm to establish relationships with suppliers that can support the business processes (Kibbeling, 2010), b) dynamic routines, collective learning and transfer of information necessary to anticipate and impact stakeholders' satisfaction (Hurley & Hult, 1998), and c) firms with the opportunity to spur innovation and, consequently, deal better with changes in the environment (Freeman et al., 2004; Harrison, Bosse, & Phillips, 2010). Effective supplier orientation also enhances performance by fulfilling customer requirements, i.e., a firm's efforts to work with supply chain partners will not pay off if the firm is not supply chain-oriented (Min et al., 2007). Moreover, market-oriented behaviors of suppliers can directly or indirectly affect all the channel relationship through distributor's market orientation, trust, cooperative norms, commitment, and satisfaction (Siguaw et al., 1998). Likewise, supply chain integration can influence firm's performance through information sharing and coordination, and in turn MO (e.g., customer orientation and competitor orientation) influences the relationship between supply chain integration and firm performance (Liu, Ke, Wei, & Hua, 2013). Investigating the relationship between MO and SCM concepts expands the boundaries of both MO and SCM research, and examines the idea of inter-functional integration both inside and outside the firm to create customer value (Kotler, 2000).

The relationship between MO and performance may be complex if the MO concept applies to multi-actor value chains rather than to business functions within a large-scale organization, which has typically been the focus of MO research. This sets an important challenge to MO theory because in such contexts, particularly business-to-business markets, the identification, and development of new products, and thus their value, partly takes place in an interaction between customers and suppliers. However, in such markets, customer value is not only a dyadic issue – but also downstream and upstream actors in the supply chain have an interest in, and impact on, this value (Lindgreen & Wynstra, 2005). However, research on supply chains with multiple actors that perform different roles in the context of D&E markets does not exist to the best of our knowledge. Thus, it is not clear how market orientation contributes to proficiency of supply chain functions in such contexts. Hence, this study fills the gap by contributing to research on MO and performance in supply chains/value chain functions.

Model and hypotheses

Market orientation of market channel functions increases performance and customer satisfaction of marketing offers. There is a limited insight into how MO increases the performance of value chain functions. Our model investigates the relationship between MO and proficiency of market channel functions. Accordingly, we conceptualize MO as influencing market channel functions. The key contribution of this paper is exploring the influence of MO on the performance of market channel functions. As per the extant research in marketing and the general marketing theory, we expect that MO contributes to the performance of value chains. More broadly, we expect a positive relationship between MO and performance for all the market channel functions performed in seed value chains. However, the relationship is not equal for all market channel functions performed in seed value chains. The closer the function to the end customer we expect the greater the relationship between MO and performance.

The study, thus, has one central objective: (1) to examine the empirical relationships between market orientation and proficiency of supply chain functions. The specific question is how the relationship between MO and performance is moderated by functions, perspectives, and crop types. We argue that the different configuration of actors performing market channel functions in the different seed value chains (maize, teff, and beans), along with the heterogeneity and degree of commercialization of these seeds, and the evaluations of MO and proficiency from the standpoint of four perspectives can potentially influence the relationship between MO and performance.

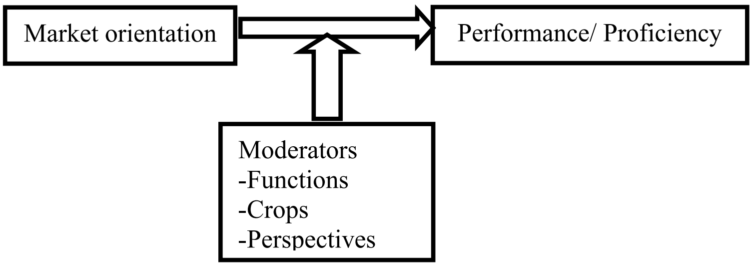

Figure 6.1: Conceptual model about the influence of MO on proficiency for seed supply value chain functions

6.3 Methodology

Sample

Data were collected between March and December 2016 from a total of 284 respondents in three regions of Ethiopia: Amhara, Oromia, and Southern Region. Respondents worked for organizations participating in Ethiopian seed value chains for (at least) one of three crops: maize, teff and beans. End customers of these crops were also surveyed.

170 farmers, as end customers, and 114 chain actors were selected based on the roles and marketing functions (market channel functions) they perform in the different seed value chains. They evaluated the MO and proficiency of supply chain functions. All respondents were informed about the confidentiality of their responses and the academic purpose of the study.

Respondent chain actors provided the market channel functions performed by their organization. Participants then gave an assessment of the proficiency and MO of market channel functions performed by their organization in each seed value chain of three crops. Depending on crop type and agro ecology, degree of specialization and size, one organization can participate in one or several seed value chains of the same crop. For example, Multinational Companies (MNCs) perform most of the seed related functions by themselves, as compared to some small and medium sized domestic private companies and farmer cooperatives that perform a single or few marketing functions. Respondents/chain actors were asked to assess the MO and proficiency of (a) the functions performed by their own organization, (b) functions performed by upstream actors (i.e., suppliers) and (c) downstream actors (i.e., customers). End customers evaluated the MO and proficiency of all functions performed in crop value chains from which they bought seed.

Measures

MO and Proficiency were measured at the level of the different functions involved in that value chain. The MO and proficiency measures were presented in Chapters 5 and 4, respectively.

The validity of the MO measures is presented in the previous Chapter. In testing the validity of the proficiency measures, we have used various data analysis techniques, which is presented/summarized in an appendix section (see Appendix 6.1). We use factor scores of MO and proficiency for further analyses and report unstandardized coefficients in our results.

The results of MO or factor scores of MO were analyzed and presented in the previous Chapter. Regarding proficiency, we calculate the mean proficiency of each functions. The paper then aims to understand how market orientation increases proficiency of supply chains. These are basically MO-performance evaluations by the same person, about the same function, for the same crop.

The effect of the MO on the proficiency of functions was examined using general linear models and multiple regression analyses. We compare the effect of MO on proficiency for every function with the effect of market orientation on the proficiency of the seed storage and processing function (our reference base).

In our present data set we have four perspectives and five different functions for three different crops. In doing so, we compare the relation between MO and proficiency against the perspective of farmers. So, the estimated influence of MO on proficiency is the average effect across all the functions for a specific crop.

In chapter 4, we had 7 functions, extracted from the CFA results from the perspective of farmers. R&D, multiplication, storage and processing, quality control and certification, and distribution which were all unidimensional. However, the proficiency measure for the marketing function was not unidimensional and we extracted 2 factors from this function: 1) related to pricing, and the other 2) related to product information-service. Hence, we had a total of 7 functions together with the other five functions. We used the 7 market channel functions for the analysis in chapter 4.

In this chapter (Chapter 6), we have performed EFA using PCA on the items measuring the proficiency of market channel functions across all observations (chain actors and farmers). For four functions (R&D, multiplication, storage and processing, and quality control and certification), the EFA and CFA results confirm that proficiency is a unidimensional construct consisting of three items. However, both the EFA and CFA results confirm that proficiency of both the distribution and the marketing functions are two-dimensional constructs. The extracted factors were time and place (distribution), and price, and product information-service (marketing).

Though, the factor analysis shows the multidimensionality of the distribution and marketing function, the researchers are more interested in looking the overall scores of distribution and marketing functions than investigating the unique contributions of each dimension (time, place, price, and service). We drop the use of the multidimensional measure or separate constructs in favor of a single average score for the distribution and marketing functions for three reasons. First, in the context of our study (smallholder farmers and chain actors), the distribution and marketing functions are often considered as one function. In our view, aggregating the scores of the multidimensional measure (time, place, price, and service) will not have practical implications if the dimensions are represented by the distribution and marketing functions score in the context of the study. Similarly, existing studies in our line of research (Maredia et al., 1999; Alemu, 2010; Alemu et al., 2010; Louwaars & de Boef, 2012) often consider the distribution and marketing functions as one function. Our research, however, recognizes the multidimensionality of these functions, and indeed considers the average scores of each four dimension to develop a single average score for the distribution and marketing functions. Second, when we closely examine the descriptive statistic of each four dimension (mean, variance, and correlation with other variables) we found that there are no large differences, even the correlations of the dimensions follow the same pattern. In the regression model as well, the dimensions have a very close beta coefficient. Third, our approach helps in the reduction of the number of factors in the present study, as well as for ease interpretation and presentation of the findings. Using five than eight market channel functions for further analysis is feasible and manageable in the current data set. Given the context of our study, the same respondents, crops, and country, we prefer to use a single score for the distribution and marketing functions.

We did that by aggregating and taking the mean scores of the proficiency of the four components of the Distribution and Marketing functions (time, place, price, and service) and grouped them as Distribution and Marketing functions score. That is, we calculate the mean across these four dimensions: (mean proficiency of time + mean proficiency of place + mean proficiency of price + mean proficiency of service)/4. It is computed from all respondents (organization performing a given function, suppliers, customers, and farmers) that evaluated a function performed by an organization in a seed value chain.

The model ran and yielded a best model fit while running across 5 functions: 1) R&D, 2) Multiplication, 3) Storage and Processing, 4) Quality control and Certification, and 5) the Distribution and Marketing function. Then we presented the MO and proficiency relationship based on these five functions.

Chapter 6 builds on data from chapter 5 as supply chain actors evaluate both MO and proficiency of (a) the functions performed by their own organization, (b) functions performed by upstream actors (i.e., suppliers), and c) functions performed by downstream actors (i.e., customers). End customers/farmers evaluated the MO and proficiency of all functions performed in crop value chains from which they bought seed. Thus the 284 respondents together provided 7447 pairs of evaluations for market orientation and proficiency. Average scores were calculated across respondents evaluating the same function (e.g., multiplication), from the same perspective (e.g., a customer), and for the same crop (e.g., maize). This resulted in a dataset of 388 unique pairs of scores for MO and proficiency, including 3 variables that indicate for each pair: 1) which function is evaluated, 2) from which perspective, and 3) for what crop. For the regression models these nominal variables are transformed into dummy variables (one for each value).

6.4 Results

The results will be organized around the two research questions: (1) How does the market orientation of the organization performing a supply chain function influence the proficiency of that supply chain function? (2) How is the relationship between MO of the organization performing a supply chain function and proficiency of that supply chain function influenced by moderators (functions, crops, and perspectives)?

6.5.1: Does market orientation increases proficiency?

This section shows the effects of MO on the proficiency of functions, by considering market channel functions as the unit of analysis. It also addresses the differences in the effect of MO on proficiency between functions. It does so across three crops, maize, teff and bean value chains.

a) How does market orientation contribute to proficiency?

The effect of the MO on the proficiency of functions was examined using general linear models and multiple regression analyses (Table 6.3). In the regression analyses we use dummy variables, so to avoid perfect multicollinearity one dummy variable needs to be excluded. We chose the storage and processing function. Consequently, coefficients for the dummy variables in our regression analysis represent the difference between the dummy variable and the storage and processing function. This also applies to interaction variables calculated with these dummy variables.

The overall model fit was good (R^2 = 0.42, F (11, 376) =24.64, p < 0.001). Results confirm that MO has a positive influence on the proficiency of R&D, Multiplication, Quality Control and Certification, and Distribution and Marketing function, but not for the Storage and Processing function. This function or our baseline dummy variable has the lowest influence.

The effect is higher for all the other functions than for the storage and processing function. Table 6.3 also shows the interaction effects of MO and the dummy variables for the functions across value chains of maize, teff, and beans. The overall regression was statistically significant for each crop. The effect of MO on the proficiency of R&D in the bean supply chains is highest (0.01+1.36=1.37), followed by its effect for maize (0.99-0.09=0.90) and teff (0.67+0.09=0.76) supply chains. The effects of MO on the proficiency of multiplication, quality control and certification, and distribution and marketing functions are positive and strong having highest coefficients for maize supply chains followed by beans and teff supply chains. The effect of MO on proficiency for maize supply chains and for the multiplication function is 0.99+ 0.12 = 1.11. Its effect for beans and teff supply chains is 0.81 and 0.73, respectively. The effect of MO on proficiency for maize supply chains and for the quality control and certification function is 0.99+0.11 = 1.10. Its effect for beans and teff supply chains is 0.76 and 0.49, respectively. The effect of MO on proficiency for maize supply chains and for the distribution and marketing function is 0.99-0.25 = 0.74. Its effect for beans and teff supply chains is 0.58 and 0.53, respectively. The result shows that for maize supply chains MO has a positive influence on the proficiency of most functions (multiplication, quality control and certification, and distribution and marketing), as compared to beans and teff. However, the influence of MO on proficiency for beans is higher as compared with teff supply chains. Specifically, the result shows that for beans supply chains MO has a more positive influence on the proficiency of R&D, quality control and certification, and multiplication functions, as compared to teff.

Table 6.3: Influence of MO on the proficiency of market channel functions in supply chains of maize, teff, and beans

Dependent variable:	Proficiency of functions			
In the marketing channels of	Overall	Maize	Teff	Beans
(Constant)	0.04	0.03	-0.08	0.03
MO	0.01	0.99***	0.67***	0.01
R&D Function	-0.07	0.05	-0.25	0.05
Multiplication Function	0.00	0.01	-0.02	0.05
Quality Control and Certification Function	0.12	0.04	0.18	0.15**
Distribution and Marketing Function	-0.01	-0.06	0.05	0.00
MO x R&D Function	1.03***	-0.09	0.09	1.36***
MO x Multiplication Function	0.88***	0.12	0.06	0.80***
MO x Quality Control and Certification Function	0.79***	0.11	-0.18	0.75***
MO x Distribution and Marketing Function	0.61***	-0.25	-0.14	0.57***
Teff01	-0.12*	-	-	-
Bean01	0.01	-	-	-
R^2	0.42	0.67	0.35	0.43
F	24.64***	27.76***	7.48***	9.47***
N	**388**	**132**	**133**	**123**

*Significance level: ***: p<0.01, **: p<0.05, *: p<0.10.*

b) How the influence of market orientation on proficiency is influenced by perspectives?

Table 6.4 shows the influence of perspectives on the relationship between MO and proficiency of functions. Again, we use dummy variables. The dummy for the farmer customer's perspective was excluded and consequently coefficients for the dummy variables and interaction variables calculated with these dummy variables in our regression analysis represent the difference with the farmer customer perspective. This test enables us to know whether it matters who is assessing MO and proficiency for the relationship between MO and proficiency.

Market orientation enhances proficiency from the perspective of chain actors, as compared against the farmers perspective (with the interaction terms). However, the effect of MO on proficiency does not exist when considering the farmers' perspective. The effects of MO on proficiency are stronger for three perspectives (own, customers, and suppliers) than the farmers' perspective.

The effects of MO on proficiency based on own evaluations are higher for all crop supply chains; beans (effect is 0.01+1.17=1.18), maize (1.11) and teff (1.04). However, the difference is not large. For example, the effect of MO on proficiency for teff supply chains and for the own evaluations is 0.22+ 0.82 = 1.04, while for beans it is 1.11 and for maize- 1.18. The effects based on customers' evaluations is smaller for teff (0.50), but significant, and bigger for beans (0.91) and maize (0.87) supply chains. The effect based on suppliers' perspectives is bigger for maize (effect is 1.18) followed by teff (0.86) and beans (0.85) supply chains.

In general, when examining the main and interaction effects, we found a strong relationship between MO and proficiency when we leave out farmers' evaluations. We also found that functions, crops, and perspectives matter to the relationship between MO and proficiency.

Table 6.4: Influence of perspectives on the MO and proficiency of market channel functions in supply chains of maize, teff, and beans

Dependent variable:	Proficiency of functions			
In the marketing channels of	Overall	Maize	Teff	Beans
(Constant)				
MO	0.01	0.05	0.22	0.01
MO x Own Perspective	1.07***	1.06***	0.82***	1.17***
MO x Customers Perspective	0.70***	0.82***	0.28	0.90***
MO x Suppliers Perspective	0.85***	1.13***	0.64**	0.84***
R&D Function	-0.08	0.04	-0.30	0.00
Multiplication Function	0.03	0.04	0.00	0.05
Quality Control and Certification Function	0.12*	0.06	0.18	0.12
Distribution and Marketing Function	0.03	-0.03	0.06	0.05
Teff	-0.07	-	-	-
Bean	0.06	-	-	-
R^2	0.59	0.73	0.44	0.63
F	38.95***	26.42***	8.01***	15.38***
N	**388**	**132**	**133**	**123**

*Significance level: ***: p<0.01, **: p<0.05, *: p<0.10.*

6.5 Conclusions

The present study contributes to the literature on market orientation of supply chains. It provides the first insight into the influence of market orientation of market channel functions on proficiency of those market channel functions in supply chains. The study confirms that market orientation has a positive influence on the proficiency of seed supply value chain functions in D&E markets. Proficiency is positively influenced by market orientation from the perspective of chain actors, but not from the perspective of end farmer customers. We can now answer the two research questions.

Our result shows that MO has a positive influence on the proficiency of market channel functions.

We have also shown how the relationship between market orientation and proficiency is influenced by functions, crops, and perspectives. The relationship between MO and proficiency is strong for R&D, Multiplication, Quality Control and Certification, and the Distribution and Marketing functions. But the effect of MO on the proficiency for the Storage and Processing function was not significant.

The effect of MO on proficiency is higher for the four market channel functions compared with the seed Storage and Processing function. The effect is higher for the R&D followed by Multiplication, Quality Control and Certification, and Distribution and Marketing Functions. The closer the function to the end customer we expect the stronger the relationship between MO and proficiency. However, our findings show that the influence of MO on proficiency is higher for the R&D function, even though R&D is furthest away from end customers. In particular, the higher MO and proficiency relationship for maize and R&D and for beans and R&D is attributed to the higher MO and proficiency of organizations performing this function (as in the case of MNCs for maize and the national research organization for beans), as compared to those organizations that perform poorly on MO and proficiency of the R&D function (as in the case of the national and regional research organizations for maize, and the regional research organizations for beans). The MNCs and the national research organizations are more market oriented in performing the R&D function for maize and beans, respectively. They are better in generating information from direct and end customers', and further disseminate and respond to the specific needs of these customers. The MNCs MO and proficiency is also higher for the maize seed multiplication, and quality control and certification functions, implying the need of adopting a market-oriented behavior at each stage of a seed value chain.

