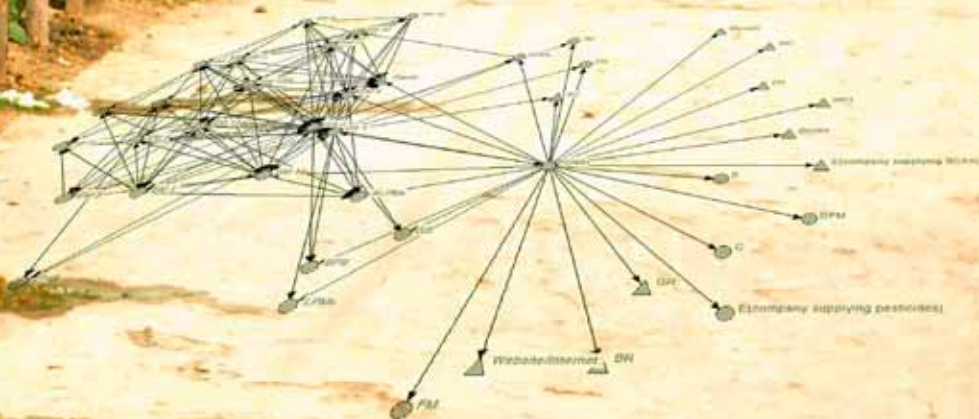




BEYOND TECHNOLOGY TRANSFER

an integrative analysis of plans, practice,
and know-how in Ethiopian floriculture



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**Beyond technology transfer:
an integrative analysis of plans, practice, and
know-how in Ethiopian floriculture**

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an integrative analysis of plans, practice, and
know-how in Ethiopian floriculture**

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CHAPTER 1

General introduction

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General introduction

Introduction

Ethiopia, located in Eastern Africa, has an area of about 1.1 million square kilometres and a population of more than 82 million people. It is the second-most populous country in Africa, after Nigeria (EPA 2012). Agriculture is the dominant sector contributing to about 85 percent of the total employment and foreign exchange earnings and 47.3 percent Gross Domestic Product (GDP) (for a detailed account see Dorosh and Rashid 2013). Teff, wheat, maize, sorghum, and barley are the main food crops. Coffee has been the dominant export commodity. Recently, agriculture in the country is moving from subsistence farming to commercial production, such as floriculture for export markets.

Floriculture has become the fastest growing sub-sector in the country (Mano et al. 2011, Lui 2014). Particularly since 2000, a number of foreign companies, mainly from EU countries, have joined the sector through direct investment (Weissleder 2009). In 2014, 84 flower farms, of which more than half are of foreign origin, are operating in Ethiopia. The floriculture sector has created employment for an estimated number of 60,000 people. Due to the rapid expansion of the sector, the export value of cut flower increased from USD 12.60 million in 2004 to USD 211.89 million in 2014 (EHPEA 2014).

Roses and cuttings are the dominant flowers, mainly grown in greenhouses. Roses account for more than 80 percent of the sector (EHPEA, 2014). The average farm size is 5–10 ha, with few larger farms having up to 42 ha. The major growing areas are located around Addis Ababa, Debre Zeit, Koka, Ziway, Hawassa, and Bahir Dar (Figure 1).

The country is currently the second largest flower producer in Africa next to Kenya. The EU markets (The Netherlands, Germany, and UK), and Switzerland, and Russia are the main export destinations. A favourable climate, low labour cost, and attractive incentives, such as access to land and long term local bank loans for growers, are among the factors that contributed to the development of the sector (Stebek 2012, Gebreeyesus 2014).