Market orientation increases performance more in the supply chain for maize than in the supply chain for beans and teff. Similarly, its influence in the supply chain for beans is higher than in the supply chain for teff. It shows that crop type matters for the relationship between MO and proficiency. The influence of MO on proficiency of R&D function is higher for beans and maize than for teff supply chains. Similarly, its influence on proficiency of multiplication, quality control and certification, and the distribution and marketing functions is higher for maize than beans and teff. It confirms that for maize supply chains MO has a more positive influence on the proficiency of most functions, than for bean and teff supply chains. Similarly, its influence for beans is higher than teff.

Finally, we have also shown how the relationship between market orientation and proficiency is influenced by perspectives. Market orientation enhances proficiency from the perspective of chain actors, but not from the perspective of farmer customers. This indicates that MO and/or proficiency of supply chains is not visible for farmers. Farmers are less aware of the internal activities of their suppliers (i.e., in terms of MO implementation and proficiency). The effect of MO on proficiency is also stronger for own evaluation of own roles/functions, than evaluation by suppliers, customers, and farmer customers. The interesting finding is also the weaker relationship between MO and proficiency when customers evaluate MO and proficiency than for example when suppliers evaluate MO and proficiency of a focal market channel function.

Market orientation increases performance of supply chains. MO provides a unifying focus and clear vision to an organization's or supply chain's strategy, which is centered around creating superior value for customers. All actors performing functions in a value chain should create value for and deliver value to other supply chain actors. In effective supply chains, supply chain actors at least maintain, but preferably add to, value created by other supply chain actors (Kozlenkova et al., 2015). A MO is required to assure that each function creates value demanded by other supply chain actors or the final customers.

6.6 Discussion

This section includes a critical reflection of the findings, and theoretical and managerial implications for developing market-oriented seed supply systems.

6.6.1 Practical relevance

Improving the MO and performance of seed systems is one of the Ethiopian government's ambitions to ensure food security, for agricultural production and productivity and for economic growth of the nation. With growing evidence of the importance of market-oriented behaviors to increase business performance of firms and/or public and private sector organizations, enhanced customer satisfaction and agricultural productivity, and ensure that those increases are translated into improved welfare of end customers, there is renewed commitment to adopting market-oriented behaviors or cultures in a wide range of development organizations. Our results confirm that this renewed commitment to MO can increase the performance of seed systems. However, the results of our study also show that much improvement is needed in the proficiency of market channel functions and the implementation of marketing activities to create and deliver superior value at each stage of the seed value chain. Much improvement is needed to incorporate the voice of the customer more central in the development and provision of seed.

The findings of the present study have several managerial implications. The study provides important lessons for supply chain actors, development partners and policy makers. First, the findings confirm the importance of market orientation for the seed supply chains to be successful. Seed supply chain actors and managers need to develop a deep understanding of how to achieve superior performance via market orientation. Second, seed supply chains can improve their performance and increase customer satisfaction by implementing a market orientation, emphasizing intelligence generation, dissemination, and responsiveness to the intelligence. Thus, supply chain actors, managers and other supporting organizations need to focus on these key market orientation dimensions. The right combination of these dimensions could help the supply chains to be truly successful in the seed market, thereby contributing to higher customer satisfaction, agricultural productivity, and superior performance.

Market orientation increases proficiency of supply chain functions. Hence, supply chains should focus on increasing the MO of all organizations participating in the Ethiopian seed value chains. Thus, to satisfy customers' needs and to increase business performance of firms and/or public and private sector organizations, supply chains and/or actors need to understand their roles (i.e., the market channel functions performed) in the seed systems, sense the needs for the market channel functions they perform, and respond accordingly. Generation and dissemination of market intelligence have no value if the actors in a value chain are not able to respond to market intelligence about the market needs.

Market orientation and proficiency of marketing channel functions

The study measures the level of MO and proficiency within the seed supply chains for maize, teff, and beans. In doing so, the study can help supply chain organizations to monitor how their market-orientation and performance changes. Thus, it can be used as an analytic tool for supply chain organizations to identify their strengths and weaknesses and take appropriate actions when needed. The study can also help supply chains to benchmark their level of MO and proficiency of functions. It helps organizations to benchmark their MO. They should also realize that external benchmarks are more critical than internal benchmarks and that the voice of farmer customers need to be central in the development and provisions of seeds. This is central to market orientation theory.

Our findings support the positive influence of MO on performance/proficiency in a multi-actor value chain setting of D&E markets and in seed supply systems. The effect of MO on supply chain functions proficiency holds for multi-actor seed value chains of D&E markets, as much as like most of the MO studies that are conducted in high income markets.

Market orientation increases performance more in the supply chain for maize than in the supply chain for beans and teff. This can result from the higher focus of supply chain actors, policy makers, and private companies on the more productive and commercial crop (hybrid maize) as opposed to self-pollinated crops such as teff and beans. For example, the MNCs and domestic private companies in Ethiopia are mainly concentrated on hybrid maize business, as compared to teff and beans, which have limited commercial interest. The higher MO and proficiency for maize is also attributed to those actors, namely the MNCs, performing each function in an integrated way, from primary production to distribution and marketing related issues. Hence, such organizations, together with their focus on small market segments, can better track customers' need, and customer satisfaction as compared to those organizations performing similar functions for teff and beans (e.g., public companies) and for large segments of customers. Similarly, MO influence on proficiency in the supply chain for beans is higher than in the supply chain for teff. The higher MO and proficiency for beans is also attributed to those actors performing each function, namely the national research organization for R&D, and the SPCs (seed producing cooperatives), seed unions, and domestic private companies performing the multiplication, quality control and certification, and distribution and marketing. Namely, the local orientation of actors for beans stimulates actors to identify and satisfy customers' needs as compared to those organizations distant from many farmer customers. Hence supply chains can better generate information from end customers', and further disseminate and respond to the specific needs of end customers.

The effect of market orientation on proficiency is stronger from the perspective of chain actors but does not exist from the perspective of farmers. It suggests that suppliers or organizations participating in the Ethiopian seed value chain relatively better know each other, as compared to farmers who reside on rural and often distant places from most of their suppliers. Hence farmers do not have sufficient understanding and awareness on the internal activities (i.e., MO and/ or proficiency) of their seed suppliers. The relationship between MO and proficiency is stronger from the perspective of own evaluation, as compared to organizational suppliers and customers, and end customers/farmers evaluation.

6.7 Implications for literature

The present study contributes to the market orientation literature in several ways. First it provides evidence on the applicability of market orientation theory in a supply systems context. The finding contributes to the deeper and broader understanding of the market orientation and performance/proficiency relationship in a D&E markets context and in seed supply chains. The effect of market orientation on supply chains proficiency holds for seed supply systems of D&E markets, as much as like most of the MO studies that are conducted at an individual firm level in high income markets.

Another contribution is the use of subjective performance measures that are applicable in the context of seed systems. This study used three proficiency measures from the NPD literature, but by adapting at each market channel functions performed in seed systems. It is also advisable to use common subjective measures of performance when objective data are difficult to obtain or insufficiently reliable for firms and/or public and private sector organizations operating at value chain level.

The present study provides a first and unique insight on the future of scientific research in MO and value creation in seed systems. It does so by showing that market-oriented behavior of firms and/or public and private sector organizations /suppliers at each stages of a supply chain can positively contribute to better performance/proficiency of supply chains. We have also shown additional issues of importance while applying the MO and proficiency concept to a multi-actor value chain by examining measurement invariance tests across functions, proficiency measures, perspectives, and groups. This test determines whether the measures had the same meaning and structure for different respondent groups and functions, proficiency measures, and perspectives. Our data provides evidence of robustness for measuring proficiency of supply chain functions in seed supply chains.

6.8 Limitation and future research

This study’s results and contributions, however, must be evaluated considering its limitations. First, our unit of analysis and quantitative data come from one country (3 regional states), so the findings may be context and country specific. Therefore, replication of the study in other contexts would be necessary to strengthen the contribution and wide applicability of our findings. Second, future research may include objective measures to complement subjective measures. Third, the study used quantitative research on a cross sectional study design; hence the MO and performance relationship might differ over time because of a growing competition and globalization. The increasing demand for networking and coordination between chain members will facilitate market information exchange, thus better performance of firms and/or public and private sector organizations. Thus, we suggest future research, particularly combined methods of qualitative and quantitative studies. Such approach may track perceptions of MO and performance over time. We also suggest future studies investigating the role of channel leaders in SCM as a basis for improvements in the effectiveness and efficiency of supply chain activities.

Market orientation increases performance. However, some authors have argued that MO focuses too much on current customers and current customers' needs, which sometimes is detrimental to long term success and even survival. A "slavish" devotion to existing customers often stifles disruptive innovations and can lead companies to miss emerging opportunities in the market (Christensen, 1997). One-way to move from reactive (market driven or customer-led) to proactive (market driving or market oriented) is to consider customer's customers. Understanding the final consumer's needs allows firms to anticipate changes in the demand of customers. These more pro-active elements are more strongly related to performance than reactive elements in highly competitive markets of developed economies (Narver, Slater, & MacLachlan, 2004; Zhang & Duan, 2010). It is not clear, however, whether a more pro-active MO also is beneficial for developing and emerging (D&E) countries. Moreover, it is not clear whether firms operating in value chains should only consider their direct customers in their customer orientation or also consider the final consumer. Thus, the present study suggests future research, investigating reactive and proactive forms of market orientation and performance in a multi-actor value chain setting or at a supply chain level.

CHAPTER 7

General Discussion

7.1 Introduction

This final chapter of the thesis first presents the key findings of each study of the thesis. Next, it describes the main conclusions, followed by its implications for theory, seed supply systems, policymakers, stakeholders, and development partners. Finally, the chapter presents the research limitations and directions for future research.

7.2 Overview of the key findings

The main motivation of the studies presented in this thesis was to explore the Market Orientation (MO) of Ethiopian seed supply systems and how MO increases the proficiency of supply chain functions, so as to design an optimal seed system that fosters sustainable seed business in Ethiopia. To achieve this aim, the thesis answered four research questions as described in Chapter One: (1) How do end customers evaluate the performance of the Ethiopian seed supply systems? (2) What is the influence of market channel functions on customer satisfaction? (3) What is the degree of MO of the Ethiopian seed supply systems? and (4) How does MO influence the proficiency of supply chains? These four research questions were addressed via four empirical studies presented in four subsequent chapters of this thesis (chapter 3 to chapter 6). The key findings of each chapter are described below.

Chapter 3 shows how end customers evaluate the performance of the Ethiopian seed supply systems. Using key informant interviews with 30 end customers, it explores customer evaluations of the performance of Ethiopian maize and teff seed supply chains. The chapter revealed that, end customers evaluate seed supply chains on (1) making available to, and (2) affordable for farmers, (3) the right variety of seed, at (4) the right quality level, and in (5) sufficient quantity. In addition (6) production (un-) certainty, (7) supporting cultural heritage and (8) supporting services to farmers are key performance indicators. These key themes of customer satisfaction criteria by and large cover important elements of the market orientation concept in general marketing theory, which can be related to the factors that drive customer satisfaction of market offerings in agricultural food value chains.

The findings of this chapter provide important building blocks for increasing MO in seed supply systems. End customer satisfaction can be enhanced by providing “the right variety, at the right quality level, available at the right time and place and in sufficient quantities, and for affordable prices”. However, it also identifies the provision of supporting services and production (un-) certainty as key performance criteria relevant to end users. This is central to marketing positioning theory, namely that it is not just the qualities of the physical product that matter, but also the perceived “quality in use” by customer/farmers. After all, the true quality in use only manifests itself at the moment of harvest and it is difficult to verify a priori. Important intrinsic quality cues of seed at the point of purchase include physical characteristics such as size, color, grading, and freshness, free from diseases, insects, physical damage, trash, or foreign seed, well-treated, and dried seeds. These intrinsic cues signal quality benefits in use, such as genetic purity; high germination; resistance to diseases, pests, and damages; product maturity; local adaptation; food, and residue qualities; productivity; product differentiation; product quantity; product market demand; income and profit. However, many of these qualities remain uncertain until the moment of harvest and cannot be easily verified “at the moment” of purchase. From this research, it shows that provision of specific services can reduce some of that uncertainty/ambivalence, such as through quality control and certification processes.

The chapter confirms that customer perceptions of the strengths (likes) and weaknesses (dislikes) of alternative seed supply systems, underlies their level of satisfaction with supply systems, with behavioral consequences at the level of trust, loyalty, and word of mouth. The strengths and weaknesses of alternative supply systems come from the extent to which market channel functions are performed (more or less proficiently) across the different stages of seed value chain. The finding of this chapter suggests that improving the (marketing) performance of existing seed supply chains in Ethiopia along the key performance indicators identified in this research can indeed contribute to the customer satisfaction of market offerings. Hence the results of chapter 3 suggested that the criteria farmers use to evaluate seed supply chains are also applicable in the D&E market and in seed supply systems.

Chapter 4 aims to identify value chain constellations that have emerged in the Ethiopian seed supply chain in terms of “who” (i.e., which actor/organization), does “what” (i.e., in terms of marketing functions), “how well” (i.e., in terms of perceived proficiency), and to “what level of overall satisfaction” (i.e., at the part of the farmer / end-customer). It shows the influence of the proficiency of market channel functions on the customer satisfaction criteria identified in chapter 3. It presents the results of a quantitative study with 170 end customers (i.e., farmers) of seed supply chains for maize, teff, and beans in three regions of Ethiopia, Amhara, Oromia, and the Southern.

The chapter reveals the dominant value chain constellations in Ethiopian seed supply chains. It identified 43 unique supply chain configurations: 16 for maize, 18 for teff, and 9 for beans. The chapter analyzed why these configurations survived in terms of (a) overall perceived satisfaction with these constellations and (b) perceived proficiency of the market channel functions performed. Such approach captures the diversity of constellations across crops.

Six key market channel functions that contribute to customer satisfaction were identified: (a) the R&D function, (b) the seed multiplication function, (c) the seed quality control and certification function, (d) the seed distribution function, (e) the seed pricing function, and (f) the marketing service function. However, the relationship between the proficiency in seed storage and processing function and overall customer satisfaction was not significant across crops.

Although the market channel functions are similar across the maize, teff, and bean seed supply chains, the proficiency considerably differs between alternative supply chains and seed offers. This shows that each seed system has its own strengths and weaknesses.

Improving the market channel functions performed by channel partners may be one way of delivering superior customer value and satisfaction. Although implemented in the Ethiopian context, it is important to note that the proficiency of channel functions can be generalizable for any emerging market where an unstructured and unorganized supply chain is dominant. This chapter shows that irrespective of economic development (i.e., developed versus D&E markets), performing functions proficiently across the different stages of a value chain contributes to superior customer satisfaction. This implies that proficiency in supply chain functions is very important for the business performance of firms and/or public and private sector organizations and a strong basis for superior end customer satisfaction.

Chapter 5 assesses the degree of market orientation of Ethiopian seed supply systems. Building on insights from MO theory (Kohli & Jaworski, 1990; Kohli et al., 1993) and market channel functions in seed supply chains (chapters 3 and 4), MO is assessed by measuring whether the market channel functions in a supply chain are performed in a market-oriented way. MO components (information generation, information dissemination, and responsiveness) are adapted to the market channel function performed within seed supply systems. Data were collected from a total of 284 respondents-114 supply chain actors and 170 end farmer customers, from three major regions of Ethiopia and about three major crop value chains (maize, teff, and beans). The chapter explores the MO of supply chains from four perspectives: (1) the organization performing a function, (2) customers, (3) suppliers, and (4) the final customers/farmers.

This chapter reveals that in the Ethiopian seed supply chain context the degree of MO differs between functions, crops, and perspectives.

First, the chapter presents how the degree of MO differs between functions. The results show that the MO of the quality control and certification function, and the seed distribution and marketing function is higher than of the R&D and the storage and processing functions, when assessed from the perspective of chain actors and farmers. The MO of the seed multiplication function is also higher than of the R&D function from the perspective of chain actors and farmers. From the perspective of farmer customers, the MO of the distribution and marketing function is highest, higher than any of the other functions. Similarly, the MO of the seed multiplication function is higher than the storage and processing function when assessed from the perspective of farmers. The results show that the MO of the R&D, and storage and processing functions is lower when assessed from the perspective of chain actors and farmers.

The chapter also presents how the MO of functions differ between crop supply chains. From the perspective of chain actors, the overall MO does not significantly differ between crop supply chains. In contrast, the results show that the overall MO for teff supply chains is higher than of the maize and the beans supply chains when assessed from the perspective of farmers. The overall MO for bean supply chain is also higher than of the maize supply chain from the perspective of farmers.

The chapter also reveals how the overall MO significantly differs between perspectives. Chain actors evaluate their own MO higher than their suppliers and customers do, both overall and on each component of MO. Both suppliers and customers are more negative about the MO of a focal organization (i.e., the organization performing a function) compared to the focal organization's own evaluation. Customers are more negative about the MO of the focal organization than suppliers.

The results show that market-oriented activities were mostly concentrated in the lower parts of the chain, particularly on the seed distribution and marketing function. This is not surprising, given that the more we come down the chain, the more value is added for end customers' satisfaction, and the more parameters decision makers or actors at the link in the value chain have to take care of, resulting in a stronger need for end-user intelligence to support these decisions.

The results of chapter 5 suggest how the existing and validated MO scales (information generation, dissemination, and responsiveness) can be applicable in seed system contexts. The findings of chapter 5 imply the need of adopting market-oriented behaviors across each stages of the seed value chain.