However, this emerging sector faces a number of challenges. One challenge is the limited professional experience in and knowledge of export oriented flower sector in Ethiopia, as floriculture is a new industry in the country. Secondly, the global market and related certification schemes demand high quality products, sustainability of production, and

corporate social responsibility. In Ethiopia, associated exporters and flower farms work in tandem with public policy to meet these challenges. Their endeavours mainly concentrate on introducing and ensuring compliance with codes of practice, involving (foreign) experts and university graduates, and importing hardware and tools. Recently, the Ethiopian Horticulture Producers Exporters Association (EHPEA) developed and introduced a code of practice (EHPEA code of practice). With this code EHPEA aims to improve flower quality and enhance competitiveness of the flower sector (for a detailed account of the code see Stebek 2012). According to the code, capabilities to produce flowers in a socially and environmentally acceptable way are vital for the sector. Complementary efforts of the association focus on the acquisition and transfer of tools and hardware and on the introduction of uniform practices and techniques mainly originating from advanced regions. The stated commitment to high principles and standards is illustrated by the following set of indicators listed in the code of practice (EHPEA code of practice, 2011, version 2. 13, p. 57, 68):

- growers implement Good Agricultural Practices (GAP) and ensure that practices such as pest management are achieved with a minimum use of pesticides and impact on the environment such by using an Integrated Pest Management (IPM);
- the person technically responsible for the practices has a high level of education / training / expertise;
- growers implement projects that benefit the local community through the impression of Corporate Social Responsibilities (CSR), at the highest standards, (“gold level”).

The research has been embedded in a collaborative programme addressing this search for new forms of professional competence. This programme is implemented by Jimma University – College of Agriculture and Veterinary Medicine – Department of Horticulture in Ethiopia in collaboration with Wageningen UR and PTC+ in the Netherlands. The programme was funded by Netherlands Programme for Institutional Strengthening of Post-secondary Education and Training Capacity (NPT-NUFFIC). This programme has been developed the project in close consultation with the Ethiopian Horticultural Producers and Exporters Association (EHPEA), representing the horticulture industry in Ethiopia and public institutions, such as the Ministry of Trade and Industry (MoTI), Ministry of Agriculture and Rural Development (MoARD) and the Ethiopian Horticultural Development Agency (EHDA). The programme has developed curricula for master and bachelor training as well as shorter trainings and aimed to strengthen the capacity of post-secondary education and training organisations in the context of increasing quality demands in international market and global values chains and by the observed need for chain coordination.

General introduction

Although the research is motivated by the observation that floriculture in Ethiopia resembles a knowledge-intensive industry and is confronted with increasing demands in the international market to comply with standards for environmentally benign production and corporate social responsibility, the thesis neither identifies what type of new competence may be required nor whether the competence of university graduates suffices. Yet, the thesis is critical about the default mechanism to revert to training of individuals induced by the sector standards introduced in Ethiopian floriculture, a move also considered problematic by Mulder (2014). Moreover, the research among employers, graduates and university lectures, reveals that competences are being rated differently, which confirms research by Mulder et al. (2007). Initial research, which is confirmed by the study presented in Chapter 4, suggested a disconnection between education, the labour market, and professional work (a general observation also made in Mulder 2014). However, bridging this gap is not specifically tackled by the thesis. This is because its main contribution, following the agenda proposed by Jean Lave (1993), is to present a rich empirical study looking closely at everyday activity rather than seeking to generate a measurable conceptualisation of competence and its effects. There are no doubts about the importance of the latter, but empirical investigation in the ethnographic tradition represented by Lave is equally important.

In this study, performance is conceptualised as a process of making (Jansen and Vellema 2011, Richards, 1993), rather than as a measurable outcome of individual or collective behaviour. The present research has an explicit focus on making the role of materiality, physical layout, and technical objects and embodied skills in learning visible (Dant 2008 on British car mechanics, and Jaarsma, Maat and Richards [2011] on apprenticeship in Ghana). Therefore, the thesis seeks to explore how the practices stipulated in the code of practice are enacted in the everyday realities of workers, technicians, and managers in the floriculture sector. This is examined in processes of solving practical problems in primary agricultural activities. Specifically, the study emphasizes situated problem solving practices as a context for emerging know-how to handle unanticipated or composite problems within the everyday socio-materiality in the greenhouse and beyond. It investigates these practices by focusing on: (1) a complicated agronomic problem, namely pest and disease management, (2) the functioning of university graduates employed by flower farms, and (3) the relationship between flower farms and the surrounding community relations in the context of shared use of a common pool resource, namely water from the lake.