Chapter 6 examines the influence of MO on the proficiency of Ethiopian seed supply systems, and how the relationship is moderated by functions, crops, and perspectives. It is based on the MO measurement scales developed in chapter 5. MO and proficiency are assessed by measuring whether the market channel functions in a supply chain are performed in a market-oriented and proficient way.

This chapter shows the effects of MO on the proficiency of functions, by considering market channel functions as the unit of analysis. In doing so, the chapter compares the effect of MO on proficiency for every function with the effect of MO on the proficiency of the seed storage and processing function (our reference base). In other words, it compares the effect of MO of the organization performing a supply chain function on proficiency of that supply chain function with the effect of MO of the organization performing a storage and processing function on the proficiency of the storage and processing function.

This chapter reveals that in the Ethiopian seed supply chain context MO contributes to higher proficiency of supply chain functions. However, the market orientation-performance/proficiency relationship differs between functions, crops, and perspectives.

MO has a positive and significant effect on proficiency for the R&D, multiplication, quality control and certification, and the distribution and marketing functions, but not for the seed storage and processing function.

The chapter also presents how the relationship between MO and proficiency of functions differs between crop supply chains. The effect of MO on proficiency of R&D function is higher for beans than for maize and teff supply chains. However, the effect of MO on proficiency of multiplication, quality control and certification, and distribution and marketing functions is higher for maize than for beans and teff supply chains. For maize MO has a more positive influence on the proficiency of (most) functions than for beans and teff. MO effects on proficiency is also higher for beans than for teff.

The chapter further reveals how the relationship between MO and proficiency is influenced by perspectives. Market orientation enhances proficiency from the perspective of chain actors. However, the effect of MO on proficiency does not exist when considering the farmers' perspective. The effects of MO on proficiency are stronger from the other three perspectives (own evaluation, customers evaluation, and supplier's evaluation). MO contributes to higher proficiency of functions when based on the focal organization's own evaluations. However, the influence of MO on proficiency is lower when customers and suppliers evaluate the MO and proficiency of a focal organization. It implies that chain actors are more critical of each other on the implementation of MO across the different stages of a seed value chain. An interesting insight this chapter revealed is that MO does not significantly contribute to higher proficiency when assessed from the perspective of end customers/farmers. This indicates that MO of supply chains is not well understood by farmers. In other words, farmers are less aware of the internal activities of their suppliers (i.e., in terms of MO implementation and proficiency).

The influence of perspectives on the MO and proficiency relationship also differs between crops. The effect of MO on proficiency of functions is higher for maize and beans than for teff. This holds for the perspectives of the focal organization's own evaluation and the customers' evaluation. But the effect of MO on proficiency of functions is higher for maize than for teff and beans when assessed from the suppliers' perspective. A focal organization, customers, and suppliers commonly agree on the higher effect of MO on proficiency for maize.

In general, the study found a strong relationship between MO and proficiency when farmers' evaluation is excluded. Crop type, functions, and perspectives influence the relationship between MO and proficiency. The relationship between MO and performance, which is well documented in the literature, also exists for Ethiopian seed supply systems. Moreover, the study confirms that MO has a positive influence also on the proficiency of seed supply value chain functions in D&E markets. The positive influence of MO on proficiency in D&E markets aligns with the core of the marketing concept i.e., creating and maintaining customer value. This indicates that MO of seed supply chains is very important for superior performance of firms and/or public and private sector organizations. Moreover, direct customers and final customers can benefit from the performance of the suppliers from which they obtain the right variety of the right quality and quantity of seeds, at the right time and place, and at the right price supported by improved product information and services. Thus, MO of seed supply chains is a basis for the livelihood of farmer customers. Through strong supplier-customer relationships, chain members can access the required market information for creating and delivering superior customer value, thereby improving the competitiveness of the whole value chain in serving end customers' needs and preferences. The chapter concludes that seed supply chains can improve their performance and increase customer satisfaction by implementing a market orientation, emphasizing intelligence generation, dissemination, and responsiveness to the intelligence.

7.3 Conclusions

The thesis comes to four conclusions.

First, in D&E markets and in supply chains, customer value creation is not a matter of basing supply chain performance from the standpoint of sellers/suppliers, but it is a matter of learning from the end-customer perspective to build the capabilities needed to deal with customer value creation and the delivery of superior end customer satisfaction. These capabilities are developed through understanding about responsive and proactive needs of customers and/or end customers satisfaction criteria of market offerings and then, integrating the resulting insights into the value creation process. For this to occur, the marketing functions (market channel functions) performed in supply chains need to be a starting and learning process, not only about satisfying customer needs but also about the performance of firms and/or public and private sector organizations operating in a value chain constellation. Supply systems can enhance customer satisfaction and customer value by improving functions within value chains.

Chapter 3 revealed that the customer satisfaction theory, which are developed in larger companies in the Western context, are also applicable in D&E markets and in seed supply systems. Chapter 3 indicated that the key themes of customer satisfaction criteria in the Ethiopian seed systems context cover important elements of the customer satisfaction concept in the marketing theory. However, the way how the customer satisfaction concept is understood does not fully overlap with the Western context. In particular, the marketing mix should be extended beyond and should be adapted to the context of complex chains because of climatic factors, and as well as for risk diversification and management. Among the eight key themes that farmer customers use to evaluate the Ethiopian seed supply systems, cultural heritage is considered one of the key themes that drives customer satisfaction of seed supply systems for teff crop. It implies that the concept of customer satisfaction criteria has many dimensions in the context of seed systems, in the eyes of end customers.

Second, proficiency of functions performed in supply systems is a key ingredient contributing to the customer satisfaction of market offerings received from suppliers. Proficiency is an important element to addressing end customer satisfaction drivers in the context of supply systems. In D&E markets, market channel functions make a positive contribution to customer satisfaction of seed supply chains. Chapter 4 revealed that supplier's proficiency on the executions of the seed multiplication, distribution, R&D, price, marketing service, and quality control and certification functions predominately contributes to the end customer overall satisfaction with seed offers/ supply chains. Performing these functions proficiently can better predict superior customer satisfaction, and subsequently superior performance of supply chains. In distinguishing dominant value chain constellations in Ethiopian seed supply chains, Chapter 4 also revealed 43 unique supply chain configurations: 16 for maize, 18 for teff, and 9 for beans. The results show that different value chain constellations matter for farmers' overall satisfaction. For example, some channels are less dominant, but scored higher on customer satisfaction as compared to the dominant channels. Therefore, seed supply chains and/or organizations that aim to create and deliver superior customer satisfaction should perform market channel functions proficiently, without surpassing customers perceived value, as some functions incur high cost. A chain is as strong as its weakest link. Hence value chain actors should know their strengths and work on their weaknesses.

Third, integrating insights from MO theories into the market channel functions performed in supply chains enables businesses to develop organizational behaviors and/or capabilities, emphasizing information generation, dissemination, and responsiveness. These capabilities are the starting point and need to be central at the value defining, developing, and delivering stages of the customer value creation process in supply systems. Market orientation is expected to improve the performance of seed supply systems by responding to customers' and/or customer's customers' demands, which include all value chain actors stretching from primary production to the end customers served by a particular seed supply value chain.

Understanding the final consumer's needs allows firms and/or public and private sector organizations to anticipate changes in the demand of customers. Chapter 5 revealed that in the Ethiopian seed supply chain context the degree of MO differs between functions, crops, and perspectives. Therefore, seed supply chains and/or organizations should become market-oriented in all market channel functions performed within the seed systems. This market-oriented behaviors will ensure the development and delivery of superior customer value at each elements of the value chain. This ultimately increases the performance of seed supply systems, and boost both agricultural production and productivity and livelihood of farm households.

Fourth, in D&E markets and supply chains, MO contributes more to the proficiency of supply chain functions. Chapter 6 revealed that in the Ethiopian seed supply chain context MO contributes to higher proficiency of supply chain functions. Hence, seed supply chains can improve their performance by implementing a market orientation across the different stages of seed value chains.

7.4 Implications

Implications for theory

This thesis has several theoretical implications for marketing and development literature.

The thesis contributes to marketing discipline, and agriculture and seed systems. It advances the knowledge on the customer satisfaction and customer value literature on six grounds. First, in examining the customer satisfaction with supply systems, it adds to the literature that examines customer satisfaction in the context of emerging markets and supply systems by providing the Ethiopian seed supply systems as a case. Second, in addressing the lack of standard measures of seed supply chain performance, it fills the existing literature gap by identifying the key customer satisfaction criteria for seed from the perspective of farmers. Moreover, the evaluations of producers/marketers' performance from the viewpoint of customers enables to assess organizational performance and customer satisfaction, hence adding knowledge to marketing science and/or methodological marketing literature to emerging markets and seed systems. Third, it adds knowledge on theory development and learning by providing guidance on how customers perceive and evaluate market offerings in seed systems. It adds knowledge on the existing marketing mix by showing that the marketing mix is extended beyond and should be adapted to the context of complex chains because of climatic factors, and as well as for risk diversification and management. Hence, the thesis contributes by extending the theory development, learning, and methodological marketing literature to emerging markets (Burgess & Nyajeka, 2007; Burgess & Steenkamp, 2006; Ingenbleek et al., 2013). Fourth, in investigating supply systems from the perspectives of customers, it adds knowledge on customer value creation (Bharti et al., 2014; Gummesson & Mele, 2010; Prahalad & Ramaswamy, 2004b). Fifth, the thesis identifies cultural heritage and production certainty as the criteria relevant to end users. It implies that farmer customers satisfaction criteria have many dimensions from the lens of customers than from the perspective of supply chains/companies. Six, another theoretical implication of the thesis for marketing literature emerged from the marketing channel perspective. Marketing literature revealed proficiency in execution of functions as a key success factor for new product development or performance. Despite an increased focus on the role of market channel functions in emerging markets, extant literature in the area has largely been absent. Hence, the thesis provides original insights into the contribution of market channel function proficiency on overall customer satisfaction of supply chains in an emerging market context. The thesis is the first of its kind by examining and quantifying the influence of various market channel functions on customer satisfaction in the Ethiopian seed market. Although implemented in the Ethiopian context, it is important to note that the proficiency of channel functions can be generalizable for any emerging market where an unstructured and unorganized supply chains are dominant.

This thesis has further extended research on the implementation of MO in supply systems in D&E markets by proving Ethiopian seed supply systems as a relevant case. Market orientation has mainly been studied in the context of large-scale businesses in the western context, and this may partly explain why there has been limited attention for MO across complex supply chains. Except for a few studies (e.g., Siguaw et al., 1998), the conceptualization and implications of MO to date have been mainly in the context of individual firms, in spite of the growing importance of supply chain management (SCM). Hence, the thesis fills the gap by contributing to research on MO in supply chains. MO in D&E markets context and in seed supply system can be related to the “prototypical” MO model (information generation, dissemination, and responsiveness) in the literature, although it needs adaptation to the context of D&E markets and in seeds systems by looking at roles, functions, and their distribution over actors.

Finally, it remarks the first thesis that tests the generalizability of the marketing theory by systematically investigating and reporting the market orientation–performance relationship in seed supply chains of D&E markets. This thesis develops and applies MO and performance measures for (seed) supply chains. MO contributes to performance from the perspective of chain actors. From the perspective of farmers, the effect was not confirmed. In general, the thesis found a strong relationship between MO and proficiency when excluding farmers perspective. It also shows how the relationship between MO and proficiency.is moderated by functions, crop type and perspectives.

The thesis is also the first of its kind that investigates the MO and proficiency of supply chains from the standpoint of four perspectives, (1) organizations preforming a function, (2) suppliers, (3) customers, and (4) end customers/farmers. In doing so, the findings support the positive influence of MO on performance/proficiency in a multi-actor value chain setting of D&E markets and in seed supply systems. However, the relationship is not equally stronger while considering different perspectives. Drawing on marketing theory (i.e., market orientation), agricultural seed supply systems should identify their target customers and meet the needs of those customers until the end customer served by a particular value chain. Therefore, this thesis has further explored and combined the concept of proficiency (i.e., new product development) with the marketing concept (i.e., market orientation). The thesis has also shown additional issues of importance while applying the MO and proficiency concept to a multi-actor value chains by examining measurement invariance tests across functions, proficiency measures, perspectives, and groups. This test determines whether the measures had the same meaning and structure for different respondent groups and functions, proficiency measures, and perspectives. Our data provides evidence of robustness for measuring MO and proficiency of supply chain functions in seed supply chains.

Implications for seed supply systems

This thesis has implication for seed supply chains in Ethiopia.

The thesis confirms criteria to assess customers' satisfaction with supply chains from the perspective of farmers as end users. It implies that improving the marketing performance of existing supply chains in Ethiopia on the key criteria identified in this thesis can indeed contribute to the customer satisfaction, and ultimately food security and agricultural growth of the nation. Supply systems can enhance customer satisfaction and customer value by improving functions within value chains. Because proficiency of market channel functions increases customer satisfaction, which will eventually lead to an increase in the number of customers, as well as increases in sales, profitability and return on investment. The findings of the thesis suggest that managers and/or value chain actors should think of the marketing (market channel) function as more than satisfying customers only.

The evidence from the thesis implies that enhancing MO of value chain actors deserves attention in the policies, programs and projects that aim to foster the sustainable growth of agricultural seed value chains. Because MO is a basis for proficiency of value chain functions. Hence, seed supply chains need to manage the various functions that significantly influence the proficiency or the success of the business. They need to focus on those functions having performed less market-oriented than the others. The findings of the thesis suggest that seed supply systems need to be more market oriented at each elements of the value chain. They need to focus on activities related to customer orientation, competitor orientation, and inter-functional coordination at each element of the market channel functions performed within seed supply systems. This implementation of marketing activities is a basis to improve their performance, i.e., in terms of the marketing (market channel) function they perform, as well as for higher customer satisfaction of the market offerings- all the way from primary production/R&D to distribution and marker related activities. Thus, seed supply chains need to be first customer-oriented at each functions of the value chain, and/or identify first customers' needs and then supply to the market based on those customers' needs. To this end, managers of different functional departments need to orchestrate such initiatives on top of policies endorsed by government.

Our thesis can still make suggestions about the informal seed systems when it is not included in our present market orientation studies. Though, we did not investigate the market orientation of the informal or farmers seed system in chapter 5 and 6, we suggest that market orientation can also be applicable to improve the performance of this seed system. Farmers through their long-lasting relationships and farming experiences, they have a long tradition of sharing and exchanging information about varieties, about customers or consumers specific demand in the local market. Moreover, farmers usually produce locally preferred varieties both for household consumption and for the market. Such practices coupled with the indigenous knowledge of farmers could suggest the market-oriented behaviors of farmers, although not for all crops and farmers groups to the same extent.

We also contributed on the different discussions about seed systems development. For example, we can argue that it is possible to improve market orientation in cash constrained smallholder farmers and government institutions. Ethiopian farmers are classified as small, medium, and large sized, and hence their capacity to afford quality seeds and their purchasing behavior might differ. Hence, it is worthy for seed supply chains to be more market oriented to address the technological needs of their customers, even cash constrained farmers. If farmers are cash constrained and can't buy improved seeds, market-oriented behaviors of suppliers can serve them by addressing their problems and helping them to get access to finance, credit, and loans via a joint effort of different actors, policy makers, development partners, micro finance institutions and credit banks.

Significant challenges remain in achieving widespread adoption of improved varieties by smallholders' farmers in low- and middle-income countries. Many farmers still do not invest in high-quality seed (e.g., certified, Quality Declared Seed or otherwise guaranteed), even where such investments are seemingly available, affordable, and profitable (Hoogendoorn et al., 2018). We encourage seed supply chains to identify and increase the farmers demand for quality seed. Researchers also suggest that research methods for studying farmers' seed demand are not yielding information that reflects the real-life decisions and behaviors of farmers in the choice and acquisition of their seeds (e.g., Almekinders et al., 2019). Though discussions in seed system consider farmers as not potential customers for formal seed sector channels, our findings show that the farmers are main customers of the formal systems especially for hybrid maize, as compared with teff and beans.

It is also possible to improve market orientation in government institutions. The primary goal of government or public sector organizations is agricultural productivity instead of profit. We argue that MO is about achieving organizational goals. If the goal is to improve food security and agricultural productivity, MO is still very relevant for public sector organizations, even if the farmer customers are cash constrained. Previous research in marketing also showed the positive contribution of market orientation to performance in public sector organizations (e.g., Caruana, Ramaseshan, & Ewing, 1999; Rodrigues, 2010; Wagner & dos Santos, 2015). Others also showed the applicability of MO theory in public service (Molander, Fellesson, & Friman, 2018).

Implications for policymakers and organizations and partners

This thesis has also implications for policy makers, and various development organizations and partners (GOs and NGOs) that are supporting seed supply systems to become more successful in meeting the broader goals of improving agricultural productivity and food security of the nation. The goal of development organizations and policy makers is to increase food security and livelihood by increasing agricultural productivity. In doing so, the thesis shows ways on how this goal can be achieved: improving proficiency of market channel functions and increasing the market orientation of supply chain actors are the key success factors.

Policy makers and relevant key development partners that support organizations participating in the Ethiopian seed system need to help firms and/or public and private sector organizations operating in seed supply chains to incorporate the key marketing activities while executing their functions. Moreover, the thesis may help development partners and policy makers to incorporate key activities in their project implementation strategies and in the policy framework development.