The rest of this chapter provides an overview of the underlying assumptions of the reliance on pre-set devices, such as codes, and prior capabilities of employed graduates. Then it presents the concerns of the present research in the context of ongoing debates related to

models largely based on pre-set practices. This is followed by presenting methodological choices of the study, the research objectives, and questions. Finally, it outlines the contents of the thesis.

The research problem: codes of practice, situated problem solving activities, and knowing how to manage pests

The research aims to unravel how codified information in standards and certification procedures used in global value chains generates relatively stable capabilities of the flower business in Ethiopia. Such capabilities enable flower farms to perform in competitive and demanding markets and to handle complicated and composite problems related to quality of products (flowers) and the production process. The empirical focus of the study is on the code of practice developed and implemented in the Ethiopian floriculture sector, which is closely associated with regulation of product and production process qualities from a distance, for example by private auditors or government agencies. These regulators use monitoring tools and uniform indicators to check whether production practices are in line with prescribed practices, often based on expert knowledge. An underlying assumption of this approach is that the development of problem solving capabilities occurs through transfer of hardware, knowledge, experiences, and best practices included in codes and manuals. In addition, codes are increasingly recognized as coordination tools that can help to improve capabilities by enhancing access to knowledge.

The model inherent to the code of practice in the Ethiopian floriculture sector builds on the idea that upgrading of local firms in developing regions is enabled through providing access to knowledge and tools, often in the form of techno-scientific scripts (codes and manuals) and hardware. Upgrading then capacitates local firms to operate in line with the requirements in the global market. The approach links closely to building the capacity of individuals and firms/farms through formal training/education so that they can use the scripts and imported hardware in prescribed ways. The emphasis on compliance with and conformity to pre-set-practices relates capabilities to gaining access to: (1) scripted best practices/codes (2) individuals' prior capabilities or experiences/educational backgrounds.

Commonly, policy and practice in the field of market-led development tend to concentrate on including firms and farmers into global value chains by enabling compliance with prescribed practices and offering training on techniques and tools, which seemingly lead to predictable outcomes. The issue of enabling compliance relates to on-going debates on whether and how value chain governance, in particular standards, certification, and codes,

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encourages upgrading and technology / knowledge transfer (see Bell and Albu 1999, Chataway and Wield 2000, Morrison et al. 2008, Kaplinsky 2000, Humphrey and Schmitz 2002, Biggs 1990, Helmsing and Vellema 2011). Specifically, issues related to features of capabilities that can emerge when pre-set arrangements are translated into practice or know-how seems invisible in the discussion of technology transfer (see also Bell and Figueiredo 2012, Pietrobelli and Rabellotti 2011).

Indubitably, codes of practice, hardware, and formal education and training can be important elements of building capabilities. The concern of my thesis is not to call into question possibilities that codes, hardware, and prior capabilities of individuals can offer for building and guiding problem solving capabilities within flower farms. However, I question the efficacy of this approach in agriculture, particularly in addressing complicated problems that involve managing the interactions between pests, plants and human action, or that cross the organizational boundaries of a firm and involve actions for managing common pool resources and corporate-community relationships. A one-sided interest in standardized procedures, formal training, and codes of practice may oversimplify our understanding of the way firms develop and sustain capabilities. Such an exclusive focus tends to dismiss capabilities to choose, use, and modify externally sourced technology or knowledge, which according to Bell and Figueiredo (2012), can be related to the shortage of empirical research at a firm or practice level in the context of less developed regions.

This thesis aims to develop a grounded understanding of how capabilities are formed or emerge in the daily practices and interactions of people and teams within firms operating in the context of less developed regions. The research endeavours to detect problem solving capabilities visible in the performance of daily practices, and complement the exclusive focus on compliance with and conformity to pre-set practices and devices, such as those included in a code of practice. It centres on know-how as a critical aspect in solving practical problems (Duguid 2005). The thesis considers this particularly important in the context of agricultural production, which is highly contextual and wherein the biological processes are only partially manageable by human intent.