Government and non-government organizations and development partners could also play an important role in strengthening the capacity of seed supply chains/organizations to perform market channel functions to improve their performance and to achieving higher agricultural economic development. Seed supply chains (e.g., the different public and private sector actors, and farmers' cooperative groups) need to be supported through various mechanisms, such as capacity building (e.g., trainings, coaching, advisory), infrastructure development (e.g., standard storage and processing facilities, land, mechanization services and irrigation schemes), access to finance, and the facilitation of market linkages in a business- to- business (B2B) approach. Investment in breeding, seed production, distribution networks, and agro dealership schemes; providing access to plant genetic resources, protecting plant breeders' rights; and ensuring seed quality control and certification need to be facilitated by policy and legal frameworks. We do suggest strengthening the dominant informal or farmers seed systems in key areas such as in quality control and certification, etc. Previous research also supported such notions (e.g., Almekinders et al., 2019; McEwan et al., 2021). Because such challenges and/or various internal and external factors can potentially affect the MO and performance of supply chains. Addressing these challenges help seed supply systems to implement specific marketing activities and customer satisfaction criteria identified in this thesis. Moreover, the high dominance of the public seed sector in the formal system provides little room for the private sector to flourish in the Ethiopian seed market. The role of the private seed sector (especially domestic ones) in Ethiopia has been limited in the past and private seed companies have been affected by limited technical capacity, lack of land and capital, inadequate access to breeder seed of publicly-bred varieties, inadequate access to pre-basic and basic seeds, less competitive seed pricing, and lack of clarity on freely marketing their materials (Alemu, 2010, 2012; Atilaw & Korbu, 2011; Thijssen et al., 2008). They also have limitations in accessing new varieties for adding and diversifying their varietal portfolio (Spielman, Byerlee, Alemu, & Kelemework, 2010).

Developing a more market oriented and competitive seed sector that satisfies the felt needs of farmers as well as for superior performance for firms and/or public and private sector organizations is needed. However, the thesis shows that each seed system has its own strengths and weaknesses. Consequently, there are opportunities for the different seed supply chains of Ethiopia to meet the heterogonous needs of farmers. The formal seed system is dominant for maize, while the informal seed system is so for teff, and the intermediate seed system/SPCs is for beans. Hence, the overall finding of the thesis leads to the conclusion that formal, informal, and intermediary seed systems are complementary. Thus, addressing the relationship between these seed systems and developing seed policies for guiding the simultaneous development of these systems is needed and prerequisite for the country’s overall agricultural development strategy. Thus, providing for the diversity of demand related to different crops, farming systems and farmers. Reality has proven more complex and that there is no blueprint seed policy implying that there is a need to understand seed systems to develop the corresponding seed policy options (Louwaars & de Boef, 2012; Louwaars et al., 2013).

To achieve access to affordable quality seed of superior varieties, a vibrant, integrated, and market-oriented seed sector is necessary to foster pluralism [actors, institutions, and functions] in matching food and seed security to economic development. Hence public sector can fulfil effectively its supportive function in the seed sector along with participating on important food security crops, and those crops that have limited commercial interest for private sector parties (Louwaars & de Boef, 2012). The Seed Sector Development Strategy in Ethiopia states that “the mission of the government parastatals (public seed enterprises) should be to fill gaps that private companies will be less likely to fill, namely self-pollinating varieties such as wheat and teff, and geographies that the private sector cannot reach" (MoA, 2018a). However, the public entities dominate the formal seed sector, and are highly involved in seed production and distribution for hybrid maize, with the scarce public resources. Despite some merit, the involvement of parastatals in the maize market can crowd out the market and thus stifle competition and private sector investment. Provisions of room for private companies to actively participate on the maize market- which have high commercial interest for the private entities, can stimulate and improve the performance of the whole seed systems.

Our research offers new insights on the application of market orientation, customer satisfaction and proficiency concepts in seed supply chains, compared to existing literature. Discussions on seed system development advocate a multistakeholder approach and an integrated, pluralistic, and vibrant seed system (e.g., Louwaars & de Boef, 2012; McEwan et al., 2021) as reflected by many practitioners, scientists and seed system specialists and policy makers. However, the role and function of different actors in the seed industry to achieve a vibrant seed system is not clear. Different approaches to seed system development exist, but how to make seed systems more effective and efficient is the ongoing concerns of different parties in the seed industry. Our present study contributes to the discussion by offering insights from market orientation theory and applying it to value chain functions in the different seed supply chains. Our results suggest that a market-oriented seed sector contributes to food security of farmers and to the marketing performance of the different actors that make up the seed systems. Other authors also call for such kinds of research dealing MO from a value chain perspective and at a supply chain level (e.g., Baker, Simpson, & Siguaw, 1999; Elg, 2000; Grunert et al., 2005; Grunert et al., 2002; Langerak, 2001; Siguaw et al., 1998; Simpson, Baker, & Siguaw, 1999).

Discussions on seed system development and research (e.g., Almekinders et al., 2019) also questioned the methodology to be used to effectively understand customers (effective) demand for seed. This calls for a more market-oriented seed sector that identifies and satisfies the needs of their target customers. Our thesis shows that being more market oriented in each function of the seed value chain improves the performance of seed systems. Market orientation theory suggests that this is caused by a better understanding of customer needs, wants and demand.

Recent research on seed systems (e.g., McEwan et al., 2021) also argues for deeper collaboration between seed systems researchers, breeders and national seed system stakeholders to address seed sector challenges and other knowledge gaps and generate the evidence and innovations needed to break through the 40% adoption ceiling for modern varieties and ensure good quality seed once the new varieties have been adopted. Our research sheds light on how this deep collaboration can be manifested to improve performance of seed systems and/or uptake of new varieties by farmers. That is by being more market oriented. Our study shows that a MO of a value chain is value chain members' generation of intelligence pertaining to current and future end-customer needs, dissemination of the intelligence across chain members, and chain wide responsiveness to the intelligence. Consequently, the competitiveness of the whole value chain in serving end-users will be related to how the various chain members (and/or seed systems researchers, breeders, and national seed system stakeholders, etc.) together perform the task of generating intelligence on end-user needs, wants, and use it to guide their value-creating and delivering activities.

7.5 Limitations and future research

The thesis results and contributions must be evaluated considering their limitations. First, data come from one country (3 regional states), so the findings may be context and country specific. Therefore, replication of the studies in other contexts would be necessary to strengthen the contribution and wide applicability of our findings. Although seed supply systems in D&E markets have several characteristics in common, they may considerably vary in the type of functions or activities in which they engage, their stage of development and the various internal and external factors they face, such as human resource management, infrastructure, financing and/or the various socio-economic, cultural, and political conditions. Therefore, the generalizability of the findings of this thesis may benefit from future research in other forms of supply chains as well as in other D&E markets.

Second, the thesis primarily builds on qualitative and quantitative research adopting cross-sectional study design, hence suggesting future studies to investigate the MO and performance relationship in a longitudinal study design. Particularly, combined methods of qualitative and quantitative research that track MO and performance overtime, data analysis, theory testing, and generalizability of our findings of this thesis warrant attention.

Third, the thesis research contributes to and uses performance measures (e.g., customer satisfaction criteria, proficiency measures) that are applicable in the context of seed systems. It is advisable to use common subjective measures of performance when objective data are difficult to obtain or insufficiently reliable for firms and/or public and private sector organizations operating at value chain level. Future research can use objective measures of supply chain performance such as on the areas of profitability, ROA, ROI, etc. Hence, such objective data would be of great importance to consolidate the findings of this thesis. Future research will also benefit from this thesis, because the thesis has considered four perspectives in dealing the MO and proficiency of seed supply chain functions in Ethiopia: a focal organization, suppliers and customers assessment of own and each other's' MO and performance, as well as end customers evaluation of the MO and performance of all organizations/suppliers of which they bought the seed from. Hence, future research would be recommended to replicate this approach, as it addresses MO and performance from a value chain perspective. This approach helps to avoid the potential common method bias on self-reported perceptions and evaluations of own roles/functions.

Fourth, the quantitative insights from this thesis open further research opportunities to investigate the various environmental moderators (e.g., technology turbulence, competitive intensity, market turbulence) and mediators (e.g., innovation orientation, entrepreneurial orientation, brand orientation, learning orientation, stakeholder orientation) shaping the MO and performance relationship in such specific context. Moreover, Ethiopian agriculture is highly dependent on rainfall, while the contribution of irrigation to the agriculture sector does not exceed 10% in coverage. Hence the performance of supply chains or seed is likely to be affected by the rainfall amount and intensity. The thesis also suggests future research on the role of trust and commitment among chain members, and how such variables contribute and/or affect the relationship between MO and proficiency. Future research on the role of channel leader and SCM also warrants attention.

Future research investigating Responsive and Proactive Market Orientation and performance relationship in D&E markets and in (seed) supply systems is needed. The more pro-active elements are more strongly related to performance than reactive elements in highly competitive markets of developed economies (Narver et al., 2004; Zhang & Duan, 2010). However, it is not clear, whether a more pro-active MO also is beneficial for developing and emerging (D&E) countries. Moreover, it is not clear whether firms and/or public and private sector organizations operating in value chains should only consider their direct customers in their customer orientation or also consider the final consumer. Thus, the thesis suggests future research, investigating reactive and proactive forms of MO and performance at supply chain level.

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Appendixes

Appendix 4.1: Customer satisfaction of seed supply chains in Ethiopia

Farmer's evaluation of seed supply chains performance for each channel for maize, teff, and bean value chains

No	Activity	1 Not at all	2 Strongly Disagree	3 Disagree	4 Neutral	5 Agree	6 Strongly Agree	7 Completely Agree
1	Farmer customers are satisfied about the product performance (right variety in terms of productivity, product options, market demand, and tested varieties).	1	2	3	4	5	6	7
2	Farmer customers are satisfied about the quality of seed available (such as among others germination, purity, seed health, and uniformity).	1	2	3	4	5	6	7
3	Farmer customers are satisfied about the affordability of seed available.	1	2	3	4	5	6	7
4	Farmer customers are satisfied about costs to obtain the seed.	1	2	3	4	5	6	7
5	Farmer customers are satisfied about the physical availability of seed.	1	2	3	4	5	6	7
6	Farmer customers are satisfied about the time when the seed is available.	1	2	3	4	5	6	7
7	Farmer customers are satisfied about the place where the seed is available.	1	2	3	4	5	6	7
8	Farmer customers are satisfied about the quantity of seed available.	1	2	3	4	5	6	7
9	Farmer customers are satisfied about the information obtained about the seed (such as among price, quality, productivity, agro ecology).	1	2	3	4	5	6	7
10	Farmer customers are satisfied about the services obtained about the seed (such as among others warrantee, reliability, after sales service, certification).	1	2	3	4	5	6	7
11	Farmer customers are satisfied about the production certainty of the seed (such as among others varietal maturity, adaptability, diseases, and pest resistance).	1	2	3	4	5	6	7
12	Growing crops with this seed involves little risk.	1	2	3	4	5	6	7
13	Growing crops with this seed involves high cultural heritage.	1	2	3	4	5	6	7
14	Farmer customers overall are satisfied about the seed.	1	2	3	4	5	6	7

Appendix 5.1: CFA results on MO components at the level of each market channel functions

No.	MO ITEMS	CODE
IG		
1	In this/their department, we/they meet with customers at least once a year to find out what products or services they will need in the future	INFOGEN1
2	In this/their department, we/they do a lot of in-house market research	INFOGEN2
3	We/they are slow to detect changes in our/their customers' product preferences. (R)	INFOGEN3r
4	We/they are slow to detect fundamental shifts in our/their industry (e.g., competition, technology, and regulation). (R)	INFOGEN4r
5	We/they periodically review the likely effect of changes in our/their business environment (e.g., regulation) on customers	INFOGEN5
6	We/they poll end-users at least once a year to assess the quality of our/their products and services	INFOGEN6
ID		
7	We/they have exclusive departmental meetings at least once per quarter to discuss market trends and this/their functional developments	INFODIS7
8	Marketing personnel in our/their organization spend time discussing customers' future needs with individuals of this/their department	INFODIS8
9	When something important happens to a major customer or market, all the individuals of this/their department quickly know about it	INFODIS9
10	When one individual of this/their department finds out something important about competitors, it is slow to alert other individuals of this/their department. (R)	INFODIS10r
11	Data on customer satisfaction are disseminated at all levels in this/their department on a regular basis	INFODIS11
IR		
~~12~~	~~It takes us forever to decide how to respond to our/their competitors' price changes. (R)~~	INFORES12r
13	For one reason or another, we/they tend to ignore changes in our/their customers' product or service needs. (R)	INFORES13r
14	We/they periodically review our/their product development efforts to ensure that they are in line with what customers want	INFORES14
15	Several individuals of this/their department get together periodically to plan a response to changes taking place in our/their business environment	INFORES15
16	If a major competitor were to launch an intensive campaign targeted at our/their customers, we/they would immediately implement a response	INFORES16
17	The different activities in this/their department are well coordinated	INFORES17
18	Customer complaints are ignored in this/their department. (R)	INFORES18r
19	Even if we/they came up with a great plan, we/they probably would not be able to implement it in a timely fashion. (R)	INFORES19r
20	When we/they find that customers would like us/them to modify a product or service, the individuals involved make concerted efforts to do so	INFORES20

NB: Item no 12 was deleted due to low loadings and low item to total correlation coefficients in both models of farmers and chain actors.

Appendix 5.1.1: Survey Questionnaire-Market Orientation in Seed Multiplication Function

Respondents: public agricultural research institutes and centers, public and private seed sector organizations or companies executing seed multiplication function. Multinational private seed companies, domestic public enterprises and private seed companies, seed producing farmers cooperatives, and seed unions perform certified seed multiplication.

Preliminary:

A. Checklist number: _______
B. Date of discussion: _________________
C. Facilitated by: ____________________________
D. Region: ___________________________
E. Locality: ____________________________
F. Name of the organization: ____________________________
G. Name of the respondent: ________________________
H. Age: ________
I. Gender: (1) Male, (2) Female
J. Educational level: ____________________________
K. Field of expertise: ____________________________
L. Total professional experience: __________________________
M. Role/current position: ____________________________N. Experience in your current position: __________________Cell phone: ________________

PART 1: Functions Performed by Seed Value Chain Actors in Seed Supply Systems of Ethiopia

1. Marketing Functions Performed in Seed Value Chains

a) Research and development function (e.g., variety development, adaptation, and maintenance)
b) Seed multiplication function (pre-basic, basic, and certified seed classes)
c) Seed storage and processing function
d) Seed quality control and certification function
e) Seed distribution and marketing function

2. What crops are grown in your organization?
    a. Any other?
3. Which varieties of each crop are grown in your organization?
    a. Any other?
4. Which seed supply channels are available for each variety grown in your organization?
    a. Any other?
    b. Which seed value chain do you engage with?
        a. Any other?

5. Functions Performed in Your Organization

a) Which marketing functions are performed by your organization?
    a. Any other?

b) For which crops does your organization perform the functions?
    a. Any other?

c) For which varieties does your organization perform the functions?
    a. Any other?

d) From which supplier does your organization obtain the seed for each variety that are grown?
    a. Any other?

e) Who are your organizational customers for each variety grown in your organization?
    a. Any other?

6. Functions Performed by Your Own: Own roles and functions in your organization

a) Which marketing functions do you perform?
    a. Any other?

b) For which crops do you perform the marketing functions?
    a. Any other?

c) For which varieties do you perform the marketing functions?
    a. Any other?

d) From which supplier do you obtain the seed for each variety that you grow?
    a. Any other?

e) Who are your customers for each variety that you grow?

a. Any other?

7. Functions Performed by Your Organizational Suppliers or External Organizations

a) Which external organizations or suppliers do your organization is engaged with?

a. Any other?

b) Which marketing functions do each external organization or suppliers perform?

a. Any other?

c) For which crops do the external organizations/suppliers perform the marketing functions?

a. Any other?

d) For which varieties do the external organizations/suppliers perform the marketing functions?

a. Any other?

8. Functions Performed by Your Organizational Customers or External Organizations

a) Which customers do your organization is engaged with?

a. Any other?

b) Which marketing functions are performed by each customer?

a. Any other?

c) For which crops do your customers perform the marketing functions?

a. Any other?

d) For which varieties do your customers perform the marketing functions?

a. Any other?

Part 2: Chain Actor's Own Evaluation of Market Orientation in Seed Multiplication Function (maize, teff and beans**)**

Own Evaluation of Market Orientation in Seed Multiplication Function				
For each of the following questions, please indicate the response that most closely describes the "**Seed Multiplication Activities"** performed in your organization				
Strongly Disagree	**(Moderately) Disagree**	**Neutral**	**(Moderately) Agree**	**Strongly Agree**
1	**2**	**3**	**4**	**5**

Activity

_____ 1. In this seed multiplication department, we meet with customers at least once a year to find out what quantities of products or services (e.g., specific quantities of seed) they will need in the future.

_____ 2. In this seed multiplication department, we do a lot of in-house market research.

_____ 3. We are slow to detect changes in our customers' needs for different quantities of seeds. (R)

_____ 4. We are slow to detect fundamental shifts in our industry (e.g., competition, technology, regulation). (R)

_____ 5. We periodically review the likely effect of changes in our business environment (e.g., regulation) on customers.

_____ 6. We poll end-users at least once a year to assess the offered quantity of our products (e.g., availability of sufficient quantity of seeds and services).

_____ 7. We have interdepartmental meetings at least once per quarter to discuss market trends and seed multiplication developments.

_____ 8. Marketing personnel in our organization spend time discussing customers' future needs (e.g., specific seed quantity) with individuals of this seed multiplication department.

_____ 9. When something important happens to a major customer or market, all the individuals of this seed multiplication department quickly know about it.

_____ 10. When one individual of this department finds out something important about competitors, it is slow to alert other individuals of this department. (R)

_____ 11. Data on customer satisfaction (e.g., perceived quantity of seed offers) are disseminated at all levels in this seed multiplication department on a regular basis.

_____ 12. It takes us forever to decide how to respond to our competitors' price changes. (R)

_____ 13. For one reason or another, we tend to ignore changes in our customers' needs for different quantities of seeds or services. (R)

_____ 14. We periodically review our seed multiplication efforts to ensure that they are in line with what customers want.

_____ 15. Several individuals of this department get together periodically to plan a response to changes taking place in our business environment.

_____ 16. If a major competitor were to launch an intensive campaign targeted at our customers, we would immediately implement a response.