The thesis addresses two major limitations of the assumption underlying standardized procedures and codes of practice currently implemented in Ethiopian floriculture. First, the model ignores the importance of context and learning (see Chataway and Wield 2000). It appears similar to much critiqued views in the 1960s of technology and industrialization, wherein according to Bell and Albu (1999), the main technological tasks were merely to acquire and learn how to use available technologies. The only needed technological

capabilities were those for undertaking such routine investment and production activities (ibid, p. 1717). Hence, capabilities that emerge at the level of practice remain invisible.

Second, with its emphasis on governance and the potential implications of governance for upgrading, the code of practice relies strongly on intents (see for instance Humphrey and Schmitz 2002). However, others argue that mere dependence on compliance with pre-set intents cannot enhance product quality, promote performance, and lead to upgrading (for instance Morrison et al. 2008, Danse and Vellema 2005, Vellema and Jansen 2007, Kaplinsky 2000, Helmsing and Vellema 2011). The approach visible in the code of practice covers only one part of problem solving capacities and leaves aside what people are doing with the code, hardware, and prior capabilities in their everyday problem solving practices.

Considering these limitations, this thesis sets out to develop an alternative approach, which recognizes specific contexts under which technical change and capability development take place. Firstly, the thesis shifts attention from a focus on pre-set practices, which is reflected in codes of practice and manuals, for explaining and assessing intended outcomes to an interest in how these pre-set practices are integrated and used in the process of solving situated problems. Recent development in Ethiopian floriculture reflect strategies importantly based on the assumption that economic development is explained by a technology gap, which translates into endeavours to develop and implement a code of practice, make use of human resources such as university graduates and experienced consultants, or acquire technological objects such as improved varieties or physical infrastructures such as ‘modern’ greenhouses that can be obtained mainly through transfer from developed regions. This assumption is critiqued by Srinivas and Sutz (2008), who instead emphasise endogenous capacities tailored to specific conditions of scarcity, and by literature that recognizes that technical change is largely induced by incremental problem solving (for instance see Parayil 1991). The approach taken in this thesis resonates with recent research on upgrading and governance in global value chains that pays attention to development of local capabilities and asks how an export-oriented industry links to endogenous development (Melese and Helmsing 2010, Helmsing and Vellema 2011, Vellema and van Wijk 2014).

Secondly, the thesis proposes a shift from learning and capacity development associated with prior experiences to capabilities and competences emerging in action and practice (Wals et al. 2013). This fresh perspective emphasizes problem solving capabilities that develop not only through formal ways and past experiences, but also appear in interactions among people and material environments (Fenwick et al. 2012). Building on insights in this latter approach, the thesis examines how recurrent and emerging problem solving practices at farm level interact with certification schemes, which increasingly require compliance with pre-set

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practices and emphasize prior capabilities of individuals. The research follows the task-oriented lens on competence used by Lans et al. (2014: 42), who define competence as the ability to apply a set of integrated knowledge, skills, and attributes within a specific position and context and underline the informal nature of competence-related activities in the practices of small business owner-managers in agriculture (ibid.: 49).

Important for the thesis is Lave's (1993) conceptualisation of learning (or skilled improvisation), which is ubiquitous in on-going activity, but not easy to recognise. Following Lave, this thesis argues that learning not only happens in the mind of the learner, but is traceable in team work and emerges in the bodily interaction of humans with plants and pests. Moreover, Lave argues that things and knowledge require reconceptualization in the context of situated action. The review of competence literature in Mulder (2014) similarly emphasises that competence only gets meaning in the socio-technical context of work and the individual's relationship to it. This shifts attention (Akkerman and Bakker 2012: 160) from knowing what to knowing how and why certain problems occur and to analyse how actors collaborating in the workplace make justifiable interpretations of, in this case, the behaviour of plants and pests in a greenhouse. A specific interest of the present research is to include materiality in studies of learning, for which it aligns the ethnographic tradition reflected in the work of Lave and Richards, discussed above, with the theoretical notion developed in organisation and management literature, particularly by Tara Fenwick and Wanda Orlikowski, that competence and learning are socio-material interactions 'constituted and reconstituted' in everyday situated practices (Orlikowski, 2002: 252).