_____ 17. The different activities in this seed multiplication department are well coordinated.

_____ 18. Customer complaints are ignored in this seed multiplication department. (R)

_____ 19. Even if we came up with a great seed multiplication plan, we probably would not be able to implement it in a timely fashion. (R)

_____ 20. When we find that customers would like us to modify a product quantity or service, the individuals involved make concerted efforts to do so.

Appendix 5.1.2: Market-oriented performance of Ethiopian seed systems: Seed supply systems from the perspectives of end customers

Preliminary:

Checklist Number: ______Date of discussion:______Gender_____Educational level____Farming experience:________Facilitated by:___________Region: ____________

Zone: ______________Woreda/District:_______________Kebele (Village): ____________

1. Introduction

1. Marketing functions performed in seed supply systems or seed value chains (maize, teff and beans)
   a. Research or variety development function
   b. Seed multiplication function
   c. Seed storage and processing function
   d. Quality control and certification function
   e. Seed distribution and marketing function
2. Which crops (maize, teff, and beans) are most prevalent in your locality?
   a. Any other?
3. Which varieties are most prevalent in your locality for each crop?
   a. Any other?
4. Which crops (maize, teff, and beans) do you grow?
   a. Any other?
5. Which varieties of each crop do you grow?
   a. Any other?
6. Where do you obtain the seed for each variety that you grow?
   a. Anywhere else?
7. How do you buy the seed for each variety that you grow?
   a. Where do you buy it?
   b. How often do you buy it?
   c. How do you assess the quality of the seed?

   d. How and when do you pay for the seed?
   e. How are you informed about the supplier of the seed?
8. What alternative seed suppliers are available for you for each crop that you grow?
   a. Any other?

2. Market Orientation of each supplier in every function

Here farmers were asked to evaluate the MO of all functions performed by their seed suppliers. We have adapted the MO items at each function. For example, the word "we/our" referred in Appendix 5.1.1 will be changed to "they/them", when farmers evaluate the MO of each supplier in seed multiplication function.

Appendix 5.2: Data analysis

Item–total correlations

Item–total correlations or corrected item-total correlations have been used extensively in the marketing, psychology, and more recently manufacturing literature for the development of one-dimensional scales (Koufteros, 1999). Item–total correlation refers to a correlation of an item or indicator with the composite score of all the items forming the same set. Corrected item-total correlation does not include the score of the particular item in question when calculating the composite score, thus it is labelled 'corrected.' Items from a given scale exhibiting item-total correlations less than 0.50 are usually candidates for elimination. The domain sampling model is that all items if they belong to the domain of the construct should have an equal amount of common core. If all the items in a measure are drawn from the domain of a single construct, responses to those items should be high inter-correlated. Item–total correlations provide a measure of this (Churchill Jr, 1979).

As shown in Figure 5.2, for the twenty items of MO, the item-total correlations were almost all acceptable, except for one item (Item12) of the intelligence responsiveness component, having the lowest value of 0.37 from the perspective of chain actors (in the left side) and 0.38 from end customers (in the right side). This item will be eliminated from our model. Out of the 20 items of MO, our item-total correlations suggest 19 items to measuring the MO of value chain functions. We will further check the loading results of all the 20 items before deleting this item (Item12).

	Stakeholder/chain actor perspective					End farmer customers perspective				
Item	N (Obs)	Item-test Correlation	Item-rest correlation	Average inter item covariance	Alpha	N	Item-test correlation	Item-rest correlation	Average inter item covariance	Alpha
Item1	3528	0.76	0.61	0.53	0.76	3919	0.76	0.60	0.37	0.73
Item2	3528	0.70	0.57	0.60	0.77	3919	0.66	0.55	0.48	0.76
Item3	3528	0.75	0.61	0.56	0.76	3919	0.70	0.52	0.41	0.76
Item4	3528	0.68	0.53	0.61	0.78	3919	0.59	0.40	0.47	0.78
Item5	3528	0.77	0.65	0.55	0.75	3919	0.74	0.63	0.42	0.73
Item6	3528	0.60	0.40	0.64	0.81	3919	0.74	0.58	0.38	0.74
Item7	3528	0.62	0.43	0.47	0.74	3919	0.46	0.29	0.30	0.73
Item8	3528	0.73	0.55	0.39	0.70	3919	0.79	0.60	0.17	0.62
Item9	3528	0.82	0.63	0.31	0.66	3919	0.82	0.62	0.15	0.61
Item10	3528	0.55	0.37	0.52	0.75	3919	0.51	0.36	0.29	0.72
Item11	3528	0.80	0.63	0.34	0.67	3919	0.77	0.58	0.18	0.63
Item12	3528	0.37	0.22	0.53	0.85	3919	0.38	0.20	0.46	0.86
Item13	3528	0.74	0.63	0.42	0.80	3919	0.79	0.70	0.35	0.81
Item14	3528	0.75	0.65	0.42	0.80	3919	0.75	0.66	0.38	0.81
Item15	3528	0.61	0.50	0.46	0.82	3919	0.59	0.50	0.43	0.83
Item16	3528	0.63	0.52	0.46	0.81	3919	0.64	0.56	0.42	0.83
Item17	3528	0.75	0.65	0.42	0.80	3919	0.77	0.69	0.37	0.81
Item18	3528	0.72	0.63	0.44	0.80	3919	0.79	0.70	0.36	0.81
Item19	3528	0.50	0.36	0.49	0.83	3919	0.57	0.41	0.41	0.84
Item20	3528	0.76	0.67	0.42	0.80	3919	0.76	0.67	0.37	0.81

Figure 5.2: Reliability of test scales from the perspective of chain actors and farmer customers

Confirmatory factor analysis

CFA involves the specification and estimation of one or more hypothesized models of factor structure, each of which proposes a set of latent variables (factors) to account for covariance among a set of observed variables (Koufteros, 1999). Linear structural equation modeling can be used to test the fit of a hypothesized model against the sample data. Model specification is accomplished by fixing or constraining elements in three matrices that are analogous to the factor pattern matrix, factor correlation matrix, and commonalities from a common factor analysis.

Step 1

A covariance matrix composed of the 20 items was submitted to CFA, which constrained each item to load on the theoretically correct facet of MO (i.e., information generation, dissemination, and responsiveness), but also assuming equal variance for all the constructs. We did these separately for the chain actors and end customers.

The results of CFA on the 20 items (see Figures 5.3a and 5.3b) show that the loading of one item (item12) is lowest, with values of 0.23 for the chain actors and 0.17 for farmers, respectively. We will remove this one item sequentially; reach at the best model fit both for the chain actors and farmers. The item-total correlations result (as previously reported) also confirmed the elimination of this item. The initial three-factor solution from the perspective of farmers and stakeholders also did not provide an adequate fit to the data on the 20 items of MO. Figure 5.4 shows a lower value of CFI (below 0.9) for both models, chain actors, and farmers.

Step 2

We further employed a second model (see Figure 5.4) or CFA on the retained 19 items of MO (also have higher loadings ranging from 0.40 to 0.80) to get an improved model. This model neither provides an adequate fit to the data, as the CFI of both farmers and chain actors were below 0.9. However, the other model fitness measures were good and reasonably fit well in aspects of x^2 , RMSEA, and SRMR, which were in the acceptable ranges for a given model.

Step 3

To get a good model fit, we go one step further and diagnose the existence of Common Method Bias (CMB), specifically related to respondent bias, in our data. We suspect this CMB mainly for two reasons. First, as we employed a cross-sectional study design and collect data from the same respondents at the same time, there will be a problem related to respondent bias, where respondents tend to rate the same pattern of answer for the questions they were asked. Second, as per our methodology, every actor (organizations participating on the Ethiopian seed systems) evaluates own roles/themselves, as well as its suppliers and customers functions performed in seed value chains. There might be also cases where respondents perceive or have a low level of understanding of the inside activities of its suppliers and customers, thus leading to inaccurate perception or rates, that might be different from the reality. With these justifications, eventually, a model was identified that provided an adequate fit to the data by introducing the concept of CMB both for the chain actors and the end farmer customers. The inclusion of one CMB on initial three-factor solution did provide a good fit to the data on the four commonly used fit indexes (see Figure 5.4). The final model fit from the perspective of chain actors was (x^2 = 1768.52 [df] = 130], p = 0.00; RMSEA = 0.06; CFI= 0.94; SRMR= 0.03), while form the perspective of end customers was (x^2 = 3852.30 [df] = 130], p = 0.00; RMSEA = 0.08; CFI=0.90; SRMR=0.05). In addition, and perhaps more important, the model appeared to retain the appropriate items, providing a high degree of confidence that the conceptual domain of each facet of MO was being represented adequately.

Item	Factor 1	Factor 2	Factor 3
Item1	.68		
Item2	.61		
Item3	.71		
Item4	.65		
Item5	.73		
Item6	.47		
Item7		.49	
Item8		.64	
Item9		.78	
Item10		.42	
Item11		.73	
Item12			.23
Item13			.69
Item14			.73
Item15			.58
Item16			.58
Item17			.67
Item18			.70
Item19			.36
Item20			.77

Figure 5.3a: CFA (loadings) from the perspective of supply chain actors

Item	Factor 1	Factor 2	Factor 3
Item1	.68		
Item2	.62		
Item3	.61		
Item4	.48		
Item5	.72		
Item6	.69		
Item7		.35	
Item8		.71	
Item9		.73	
Item10		.42	
Item11		.70	
Item12			.17
Item13			.76
Item14			.74
Item15			.58
Item16			.62
Item17			.72
Item18			.76
Item19			.40
Item20			.79

Figure 5.3b: CFA (loadings) from the perspective of end customers

Model	Overall fit indexes				
	x^2	Df	RMSEA	CFI	SRMR
Full model					
Chain actors	3616.11	167	0.08	0.88	0.05
Farmers	9657.73	167	0.12	0.75	0.09
Second model					
Chain actors	3428.34	149	0.08	0.88	0.05
Farmers	9087.48	149	0.12	0.76	0.09
Third model					
Chain actors	1768.52	130	0.06	0.94	0.03
Farmers	3852.30	130	0.08	0.90	0.05

x2 = Chi-square; df = degree of freedom; RMSEA = root mean square error of approximation; CFI = comparative fit index; SRMR = standardized root mean squared residual. The first full model includes all the 20 items of MO for both channel actors and farmers; the second model includes the retained 19 items of MO for both channel actors and farmers; the third model includes the 19 items of MO but also introducing one common method bias for both models of farmers and chain actors.

Figure 5.4: Model fitness from the perspective of chain actors and farmer customers

Reliability of the market orientation constructs.

Reliability of the MO measures was assessed with Cronbach alpha for both models, i.e., from the perspective of supply chain actors and end farmer customers. The Cronbach alpha was above the cutoff point (0.7) for both models, indicating excellent reliability of the MO measures (Table 5.1).

Table 5.1: Reliability of market orientation constructs

Dimension	Number of items	Coefficient Alpha	
		Chain actors	End customers
Intelligence generation	6	0.80	0.78
Intelligence dissemination	5	0.75	0.72
Responsiveness to the intelligence	8	0.85	0.86

Results of the measurement model

Confirming the dimensions of market orientation

Confirmatory factor analysis (CFA) was used to see whether the three validated dimensional model of Jaworski and Kohli (1993) is a good representation of MO. The results (see Figures 5.5 and 5.6) confirm that MO is a multidimensional construct consisting of three sub-dimensions. The model in Figure 5.4 yielded an excellent fit for chain actors and a good fit for end customers, with t-values for each of the loadings significant at $p < 0.05$. Although the x^2 value is rather high, it is sensitive to sample size, particularly where the number of respondents exceeds 200 (Hair et al., 1995) and in this case, should not be examined in isolation. The other fit indices are highly satisfactory. Guidelines for the use of CFI suggest a value higher than 0.9, with a measure of 1 indicating a perfect fit. RMSEA values of below 0.08 also suggest the data fit the hypothesized model very well. The SRMR has no specified range of accepted values, but smaller numbers are preferred, especially below 0.08. The SRMR of 0.03 and 0.05 are satisfactory. Thus, the results of the confirmatory factor analysis provide good support for the proposed three-dimensional model of MO.

Based on the existing scale developed in the literature, we can say that MO in the Ethiopian seed supply systems context consists of three dimensions which can be measured by 19 questionnaire items using a five-point Likert scale (see Appendix 5.1). It might also suggest that intelligence generation, intelligence dissemination and responsiveness to the intelligence are to be considered as separate dimensions and probably have independent effects on performance.

Correlation matrix

Figures 5.5 and 5.6 shows the existence of associations between the three components of MO from the perspective of chain actors and end customers, respectively. The strongest and positive association is between intelligence generation and intelligence dissemination (r=0.92 and r=0.93 for chain actors and farmers, respectively). From the perspective of chain actors (Figure 5.5), there is also a significant and positive association of intelligence generation and intelligence responsiveness (r=0.88) and between intelligence dissemination and intelligence responsiveness (r=0.89). While from the perspective of end customers (Figure 5.6), there is a good and positive association between intelligence dissemination and intelligence responsiveness (r=0.59), as well as between intelligence generation and responsiveness (r=0.54).

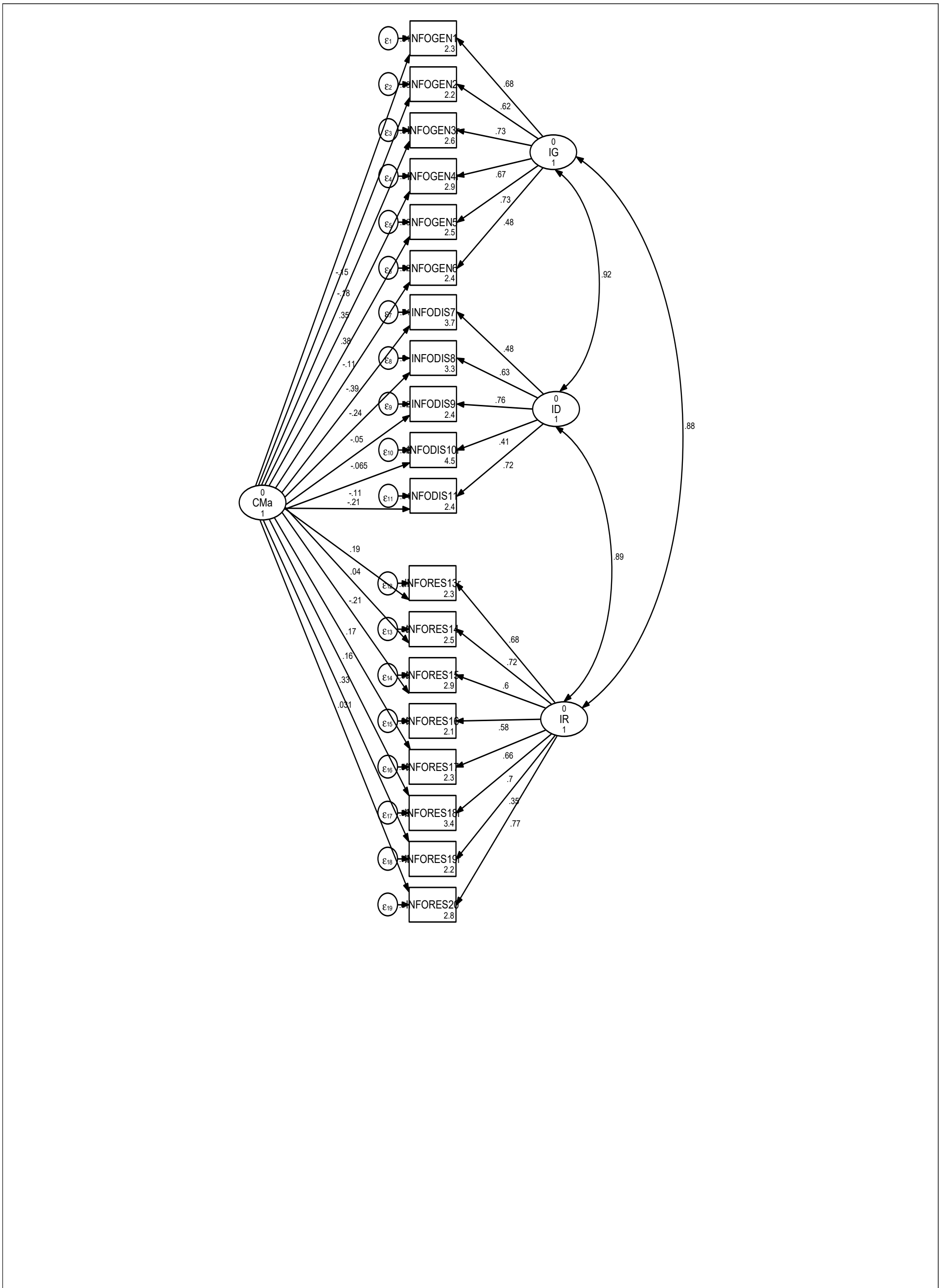

Figure 5.5: Confirmatory factor analysis results of the measurement model from the perspective of chain actors

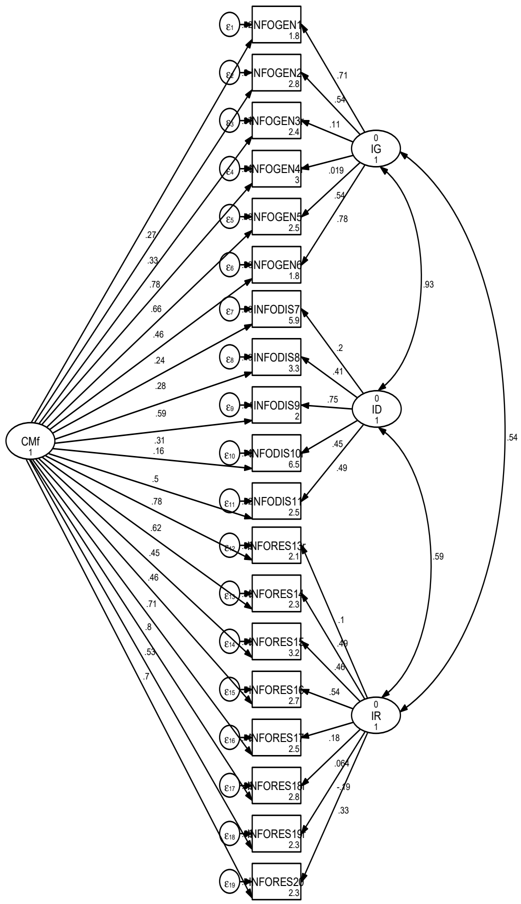

Figure 5.6: Confirmatory factor analysis results of the measurement model from the perspective of end farmer customers

Measurement Invariance

After confirming the best model for representing a MO, we tested invariance across different (a) functions performed in seed value chains, (b) perspectives (a focal organization's own evaluation of themselves, evaluation of its suppliers, and its customers), and (c) respondent groups. Invariance is indicated if a good model fit is maintained after the introduction of constraints (Nam et al., 2016). Invariance test helps to answer whether this developed model of MO holds across multiple groups/functions/perspectives. Thus, performing CFA on the different types of functions performed in seed systems. With this justification, we have employed the three common types of measurement invariance across marketing functions and the different perspectives from supply chain actors: 1) Metric invariance, 2) Scalar invariance, and 3) Residual invariance. Typically, it is paramount to understand invariance test from the perspective of supply chain actors, chain actors evaluate each other on the different marketing functions performed, as opposed to end customers evaluation of only its suppliers on the different functions performed. This, in turn, suggests the non-importance of performing invariance test from the perspective of end customers. Our model from the end customers perspective also confirmed the good fit to the data on all the marketing functions performed by their seed suppliers.