Research approach

To explore problem solving capabilities, the study builds on the scholarly work of practice based and socio-material approaches to agriculture, science and technology studies, organizational studies, and workplace learning. It primarily draws upon two methodological approaches: (1) technography (Jansen and Vellema 2011) and socio-materiality (Orlikowski 2002, Fenwick et al. 2012). These two approaches have an interesting synergy as both: (1) focus on situated action, (2) reject an exclusive focus on either social or material and take an integrative perspective on socio-material interactions, and (3) emphasize technology in use rather than design. Typically, both approaches take seriously the role of material environments by showing how problem solving is relational and distributed among people, activities, standard procedures and biophysical environments. Further, they regard capabilities

as situated; hence, know-how emerges in a particular practice. By taking practice seriously, they use research tools oriented towards observing daily practices.

The empirical focus of this research is on the cluster of abilities, know-how, and skills that enables a person, or in the case of task-oriented groups (see McFeat 1974), to act effectively in a job or a variety of situations and to meet increasingly complex demands in the context of a global value chain and a competitive international market (Mulder et al., 2007). Indeed, the thesis confirms the suggestion by Mulder (2014) that competence is domain (floriculture, standard-setting, quality requirements in international markets) and problem specific (pests and plants).

Technography

Technography is a descriptive social science of technology (Jansen and Vellema 2011) that enables understanding the outcomes of actions and interactions taking place within a socio-technical system and across its boundaries. It is a multi-method approach that can help to adequately describe processes in a complex and dynamic socio-technical system, which enables the researcher to analyse data from multiple perspectives (Walker et al. 2010). Technography takes the use of skills, tools, techniques, and know-how as a starting point for describing individual and collective performance. It documents how tasks are coordinated and gives structure to small groups. And, it traces how rules and routines, associated with a non-localized profession and manifest in codes, standards and manuals, shape practices and performance. The empirical focus of integrative research informed by technography is on hands-on problem solving and the ways people and organizations achieve practical ends. Further, the technographic methodology underlying my research entails that the nature of a problem is related to how solving it is organized in daily practice. Accordingly, my research on Ethiopian flower farms integrated the technical and social dimensions of performing pest and disease management tasks.

My investigation of problem solving centres on farming practices and the manipulation and regulation of biological and agro-ecological conditions; it links these practices to the interaction among actors both internal and external to the firm/farm. Accordingly, I approach problem solving not only from the internal activities of the farms, but also from the interface between farms and the social and agro-ecological context for performance. Understanding a system requires understanding its relationships to the broader context of which it is a part (Parent et al. 2007, Jansen and Vellema 2011).

Guided by the technographic approach, I collected and analysed data related to both the technical and social aspects of problem solving both within and across the boundaries of

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Ethiopian flower farms. I followed the research conducted by Vellema (2002) who investigated processes underlying the improvement of quality in asparagus, by Philippine farmers growing asparagus for export to Japanese markets under contractual conditions set by a global food company. His work helped me to formulate focused questions to understand practices at the farm level. Taking a micro-level approach shift attention to how problem solving was performed. Further it helps to describe how people interact with each other, their task, and their environment (such as interaction with members, tools, biophysical environments, standard procedures, and codes). This line focuses on the coping skills of people within everyday reality (Richards 1993).

In summary, throughout the four empirical chapters of my thesis, the research tools I use strongly build on technography, with an emphasis on observing, documenting, and filming real life practices. I combine multiple methods to document daily practices with collecting information from standard manuals including the code of practice, interviews with professionals, focus group discussions, and participation in training sessions and meetings (Jansen and Vellema 2011). The research also uses secondary sources and data bases used by the firms in on-going operations. I had unlimited access to people, facilities, and documentation in the case study farm and my roles as university lecturer and student dean enabled access to the network of university graduates currently employed in the floriculture sector.

Socio-materiality

The socio-material approach has received increased interest in research areas such as organizational studies (Orlikowski and Scott 2008) and workplace learning (Fenwick et al. 2012). The key focus is on social and the material interactions in which new capabilities or know-how, which can be described as peoples' continuous coping in the material and social environments can emerge (Fenwick 2006b). Research within this practice based socio-material perspective examines the relations between standards, other human intentions, and 'real world' encounters of practice (Gherardi 2000, Orlikowski 2002, Fenwick et al. 2012).

This approach contrasts a strong focus on pre-defined attributes or competences, and emphasizes the materiality of knowing / learning / doing, and investigates knowing-in-practice (Feldman and Orlikowski 2011). The socio-material approach accentuates the significance of interactions among people and material environments in solving situated problems in workplaces. In short, it asserts that problem solving involves networks that are more-than-social and is performed not just by an individual person but by socio-material collectives (Fenwick et al. 2012).

I make use of the notion of technology in practice (Orlikowski 1992, Feldman and Orlikowski 2011) to explore the know-how generated while people solve situated problems in the greenhouse of flower farms. According to Feldman and Orlikowski (2011), this approach recognizes that the operations and outcomes of codes and prior capabilities in practice are neither fixed nor given *a priori*, but are situated in the interactions among people and their material environments. Feldman and Orlikowski (2011) also state that a scripted practice or a prior capability becomes meaningful only when people actually engage with it in practice.

Accordingly, the focus of my research is not on the code or pre-set attributes/prior capabilities per se. Rather, it examines how the code and pre-set attributes of graduates became part and parcel of problem-solving capacities that were generated in everyday encounters shaping know-how. Hence, explaining the development of know-how requires an inquiry of technology-in-use (Feldman and Orlikowski 2011). This is in contrast to privileging codified practices under the assumption that these work across contexts and are relatively stable. A study of socio-material practices indicates that the effects of both the competence of individual persons (graduate) and of codes of practice are less predictable. Competence generated in practice is situated and distributed.

Tara Fenwick studied socio-material practices empirically by focusing on the everyday encounters of police in rural Scotland. She explored co-production in practice in a case study of the community policing model implemented in the United Kingdom. In this model, co-production is defined as “services and products that are planned and delivered in full conjunction with clients [...] popular policy discourse and prescription for professional practice across a wide range of public services” (Fenwick 2012: 1.). The study analyses everyday practices in real settings and local sites and identifies the implications for professional learning. The research indicated that co-production was a multi-faceted practice occurring in unanticipated ways at the local level. The study further showed that the police professionals used creative strategies, which were not pre-planned. These were not individually induced strategies, but distributed among the professional police officers, the local community, and material environments (technologies, tools, and topographies). This finding was in contrast to the assumptions underlying the policing model and the associated training, which shows the importance of everyday encounters in policing and of knowing how to work with all participants in these encounters, including the material environments, to co-produce outcomes that build community wellbeing (Fenwick 2012: 14).

Wanda Orlikowski’s develops a socio-material approach for understanding problem solving capability in everyday life. Her research presents empirical examples within the field of organization and information system studies, two of which are discussed here. First,

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Orlikowski (1992) studied a multinational consulting firm that had adopted a groupware-technology (Lotus Notes) to facilitate knowledge sharing among its global consultants. In this firm, the managers spent their energies and resources on installing the software in the firms' infrastructure including the desktop of consultants. They measured performance of the technology by using indicators such as number of user accounts established, number of servers installed, number of databases created. However, according to Orlikowski, the firm did not achieve the intended benefit: knowledge sharing across the firm as they did not pay attention to 'the technologies-in-use'. What consultants were actually doing with the Notes in their everyday consulting practice remained a black box. Second, Orlikowski (2002) elaborated the socio-material approach in a case study of a globally distributed, high-tech organization (Kappa) with its head quarter in The Netherlands. This study emphasized the dimension of know-how in the process of global product development by the firm. The findings suggest that know-how emerges in situated practices important for global product development. Her study complements organization literature and pays attention to knowledge transfer across contexts by focusing on capturing, codification, transfer, and exchange. This case study locates problem solving capabilities in everyday practices of global product development work that were collective, distributed, and emergent (Orlikowski 2002).