In general, the model to be excellent or to check whether the model is stable, the model should show a good fit. In addition the changes in the fit indices less than the recommended amount (the change in CFI less than 0.01, SRMR less than 0.01 or RMSEA less than 0.02 (Chen, 2007) is best preferable when comparing the different models or invariance tests.

Metric invariance

In the first step, the loadings of each construct of MO are constrained to be equal across functions. We evaluated whether the factor loadings of the three-factor indicators were equivalent in different functions (i.e., R&D, multiplication, storage and processing, quality control and certification, and distribution and marketing). For example, if the same construct of MO has equal loadings across function1, function2, function3, function4 and function5, the MO level will show the same changes across function1, function2, function3, function4 and function5 i.e. equality of scaling units (Burns, Walsh, Gomez, & Hafetz, 2006). This test determined whether the measures had the same meaning and structure for different marketing functions. Furthermore, this test established the suitability of group comparisons of possible substantive interest. The equal factor loadings model in the present dataset evidenced an overall good fit to the data and did not significantly degrade the fit of the model relative to the equal form solution, as reflected by the model fitness (see Table 5:2). Thus, we can say that the indicators provide comparable relationships to the latent constructs of (1) information generation, (2) information dissemination and (3) responsiveness to information in different functions performed in seed systems (see Table 5:2).

Like the above procedure, we have tested metric invariance across perspectives, i.e., chain actor's evaluation of own functions, its suppliers, and customers. The equal factor loadings model in the three perspectives evidenced an overall good fit to the data. Thus, we can conclude that the indicators provide comparable relationships to the latent constructs of MO in different perspectives.

Scalar invariance

In the second step, with constraints on the loadings remaining in place, we add another constraint, specifically measurement intercepts. Scalar variance test, where the measurement intercepts of the same constructs are examined across different function and set to equal (Nam et al., 2016). If this intercept is equal across different functions, it provides a common zero point on factors for functions, allowing a comparison of the latent construct means that may be used to answer questions such as "Do managers/respondents in supply chains perceive a more market-oriented behavior of themselves than those of its customers and suppliers?" (Burns et al., 2006). The result of the equal measurement intercepts models also showed good fit and did not result in significant degradation of fit relative to the equal factor loadings solution. The changes in the fit indices when comparing this model with the previous metric invariance was a change in RMSEA of 0.007, CFI in 0.03 and a change in SRMR of 0.01, which is in the acceptable recommended amount, despite one of the fit indices, CFI has a slight increase in 0.01. The model fit was (x^2 = 4597.58 [df] = 726], p = 0.00; RMSEA = 0.09; CFI=0.87; SRMR=0.06).

We have also employed scalar invariance test across perspectives. The CFI and SRMR are slightly greater than the recommended amount when comparing it with the metric invariance, but the overall model fitness was reasonably fair (see Table 5:2).

Residual invariance

In the third step, the residuals of the constructs are constrained across functions. Again, the previous constraints remain in place [metric and scalar invariance]. By constraining the residuals of same constructs, we can provide evidence that the differences among MO factors are due to different marketing functions on only the latent factors (Burns et al., 2006; Chen, Sousa, & West, 2005). Equality among the construct residuals also ensures that like constructs have similar reliabilities across different functions as long as the variance of the factors is invariant across functions (Burns et al., 2006).

The equal residual construct model yielded a good result and did not degrade the fit of the model relative to the equal form solution/compared with the scalar invariance. This holds both for the different marketing functions and the different perspectives tested in our analysis (see Table 5:2). This was reflected by the change in the three fitness measures (CFI, RMSEA, and SRMR) of a value of 0.000, which all are below the ideal recommended amount of changes greater than 0.001.

Generally, our model confirms its relative robustness/stable, as we wittiness, the change in the fit indices is not significantly greater than the recommended amount when we compare the equal form solution with metric invariance, scalar, and residual invariance. The implication of the measurement invariance test is that the MO constructs are comparable across different functions and perspectives.

Table 5.2: Measurement invariance tests

Model	Overall fit indexes					Model comparison	Change in fit indexes		
	x^2	Df	RMSEA	CFI	SRMR		ΔCFI	ΔRMSEA	ΔSRMR
	Invariance across functions								
(a) Chain actors									
1.Metric	3793.05	650	0.08	0.90	0.05				
2.Scalar	4597.58	726	0.09	0.87	0.06	2 vs. 1	0.03	0.01	0.01
3.Residual	4597.58	726	0.09	0.87	0.06	3 vs. 2	0.00	0.00	0.00
	Invariance across perspective								
1.Metric	2180.13	390	0.08	0.90	0.05				
2.Scalar	4545.21	428	0.09	0.85	0.16	2 vs. 1	0.05	0.01	0.11
3.Residual	4545.21	428	0.09	0.85	0.16	3 vs. 2	0.00	0.00	0.00

Appendix 6.1: Data analysis, procedure, and measurement model results

Questionnaire: Proficiency of Seed Value Chain Functions (e.g., Proficiency in Seed Multiplication Function)

For each of the following questions, please indicate the response that most closely describes the "**Seed Multiplication Activities"** performed (a) in your organization, (b) by your suppliers, and (c) by your customers.

Not At All	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	An Extreme Extent
1	2	3	4	5	6	7

I. Proficiency in Seed Multiplication Function (Pre-Basic, Basic, and Certified Seed Classes)

1. Proficiency in Pre-Basic Seed Multiplication

A. Own Proficiency (Pre-Basic Seed Multiplication)

_____ 1.This research organization's pre-basic seed multiplication function excellently for crop X. Example: We multiply excellently pre-basic seed for X crop.

_____ 2.This research organization is superior to competitors in pre-basic seed multiplication function for crop X. Example: Our research org. is superior to competitors in pre-basic seed multiplication for X crop.

_____ 3.This research organization performs poorly pre-basic seed multiplication function for crop X (R). Example: Our research org. performs poorly pre-basic seed multiplication for X crop.

Suppliers Proficiency (Pre-Basic Seed Multiplication)

Name of the Supplier: ______________________

_____ 4.Supplier A pre-basic seed multiplication function excellently for crop X. Example: ABC, research org. multiplies excellently pre-basic seed for X crop.

_____ 5.Supplier A is superior to competitors in pre-basic seed multiplication function for crop X. Example: ABC, research org. is superior to competitors in pre-basic seed multiplication for X crop.

_____ 6.Supplier A performs poorly pre-basic seed multiplication function for crop X (R). Example: ABC, research org. performs poorly pre-basic seed multiplication for X crop.

Customers Proficiency (Pre-Basic Seed Multiplication)

Name of the Customer: ___________________________

_____ 7. Customer B pre-basic seed multiplication function excellently for crop X. Example: DE, research org. multiplies excellently pre-basic seed for X crop.

_____ 8. Customer B is superior to competitors in pre-basic seed multiplication function for crop X. Example: DE, research org. is superior to competitors in pre-basic seed multiplication for X crop.

_____ 9. Customer B performs poorly pre-basic seed multiplication function for crop X (R). Example: DE, research org. performs poorly pre-basic seed multiplication for X crop.

Proficiency in Basic Seed Multiplication

Own Proficiency (Basic Seed Multiplication)

_____ 10. This company's basic seed multiplication function excellently for crop X. Example: We multiply excellently basic seed for X crop.

_____ 11. This company is superior to competitors in basic seed multiplication function for crop X. Example: Our private company is superior to competitors in basic seed multiplication for X crop.

_____ 12. This company performs poorly basic seed multiplication function for crop X (R). Example: Our private company performs poorly basic seed multiplication for X crop.

Suppliers Proficiency (Basic Seed Multiplication)

Name of the Supplier: _____________________

_____ 13. Supplier A basic seed multiplication function excellently for crop X. Example: ABC, research org. multiplies excellently basic seed for X crop.

_____ 14. Supplier A is superior to competitors in basic seed multiplication function for crop X. Example: ABC, research org. is superior to competitors in basic seed multiplication for X crop.

_____ 15. Supplier A performs poorly basic seed multiplication function for crop X (R). Example: ABC, research org. performs poorly basic seed multiplication for X crop.

Customers Proficiency (Basic Seed Multiplication)

Name of the Customer: ___________________________

_____ 16. Customer C basic seed multiplication function excellently for crop X. Example: YZ, Seed Company multiplies excellently basic seed for X crop.

_____ 17. Customer C is superior to competitors in basic seed multiplication function for crop X. Example: YZ, Seed Company is superior to competitors in basic seed multiplication for X crop.

_____ 18. Customer C performs poorly basic seed multiplication function for crop X (R). Example: YZ, Seed Company performs poorly basic seed multiplication for X crop.

Proficiency in Certified Seed Multiplication

Own Proficiency (Certified Seed Multiplication)

_____ 19. This seed company's certified seed multiplication function excellently for crop X. Example: We multiply excellently certified seed for X crop.

_____ 20. This seed company is superior to competitors in certified seed multiplication function for crop X. Example: Our seed company is superior to competitors in certified seed multiplication for X crop.

_____ 21. This seed company performs poorly certified seed multiplication function for crop X (R). Example: Our seed company performs poorly certified seed multiplication for X crop.

Suppliers Proficiency (Certified Seed Multiplication)

Name of the Supplier: _____________________

_____ 22. Supplier C certified seed multiplication function excellently for crop X. Example: YZ, Seed Company multiplies excellently certified seed for X crop.

_____ 23. Supplier C is superior to competitors in certified seed multiplication function for crop X. Example: YZ, Seed Company is superior to competitors in certified seed multiplication for X crop.

_____ 24. Supplier C performs poorly certified seed multiplication function for crop X (R). Example: YZ, Seed Company performs poorly certified seed multiplication for X crop.

Customers Proficiency (Certified Seed Multiplication)

Name of the Customer: ___________________________

_____ 25. Customer D certified seed multiplication function excellently for crop X. Example: GH, cooperative org. multiplies excellently certified seed for X crop.

_____ 26. Customer D is superior to competitors in certified seed multiplication function for crop X Example: GH, cooperative org. is superior to competitors in certified seed multiplication for X crop.

27. Customer D performs poorly certified seed multiplication function for crop X (R). Example: GH, cooperative org. performs poorly certified seed multiplication for X crop.

Data analysis

Scale reliability is assessed through Cronbach's alpha and CFA using STATA. Relations between MO and proficiency were assessed through correlation coefficients, multiple regression, and general linear models.

Although each of the market orientation scales and proficiency measures has been reported in the literature, a scale validation procedure was followed using (1) Exploratory Factor Analysis (EFA) and (2) Confirmatory Factor Analysis (CFA). The purpose of this stage of the analysis was to identify and eliminate poorly performing items from measures. As the MO results were reported in the previous study (Chapter 5), this section presents our analysis of the three items that measure the proficiency of functions.

Exploratory Factor Analysis (EFA)

We have performed EFA using PCA on the items measuring the proficiency of marketing functions across all observations (chain actors and farmers). The PCA provides support for a one-component solution for the market channel functions: R&D, multiplication, storage and processing, and quality control and certification. The first factor accounts for 81.60 % of the variance in the items for the R&D function, 82.19% for Multiplication, 84.09 % for Storage and processing function, and 85.31% for Quality control and certification function. However, four factors were extracted for the distribution and marketing function. According to the PCA, the proficiency of distribution (i.e., time, place) and marketing (i.e., price, varietal information, and services) is not one-dimensional. Extracted factors are related to (a) product timeliness, (b) place, (c) product pricing, and (d) product information and services. The four components account for 68.97 % of the variance in the items.

Confirmatory Factor Analysis (CFA)

CFA was used to see whether the three items of proficiency are comparable measures across the market channel functions of R&D, multiplication, storage and processing, and quality control and certification. The results support the EFA by confirming that proficiency is a unidimensional construct consisting of three items for the four functions. Cronbach alphas for each item were high (0.83, 0.89, and 0.85), indicating excellent reliability of the proficiency measures. The measurement model yielded an excellent fit, with t-values for each of the loadings significant at p <0.001 (p=0.000).

Figure 6.2 shows CFA results of the measurement model consisting of three items for the four functions. Item 1 to 3 indicate the three items measuring the proficiency of 4 functions [R&D, multiplication, storage and processing, and quality control and certification] in seed value chains, while the numbers indicate the factor loading of each item on the construct. We reversed item 3 before the analyses to present a positive loading.

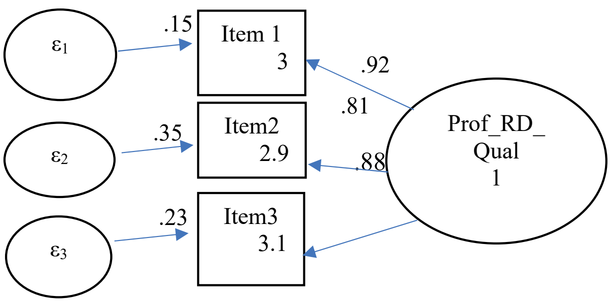

Figure 6.2: CFA results of the measurement model from the perspective of chain actors and farmers

Like the above procedure, we employed CFA on the four factors measuring the distribution and marketing functions in seed value chains. The results (see Figure 6.3) also support the EFA by confirming that proficiency of the distribution and marketing function is a multidimensional construct consisting of four items (time, place, price, and varietal information and service related). The model evidenced a satisfactory fit to the data, as reflected by the model fitness (x^2 = 2691.54 [DF] = 84], p = 0.00; RMSEA = 0.10; CFI=0.88; SRMR=0.07).

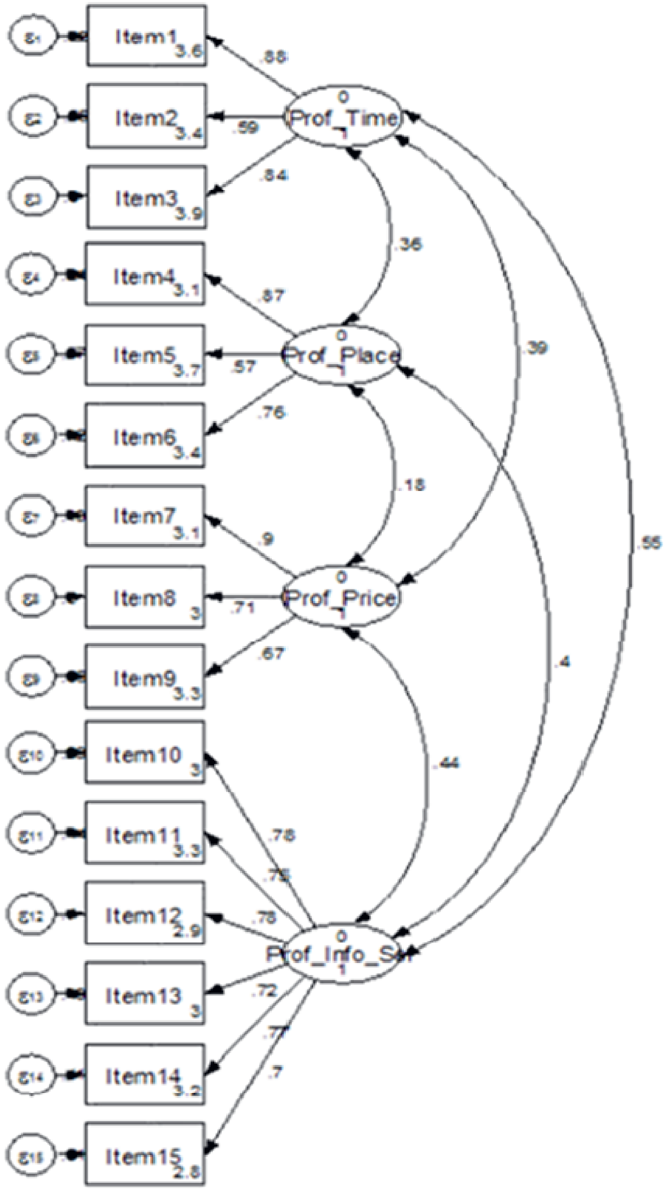

Figure 6.3: CFA results of the distribution and marketing function model (time, place, price, and product information and service) from the perspective of chain actors and farmers

Though, the factor analysis shows the multidimensionality of the distribution and marketing function, the researchers are more interested in looking the overall scores of distribution and marketing function than investigating the unique contributions of each dimension (time, place, price, and service). We drop the use of the multidimensional measure or separate constructs in favor of a single average score for the distribution and marketing functions for three reasons (see Chapter 6). We use the average scores of distribution and marketing functions: (mean scores of distribution-time + mean scores of distribution-place + mean scores of marketing-price + mean scores of marketing-service)/4. Thus, we use the proficiency of 5 market channel functions for further analyses: R&D, multiplication, storage and processing, quality control and certification, and distribution and marketing. The reliability of the measures for proficiency of each function was excellent (see Table 6.1).

Factor scores of proficiencies were computed from the two different CFA: one involving the one-component solution for the 4 market channel functions: R&D, multiplication, storage and processing, and quality control and certification, and the other from the four factors of the distribution and marketing function. A mean proficiency score across all chain actors and farmers was used for further analysis. That is, a mean score for proficiency of market channel functions is computed from all respondents (organization performing a given function, suppliers, customers, and farmers) that evaluated a function performed by an organization in a seed value chain. We calculate the mean score across these four perspectives, i.e., we calculate (1) the mean proficiency across the suppliers that evaluated a function in an organization, and (2) the mean proficiency across the customers that evaluated a function in an organization, and (3) the mean proficiency across the farmers that evaluated a function in an organization, and (4) the mean proficiency across the people within the organization that evaluated a function in an organization. Finally, we calculate the mean across these four perspectives: (mean proficiency according to suppliers + mean proficiency according to customers + mean proficiency according to farmers + mean proficiency according to people within the organization)/4.

Table 6.1: Reliability of proficiency of market channel functions

Functions	R&D	Multiplication	Storage & Processing	Quality Control and certification	Distribution and Marketing			
					Time	Place	Price	Service
Alpha	0.88	0.89	0.90	0.91	0.80	0.78	0.80	0.88

Regarding MO, we have presented in the previous Chapter how we analyzed the MO scores. As MO measures are already validated in the extant literature, we employed a CFA with the three components of MO (information generation, dissemination, and responsiveness). We compute the factor scores for each of the three MO dimensions, i.e., we perform a CFA with 3 components. However, factor scores of the three MO dimensions were extracted from two separate factor analysis (see Chapter 5): One is from the perspective of chain actors, and the other from the perspective of farmer customers', as the model did not perform or run across all observations (chain actors and farmers). Then we calculate the overall mean MO scores based on the CFA scores of these components (i.e., MO= (IG+ID+IR)/3)).

Measurement Invariance

After confirming the best model for representing proficiency/performance, we tested invariance across different (a) functions performed in seed supply value chains and (b) perspectives (i.e., focal organizations, suppliers, customers, and final farmer customers). Invariance is indicated if a good model fit is maintained after the introduction of constraints (Nam et al., 2016). Invariance test helps to answer whether this measurement model holds across functions and perspectives.

We have tested the three common types of measurement invariance across marketing functions and perspectives: 1) Metric invariance, 2) Scalar invariance, and 3) Residual invariance. The invariance test in the present dataset evidenced an overall good fit to the data and did not significantly degrade the fit of the model relative to the equal form solution (full model), as reflected by the model fitness (see Table 6.2). Thus, we can conclude that the indicators provide comparable relationships to the latent construct of proficiency in different functions and perspectives, which mean the measures had the same meaning and structure for different perspectives and functions. Chapter 5 already presented the MI tests employed in the MO model.

Table 6.2: Measurement invariance tests

Model	Overall fit indexes					Model comparison	Change in fit indexes		
	x^2	Df	RMSEA	CFI	SRMR		ΔCFI	ΔRMSEA	ΔSRMR
Full model	11185.63	3	0.00	1.00	0.00				
	Invariance across functions								
1.Metric	11251.82	12	0.00	1.00	0.00	1 vs full	0.00	0.00	0.00
2.Scalar	82.86	9	0.08	0.99	0.05	2 vs. 1	0.01	0.07	0.05
3.Residual	82.86	9	0.08	0.99	0.05	3 vs. 2	0.00	0.00	0.00
	Invariance across perspective								
1.Metric	11460.62	12	0.00	1.00	0.00				
2.Scalar	11185.63	3	0.00	1.00	0.00	2 vs. 1	0.00	0.00	0.00
3.Residual	11185.63	3	0.00	1.00	0.00	3 vs. 2	0.00	0.00	0.00

x2 = Chi-square; df = degree of freedom; RMSEA = root mean square error of approximation; CFI = comparative fit index; SRMR = standardized root mean squared residual. The first full model includes all the 3 items of proficiency measuring four functions (R&D, multiplication, quality control and certification, and processing functions) for channel partners -both channel actors and farmers

Summary

With the ongoing concern about the food insecurity, poverty, and the low production and productivity level of the agricultural industry in many developing economies, companies, policy makers, GOs, NGOs, and development partners are increasingly interested in finding ways to adapt and/or to transform the existing food system for the sustainable increment of agricultural production, and to end extreme poverty, boost shared prosperity and feed a growing number of populations. As a result, seed sector development gains attention when seed security and food security are linked together with agricultural economic development in developed and developing economies. Cognizant of this fact, agricultural seed companies and their marketers are also interested in looking ways to adapt their business to the scarcity of quality seeds of different agricultural crops, thus for the development and delivery of superior quality seeds in a sustainable basis, to ensure high production and productivity, enhanced food security, and for economic growth of a nation. How companies, seed value chain actors or the seed industry, policy makers, GOs, NGOs, and development partners can do is, however, still not clear. This indicates the lack of understanding of how to incorporate insights from the MO theory into the companies or agricultural seed supply chains primary business and/or value chain function which is essential to create and deliver superior customer value.

The thesis argues that lessons on how to adapt MO to seed supply value chain functions can be draw from value chain actors and farmer customers in D&E market contexts. In doing so, the thesis identifies from a structural and end customer perspective, the strengths and weakness of different agricultural seed supply chains and functions for potential improvements. This will ensure the development of a more market-oriented seed supply chains that can respond to the expressed and latent needs of their customers or target markets. This will in turn boost agricultural production and productivity, enhanced food security, and reduction of poverty among large segments of a growing population.

Ethiopia has long suffered from food shortages and economic underdevelopment even though it is endowed with a wide range of crop and agro ecological diversity. Since the mid-1990s, Ethiopia puts agriculture at the heart of its economic development by launching its Agriculture Development Led Industrialization (ADLI) strategy. ADLI puts agriculture at the forefront of Ethiopia's development process. Yet, the performance of Ethiopian agriculture is below its potential. One important reason is the poor quality of the seed used, and a lack of demand focus on production, distribution, and marketing of seeds. The average annual

national seed supply of improved varieties for most food crops covers less than 10% of the total agricultural land area in Ethiopia, as compared to 25% in many other African nations.

High quality seed is the basis for the sustainable increase of agricultural production and reduction of poverty. Assuring access to quality seed is essential in efforts to reduce food insecurity and increase farm-derived income. The challenge facing Ethiopian agricultural development efforts is how to sustainably improve access to quality seed, as part of improving agricultural sector functioning. However, there is a substantial gap between the production of seeds and farmers' demand for seeds in Ethiopia. However, we do not sufficiently understand the mismatch between supply and demand for seed. One important reason is the lack of or the limited systematic studies on MO and performance in complex chains (seed supply systems) in D&E markets.

Effective seed systems enhance customer satisfaction and superior performance for firms. However, effectiveness and efficiency will come from the extent to which the functions are performed in a market-oriented way across the different stages of a seed value chain. MO contributes to effective seed systems, but measures for the MO of functions do not exist. Measuring the MO of seed systems is also difficult because measures of MO may not be comparable across functions and different perspectives. In doing so the thesis contributes to the literature gap on measuring supply systems by using the theoretical framework of MO from the perspectives of all channel actors and the end customers/farmers. More specifically, empirical evidence on how MO is applicable to and increases performance for seed supply systems and/or in a multi actor value chain setting in D&E markets is absent. The general aim of this thesis is to deepen the understanding of the implementation of MO in agricultural seed supply chains in D&E economies, taking Ethiopian seed supply chains as a relevant case.

To achieve the general objective of the study, this thesis explored four lines of empirical research: (1) How do end customers evaluate the performance of the Ethiopian seed supply systems/chains? (2) What is the influence of market channel functions on customer satisfaction with supply chains? (3) What is the degree of MO of the Ethiopian seed supply chains? and (4) How does MO influence the proficiency of supply chains?

To answer question 1, Chapter 3 offered a detailed understanding of the criteria that farmers use to evaluate the performance of the Ethiopian maize and teff seed supply systems. The chapter revealed that in the Ethiopian seed system context the customer performance measures are categorized into seven major themes for maize and eight for teff, encompassing 30 and 28 performance items, respectively. For farmer customers, the key evaluation criteria are that the seed supply systems deliver seed (1) of the right variety, (2) at the right quality, (3) easily available, (4) in the right quantity, (5) at an affordable price, (6) with adequate supporting services, (7) with limited production uncertainty, and specific to teff, (8) with an appreciation of cultural heritage. These key themes of customer satisfaction criteria by and large cover important elements of the MO concept in general marketing theory, which can be related to the factors that drive customer satisfaction of market offerings in agricultural food value chains. Hence the results of chapter 3 suggested that the criteria of customer satisfaction are also applicable in the D&E market and in seed supply systems.

Chapter 4 presented the results of a quantitative study with 170 end customers (i.e., farmers) for deeper understanding and analysis of the influence of market channel functions proficiency on the customer satisfaction with supply chains for maize, teff, and beans in three regions of Ethiopia, Amhara, Oromia, and the Southern. It links the various functions performed within seed supply systems with the end customer satisfaction criteria identified in chapter 3 of this thesis. Overall performance or customer satisfaction of the whole value chain was measured for each channel that the farmers buy from. Across the three crops (maize, teff, and beans), six key market channel functions that contribute to customer satisfaction were identified, which together can be grouped as (a) the R&D function, (b) the multiplication function, (c) the quality control and certification function, (d) the distribution function, (e) the pricing function, and (f) the marketing service function. The results show that the seed multiplication function followed by distribution, R&D, price, marketing service, and quality control and certification functions predominately contribute to the end customer overall satisfaction of seed offers. This chapter shows that irrespective of economic development (i.e., developed versus D&E markets), performing functions proficiently across the different stages of a value chain contributes to superior customer satisfaction. The chapter further revealed the dominant value chain constellations in Ethiopian seed supply chains. The results show that the Ethiopian seed supply chains have developed around a specific set of "prototypical" constellations. It identified 43 unique supply chain configurations, in the data: 16 for maize, 18 for teff and 9 for beans. The chapter presented an inventory of which value chain constellations have emerged/survived and analyzed why in terms of (a) overall perceived satisfaction with these constellations and (b) perceived proficiency with the marketing (market channel) functions performed by the actors involved.

Chapter 5 focused on how MO is best measured in the Ethiopian seed supply system context building on insights from market orientation theory (Kohli & Jaworski, 1990; Kohli et al., 1993). In doing so, the chapter adapted the specific MO components (information generation, information dissemination, and responsiveness) at the level of each market channel function performed within seed supply systems. The chapter explored MO of supply chains (maize, teff, and beans) from four perspectives: (1) the organization performing a function, (2) customers, (3) suppliers, and (4) the final customers/farmers. This chapter revealed that in the Ethiopian seed supply chain context the degree of MO differs between functions, crops, and perspectives. The chapter showed that both suppliers and customers are more negative about the MO of a focal organization (i.e., the organization performing a function) than the focal organizations own evaluation. Customers are more negative about the MO of the focal organization than suppliers. However, a focal organization perceives MO of the function performed by themselves higher than their suppliers and customers. In general, from the lesser MO of a focal organization that customers and suppliers express with, as well as their level of (dis-) satisfaction, it seems that there is much to be gained by incorporating the "voice of the customer"/farmer more centrally in the development and provision of seeds. This basic contention from MO is central to Ethiopian Agricultural policy and is a cornerstone of the government ambition to restructure its seed supply systems. Hence, the results of chapter 5 suggested how the existing and validated MO scales can be applicable in seed system contexts, like that of high-income economies.

Chapter 6 examined the market orientation- proficiency relationship in the Ethiopian seed supply chains context. This chapter quantitatively assessed the influence of MO on the proficiency of supply chain functions. The results show that MO contributes to higher proficiency of functions, though the strength of the relationship differs between the various functions, crops, and perspectives. The study confirms that MO has a positive influence on the proficiency of seed supply value chain functions in D&E markets. The relationship between MO and performance, which is well documented in the literature, also exists for Ethiopian seed supply systems. The positive influence of MO on proficiency in D&E markets aligns with the core of marketing concept i.e., create and maintain customer value. This indicates that MO of seed supply chains is very important for superior performance of firms and a strong basis for the livelihood of farmer customers. Hence, all organizations participating in the Ethiopian seed sector need to foster an organizational culture that most effectively and efficiently creates the necessary behaviors for the creation of superior value for buyers/customers, and thus, continuous superior performance for the business.

Finally, Chapter 7 synthesizes the results of the preceding chapters, draws main conclusions, and discuss the implications for theory, seed supply chains, policy makers and development partners. In general, this thesis shows that understanding customer satisfaction criteria and implementation of MO across value chain functions can indeed improve the performance of the different seed supply chains. Seed supply chains' need to establish and strengthen a customer and competitor-oriented culture to obtain competitive edge as well as for superior performance of the business, and farmers' livelihood. This thesis also explores the concept of new product development (proficiency on executions of functions) with the marketing concept (i.e., MO). Formal, informal, and intermediary seed systems can contribute to seed supply improvement and enhanced production and productivity of farmers by understanding the key customer criteria of market offerings and by being responsiveness to those needs (i.e., being market oriented). For seed supply chains to be successful and sustain in the business, policy makers and development partners should support the different seed systems to implement effectively and efficiently the key MO components. The thesis acknowledges the complementarity of roles between the alternative seed supply systems in Ethiopia.

The role of the seed industry improved crop varieties has enabled farmers in advanced agricultural systems to triple their yields and to ensure their food security. What is the seed industry doing to enable smallholder farmers in developing regions to achieve similar results? The thesis shines a light on this question. The thesis seeks primarily to identify strengths and weaknesses from a value chain perspective, providing an evidence base for the practical and managerial implications on where and how the seed industry can do more. A chain is as strong as its weakest link. Hence value chain actors should know their strengths and work on their weaknesses. The thesis also offers advice for seed companies, development partners, policy makers, GOs, and NGOs on how to create and maintain a more market-oriented seed sector that will accelerate the development of competitive seed systems serving smallholder farmers. The goal of development organizations and policy makers is to increase food security and livelihood by increasing agricultural productivity. In doing so, the thesis shows ways on how this goal can be achieved: improving proficiency of market channel functions and increasing the MO of supply chain actors.

Samenvatting

Door de aanhoudende bezorgdheid over voedselonzekerheid, armoede en lage productie- en productiviteitsniveaus van de landbouw in veel opkomende economieën, zijn bedrijven, beleidsmakers, GO's, NGO's en ontwikkelingspartners steeds meer geïnteresseerd in het vinden van manieren om het bestaande voedselsysteem te transformeren voor een duurzame toename van de landbouwproductie om extreme armoede te beëindigen en om gedeelde welvaart te stimuleren en om een groeiende bevolking te voeden. Als gevolg hiervan groeit de aandacht voor de ontwikkeling van de zaadsector, omdat zaadzekerheid en voedselzekerheid worden gekoppeld aan agrarische economische ontwikkeling in ontwikkelde en zich ontwikkelende economieën. Hierdoor zoeken zaadvermeerderingsbedrijven en hun marketers naar manieren om met hun bedrijf in te spelen op de schaarste aan kwaliteitszaden van verschillende landbouwgewassen. Ze zetten zich in voor de ontwikkeling en levering van zaden van superieure kwaliteit op een duurzame basis, om hoge productie en productiviteit te realiseren, om voedselzekerheid te verbeteren en voor economische groei van een natie. Hoe actoren in de zaadwaardeketen of de zaadindustrie, zoals bedrijven beleidsmakers, GO's, NGO's en ontwikkelingspartners dit kunnen doen, is echter nog steeds niet duidelijk. Dit wijst op een beperkt begrip van hoe inzichten uit de markt oriëntatie (MO) theorie kunnen worden toegepast op waardeketenfuncties of bedrijven in de toeleveringsketens van landbouwzaden, terwijl dat essentieel is om superieure klantwaarde te creëren en te leveren.

Dit proefschrift stelt dat er lessen kunnen worden geleerd uit hoe MO aan te passen is aan de functies in de toeleveringsketen van zaden van waardeketenactoren en met boeren als klanten in de context van D&E markten. Door dit te doen, identificeert dit proefschrift mogelijkheden voor verbeteringen van sterke en zwakke punten in verschillende toeleveringsketens voor landbouwzaden en van functies, vanuit het perspectief van de uiteindelijke klant. Dit zal zorgen voor de ontwikkeling van meer marktgerichte toeleveringsketens voor zaden die kunnen inspelen op uitgesproken en latente behoeften van hun klanten of doelmarkten. Dit zal op zijn beurt de landbouwproductie en -productiviteit stimuleren, de voedselzekerheid vergroten en de armoede onder grote delen van een groeiende bevolking terugdringen.

Ethiopië heeft lange tijd te lijden gehad van voedseltekorten en economische onderontwikkeling, hoewel het beschikt over een breed scala aan gewassen en agro-ecologische diversiteit. Sinds het midden van de jaren negentig plaatst Ethiopië landbouw in het hart van zijn economische ontwikkeling door de lancering van haar strategie van ‘industrialisatie geleid door agrarische ontwikkeling’ (Agriculture Development Led

Industrialization ADLI). ADLI plaatst landbouw in de voorhoede van het ontwikkelingsproces voor Ethiopië. Toch blijven de prestaties van de Ethiopische landbouw beneden zijn potentieel. Een belangrijke reden is de slechte kwaliteit van het gebruikte zaad en een gebrek aan vraagfocus bij de productie, distributie en marketing van zaden. De gemiddelde jaarlijkse nationale zaadvoorraad van verbeterde variëteiten voor de meeste voedselgewassen beslaat minder dan 10% van het totale landbouwareaal in Ethiopië, vergeleken met 25% in veel andere Afrikaanse landen.

Zaad van hoge kwaliteit is de basis voor duurzame verhoging van de landbouwproductie en vermindering van armoede. Het verzekeren van toegang tot kwaliteitszaad is essentieel bij inspanningen om de voedselonzekerheid te verminderen en het inkomen van boeren te verhogen. De uitdaging waarmee de Ethiopische inspanningen op het gebied van landbouwontwikkeling worden geconfronteerd, is hoe de toegang tot kwaliteitszaad duurzaam kan worden verbeterd als onderdeel van het verbeteren van het functioneren van de landbouwsector. Er is echter een aanzienlijke kloof in Ethiopië tussen de productie van zaden en de vraag van boeren naar zaden. We begrijpen echter onvoldoende de mismatch tussen vraag en aanbod van zaad. Een belangrijke reden is het gebrek aan systematische studies naar MO en prestaties in complexe ketens (zaadtoeleveringssystemen) in D&E-markten.

Effectieve zaadsystemen verhogen de klanttevredenheid en superieure prestaties voor bedrijven. Effectiviteit en efficiëntie zullen echter voortkomen uit de mate waarin de functies op een marktgerichte manier worden uitgevoerd in de verschillende stadia van een zaadwaardeketen. MO draagt bij aan effectieve zaadsystemen, maar meetinstrumenten voor de MO van functies bestaan niet. Het meten van de MO van zaadsystemen is ook moeilijk omdat meetinstrumenten voor MO mogelijk niet vergelijkbaar zijn tussen functies en tussen verschillende perspectieven. Door het theoretische raamwerk van MO te gebruiken vanuit het perspectief van alle kanaalactoren en de eindklanten/boeren draagt het proefschrift bij aan de literatuur over meten in en verbeteren van leveringssystemen. Meer specifiek is er geen empirisch onderzoek naar hoe MO van toepassing is op en de prestaties verbetert van zaadleveringssystemen en/of van een waardeketen met meerdere actoren in D&E-markten. Het algemene doel van dit proefschrift is om het begrip van en de implementatie van MO in de toeleveringsketens van landbouwzaden in D&E-economieën te verdiepen, waarbij Ethiopische toeleveringsketens voor zaden als een relevante case worden beschouwd.

Om de algemene doelstelling van de studie te bereiken, verkent dit proefschrift vier lijnen van empirisch onderzoek: (1) Hoe evalueren de uiteindelijke klanten de prestaties van de Ethiopische zaadtoeleveringssystemen/ketens? (2) Wat is de invloed van marktkanaalfuncties op klanttevredenheid met toeleveringsketens? (3) Wat is de MO van de Ethiopische toeleveringsketens voor zaden? en (4) Hoe beïnvloedt MO de vakbekwaamheid van toeleveringsketens?

Om vraag 1 te beantwoorden, biedt hoofdstuk 3 een gedetailleerd inzicht in de criteria die boeren gebruiken om de prestaties van de Ethiopische maïs- en teff-zaadtoeleveringssystemen te evalueren. Uit het hoofdstuk blijkt dat in de context van het Ethiopische zaadsysteem de evaluaties door klanten zijn onderverdeeld in acht hoofdthema's voor maïs en zeven voor teff, die respectievelijk 30 en 28 prestatie-items omvatten. Voor boerenklanten zijn de belangrijkste evaluatiecriteria dat de zaadtoeleveringssystemen zaad leveren (1) van het juiste ras, (2) met de juiste kwaliteit, (3) gemakkelijk verkrijgbaar, (4) in de juiste hoeveelheid, (5) tegen een betaalbare prijs, (6) met adequate ondersteunende diensten, (7) met beperkte productieonzekerheid en, specifiek voor teff, (8) met waardering voor cultureel erfgoed. Deze hoofdthema's van klanttevredenheidscriteria bestrijken over het algemeen belangrijke elementen van het MO-concept in de algemene marketingtheorie, die gerelateerd kunnen worden aan de factoren die de klanttevredenheid van het marktaanbod in agrarische voedselwaardeketens stimuleren. Vandaar dat de resultaten van hoofdstuk 3 suggereren dat de criteria van klanttevredenheid ook van toepassing zijn op D&E-markten en in zaadtoeleveringssystemen.

Hoofdstuk 4 presenteert de resultaten van een kwantitatieve studie onder 170 eindklanten (d.w.z. boeren). Het analyseert de invloed van de vakkundigheid waarmee marktkanaalfuncties worden uitgevoerd op de klanttevredenheid met toeleveringsketens voor maïs, teff en bonen in drie regio's van Ethiopië: Amhara, Oromia en het Zuiden. Het verbindt de verschillende functies die worden uitgevoerd binnen zaadtoeleveringssystemen met de eindklanttevredenheidscriteria die in hoofdstuk 3 van dit proefschrift zijn geïdentificeerd. De algehele prestatie van, ofwel de klanttevredenheid met, de hele waardeketen werd gemeten voor elk kanaal waarvan de boeren kopen. Voor de drie gewassen (maïs, teff en bonen) worden zes belangrijke marktkanaalfuncties geïdentificeerd die bijdragen aan klanttevredenheid: (a) de R&D-functie, (b) de vermenigvuldigingsfunctie, (c) de kwaliteitscontrole en certificeringsfunctie, (d) de distributiefunctie, (e) de prijsfunctie, en (f) de marketingservicefunctie. De resultaten laten zien dat de functie van zaadvermenigvuldiging, gevolgd door distributie, R&D, prijs, marketingservice en kwaliteitscontrole en certificeringsfuncties voornamelijk bijdragen aan de algehele tevredenheid van de eindklant over zaadaanbiedingen. Dit hoofdstuk laat zien dat, ongeacht de economische ontwikkeling (d.w.z. ontwikkelde versus D&E-markten), het vakkundig uitvoeren van functies in de verschillende stadia van een waardeketen bijdraagt aan superieure klanttevredenheid. Het hoofdstuk onthult verder de dominante waardeketenconstellaties in Ethiopische zaadtoeleveringsketens. De resultaten laten zien dat de Ethiopische toeleveringsketens voor zaden zich hebben ontwikkeld rond een specifieke reeks "prototypische" constellaties. Het identificeert 43 unieke waardeketenconfiguraties: 16 voor maïs, 18 voor teff en 9 voor bonen. Het hoofdstuk inventariseert welke waardeketenconstellaties zijn ontstaan en hebben overleefd en analyseert waarom ze hebben overleeft in termen van (a) algemeen ervaren tevredenheid met deze constellaties en (b) ervaren vakbekwaamheid waarmee de marktkanaalfuncties door de betrokken actoren worden uitgevoerd.

Hoofdstuk 5 concentreert zich op hoe MO het beste kan worden gemeten in de context van het Ethiopische zaadvoorzieningssysteem, voortbouwend op inzichten uit de marktoriëntatietheorie (Kohli & Jaworski, 1990; Kohli et al., 1993). Daarbij heeft het hoofdstuk de specifieke MO-componenten (informatiegeneratie, informatieverspreiding en responsiviteit) aangepast aan elke marktkanaalfunctie die wordt uitgevoerd binnen zaadleveringssystemen. Het hoofdstuk onderzoekt de MO van de toeleveringsketens (maïs, teff en bonen) vanuit vier perspectieven: (1) de organisatie die een functie vervult, (2) klanten, (3) leveranciers en (4) de uiteindelijke klanten/boeren. Dit hoofdstuk laat zien dat in de Ethiopische context van de toeleveringsketen van zaden de mate van MO verschilt tussen functies, gewassen en perspectieven. Uit het hoofdstuk blijkt dat zowel leveranciers als klanten negatiever zijn over de MO van een organisatie (d.w.z. de organisatie die een functie vervult) dan de eigen inschatting van de organisaties. Klanten zijn negatiever over de MO van de organisatie dan leveranciers. Een organisatie beoordeelt de MO van de door henzelf uitgevoerde functie echter hoger dan hun leveranciers en klanten. Op basis van de lagere beoordeling van de MO door klanten en toeleveranciers en hun (on) tevredenheid lijkt het erop dat er veel te winnen valt met het inbouwen van de "stem van de klant/ boer” bij de ontwikkeling en levering van zaden. Deze fundamentele stelling van MO staat centraal in het Ethiopische landbouwbeleid en is een hoeksteen van de ambitie van de regering om haar zaadvoorzieningssystemen te herstructureren. Daarom doet hoofdstuk 5 op basis van de resultaten suggesties over hoe bestaande en gevalideerde MO-schalen kunnen worden toegepast in de context van zaadsystemen, net zoals in ontwikkelde economieën.

Hoofdstuk 6 onderzoekt de relatie tussen marktoriëntatie en vakkundigheid van functies in de context van Ethiopische toeleveringsketens van zaden. In dit hoofdstuk is de invloed van MO op de vakkundigheid van waardeketenfuncties kwantitatief beoordeeld. De resultaten laten zien dat MO bijdraagt aan een hogere vakkundigheid van functies, hoewel de sterkte van de relatie verschilt tussen de verschillende functies, gewassen en perspectieven. De studie bevestigt dat MO een positieve invloed heeft op de vakkundigheid van de waardeketenfuncties van zaden in D&E-markten. De relatie tussen MO en prestaties, die goed gedocumenteerd is in de literatuur, bestaat ook voor Ethiopische zaadtoevoersystemen. De positieve invloed van MO op vakkundigheid van functies in D&E-markten sluit aan bij de kern van het marketingconcept, namelijk het creëren en behouden van klantwaarde. Dit geeft aan dat de MO van zaadtoeleveringsketens erg belangrijk is voor superieure prestaties van bedrijven en een sterke basis is voor het levensonderhoud van boerenklanten. Daarom zouden alle organisaties die deelnemen aan de Ethiopische zaadsector een organisatiecultuur moeten bevorderen die het meest effectief en efficiënt het noodzakelijke gedrag creëert voor het creëren van superieure waarde voor kopers/klanten, en dus continue superieure prestaties voor het bedrijf.

Hoofdstuk 7, ten slotte, vat de resultaten van de voorgaande hoofdstukken samen, trekt de belangrijkste conclusies en bespreekt de implicaties voor de theorie, de toeleveringsketens van zaden, beleidsmakers en ontwikkelingspartners. In het algemeen laat dit proefschrift zien dat het begrijpen van klanttevredenheidscriteria en de implementatie van MO over waardeketenfuncties inderdaad de prestaties van de verschillende zaadtoevoerketens kan verbeteren. Toeleveringsketens voor zaden moeten een klant- en concurrentgerichte cultuur tot stand brengen en versterken om een concurrentievoordeel te verkrijgen voor superieure prestaties van het bedrijf en om op die manier de leefbaarheid van boeren te verbeteren. Dit proefschrift onderzoekt ook de invloed van het marketing concept (d.w.z. MO) op de ontwikkeling van nieuwe producten (vakbekwaamheid in het uitvoeren van functies). Formele, informele en intermediaire zaadsystemen kunnen bijdragen aan een verbetering van de zaadvoorziening en een verhoogde productie en productiviteit van boeren door de belangrijkste klantcriteria van het marktaanbod te begrijpen en door op die behoeften in te spelen (d.w.z. marktgericht te zijn). Om de toeleveringsketens van zaden succesvol te laten zijn en in stand te houden, moeten beleidsmakers en ontwikkelingspartners de verschillende zaadsystemen ondersteunen om de belangrijkste MO-componenten effectief en efficiënt te implementeren. Het proefschrift erkent de complementariteit en rollen van de alternatieve zaadtoevoersystemen in Ethiopië.

Door de zaadindustrie verbeterde gewasvariëteiten hebben boeren in geavanceerde landbouwsystemen in staat gesteld hun opbrengsten te verdrievoudigen en hun voedselzekerheid te waarborgen. Wat doet de zaadindustrie om kleine boeren in ontwikkelingsregio's in staat te stellen vergelijkbare resultaten te behalen? Het proefschrift werpt licht op deze vraag. Het proefschrift is primair gericht op het identificeren van sterke en zwakke punten vanuit een waardeketenperspectief, en biedt op bewijs gebaseerde praktische en managementimplicaties over waar en hoe de zaadindustrie meer kan doen. Een ketting is zo sterk als de zwakste schakel. Daarom moeten actoren in de waardeketen hun sterke punten kennen en aan hun zwakke punten werken. Het proefschrift biedt ook advies aan zaadbedrijven, ontwikkelingspartners, beleidsmakers, GO's en NGO's over het creëren en onderhouden van een meer marktgerichte zaadsector die de ontwikkeling van concurrerende zaadsystemen ten dienste van kleine boeren zal versnellen. Het doel van ontwikkelingsorganisaties en beleidsmakers is om de voedselzekerheid en het levensonderhoud te vergroten door de landbouwproductiviteit te verhogen. Door dit te doen, laat het proefschrift zien hoe dit doel kan worden bereikt: het verbeteren van de vakbekwaanheid van marktkanaalfuncties en het vergroten van de MO van spelers in de toeleveringsketen.

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Biography

Shimelis Altaye Bogale was born (08 Dec 1983) in Jimma, Ethiopia. He has a BSc degree in Agriculture (Agricultural Extension) from Haramaya University (July 2004), and M.A in Development Studies (Regional and Local Development Studies) from Addis Ababa University (July 2010), Ethiopia. He has worked as a lecturer, and socio-economics researcher in higher learning (*Welega*) and public agricultural research (*Adet*) institutes, respectively in the period between August 2004 and August 2010. He then joined to project/program LSB/ISSD Ethiopia of the Netherlands based at Hawassa University and where he worked for 5.3 years of his career [Nov. 2010- Jan. 2016] in parallel with his PhD studies in the period between Oct. 2012 and Jan 2016. Since Sept. 2019 till now he has been working as a senior business development expert in the Ethiopian Agricultural Transformation Agency (ATA) based at Hawassa branch. Bogale main interest areas of research include agriculture and seed systems, marketing and market orientation, agri-business and value chains, supply chain management, partnerships and innovations, entrepreneurship and resilience, and research for development. His previous publications include: **Bogale, S. A.,** Verhees, F. J., & van Trijp, H. C. v. (2018). Customer Evaluation of Supply Systems: The Case of Ethiopian Seed Supply Systems. *Journal of African Business*, *19 (4), 550*-570; **Shimelis Altaye Bogale** (2015). Does Direct Seed Marketing Matter? Exploration of Attitudinal Change of Partners in the Southern Region of Ethiopia. *International Journal of Agriculture Innovations and Research, 4(3), 460-465;* **Shimelis Altaye** & Hussein Mohammed (2013). Linking Seed Producer Cooperatives with Seed Value Chain Actors: Implications for Enhancing the Autonomy and Entrepreneurship of Seed Producer Cooperatives in Southern Region of Ethiopia. *International Journal of Cooperative Studies, 2(2), 61-65;* **Shimelis Altaye** (2012). Analysis of Research-Extension-Farmer Linkage in Finger Millet Technology Development and Delivery in Mecha District of Amhara Region, Ethiopia. *Journal of Agricultural Economics and Development, 1(6), 121-129;* and a book titled**: Shimelis Altaye** (2011). Enhancing Research-Extension-Farmers Linkage in Ethiopia: Success Factors for Collective Innovation. *VDM Verlag Dr. Muller¨GmbH & Co. KG, German:* ISBN: 978-3-639-34364-9. 156p. He published proceedings on the areas of potato, finger millet, and teff varieties development and adoption in Ethiopia (2005-2010). He can be reached at: shimealt@yahoo.com; shimealt@gmail.com.

Completed Training and Supervision Plan

Shimelis Altaye Bogale

Wageningen School of Social Sciences (WASS)
Completed Training and Supervision Plan

Name of the learning activity	Department/Institute	Year	ECTS*
A) Project related competences			
Microfinance and Marketing in Developing Countries, DEC-51806	WUR	2013	6
PhD Proposal writing	MCB, WUR	2013	6
PhD Colloquium MCB Group	MCB, WUR	2013	0.5
"Market Orientation and Performance in Seed Supply Systems of Ethiopia: A theoretical perspective"	ISSD National Workshop, Mekelle, Ethiopia	2013	1
"Customer Perception and Evaluation of Ethiopian Seed Supply Systems: Preliminary Results"	ISSD National Seed Marketing Workshop, Addis Ababa, Ethiopia	2014	1
B) General research related competences			
Quantitative and Qualitative Research Techniques (for the Social Science) (YSS 20306)	WUR	2012	6
Techniques for Writing and Presenting Scientific Papers	WGS	2013	1.2
Research Methodology: From Topic to Proposal	WASS	2012	4
WASS Introduction Course	WASS	2013	1
Data Management	WGS	2012	0.4
Information Literacy including EndNote Introduction	WGS	2013	0.6
Reviewing a Scientfic Paper	WGS	2017	0.1
Food Value Chain Research: Understanding Inter-Organizational Relationships	WASS	2017	1.5
C) Career related competences/personal development			
Entreprenership in and outside science	WGS	2017	1.1
Practicing Feminist Political Ecology: Linking Gender, Theory, Self and Sustainable Development	WASS	2017	0.5
"Market Orientation and Performance in Seed Supply Systems of Ethiopia: Preliminary Results"	PhD Seminar of MCB Group, WUR	2017	1
"The Influence of Marketing Channel Functions on the Performance of Supply Chains: The Case of Ethiopian Seed Supply Systems"	WASS PhD Day	2018	1
Total			**32.9**

*One credit according to ECTS is on average equivalent to 28 hours of study load

Abbreviations

WUR: Wageningen University & Research

MCB: Marketing and Consumer Behavior

ISSD: Integrated Seed Sector Development

WGS: Wageningen Graduate School

WASS: Wageningen School of Social Sciences

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