Methodological conclusion

My research combines the two practice-based approaches, technography and socio-materiality, and focuses on socio-technical interactions to explore how scripted practices and prior capabilities of graduates in employment are used in practice. It provides an analytical lens for the integrative analysis of plans, i.e. pre-set intentions and prior capabilities, practice, and emerging know-how in the context of solving situated problems in changeful social and material environments. The design of the technographic study of situated activities in Chapters 2 and 3, central to the methodological choices discussed in this section, is described in more detail below. Research methods used are explained in more detail in the research chapters 2-5 and the appendixes.

Through in-depth analysis of problem solving, the study examined how technicians, farm managers, and workers in a case study export flower farm in Ethiopia use standards and expert knowledge with the general objective of producing quality flowers for international markets. The thesis explores how a set of capabilities was used and formed in the situated and interactive processes of problem solving in real settings. More specifically, the study sought to understand the inextricable relationships between plans, practice, and know-how.

In my thesis I view a code of practice and associated efforts such as employing university graduates in the context of Ethiopian floriculture as plans: a set of pre-set practices and prior capabilities to achieve some anticipated objectives. Informed by the notion of plans and situated actions (Suchman 2007), I conceptualize these ready-to-use arrangements as plans. I argue that an exclusive focus on plans can lead to the neglect of the situated and interactive aspects capabilities or know-how unfolding in the process of solving practical problems.

I conceptualize practice as the situated and recurrent activities of people using guiding tools, such as codes and manuals, and performing tasks interactively and in a coordinated way (Orlikowski 2002). Further, know-how is conceptualized as coping skills in situated socio-material practices. In a nutshell, as suggested by Orlikowski (2002), know-how emerges from situated and ongoing interactions between human action and time and place specific conditions, interactions between coordinated activity stream and intentions, and the interaction between practice and organizational structure (normative, authoritative, and interpretive).

The study moves beyond the boundaries of the individual case study farm by mapping the interactions and linkages among actors in the flower sector, with a specific focus on the selection of technological recipes embedded in the code and engaging employed university graduates and the local community in solving practical problems. It documents the functioning of university graduates in a setting wherein improvisation, repair, and adjustment are essential for finding workable solutions. Finally, the research expands its scope by analysing the way a cluster of corporate farms interacts with the surrounding communities to manage the use of a common pool resource: water.

Research objectives and main research question

The research aims to provide an account of the everyday encounters through which the code of practice and other pre-defined practices were actually negotiated at the sites of real world problems. Such accounts can help to nuance assumptions and promises of a code of practice and prior capabilities and experiences leading towards approaches to understanding know-how as it emerges solving practical problems in the social and material environments. The research's focus on regulation and manipulation of biological and material conditions for managing pests in greenhouses can complement the understanding of socio-material approaches in organizations. The grounded approach gives a strong empirical basis for theoretical generalizations. According to Feldman and Orlikowski (2011), it is powerful to explain situated dynamics across contexts. It studies learning while recognising the specific

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subject of the agricultural labour process: the regulation of agro-ecological conditions of biological processes (Benton 1989). The account further contributes to debate on how governance mechanisms in cross-border chains relate to technological upgrading and learning in primary production.

My thesis explores capabilities that unfold at the sites of problem solving and decision-making practices, specifically through the case study of a flower farm. It investigates how a set of capabilities or know-how can be generated in practice that potentially may support performance, and looks beyond the pre-set intentions and prescriptive arrangements. The research emphasized situated problem solving practices as context for emerging know-how to handle unanticipated or composite problems within the everyday socio-materiality in the greenhouse and beyond. It studies how people use skills, tools, techniques, and know-how to manage pest and diseases, how they interact among themselves and with plants and materials, and how they coordinate their actions to manage pest problems in the workplace.

The study contributes to the on-going debate on technological change and industrialization in less developed regions by leading us beyond the strong focus on transfer of technical artefacts or hardware and emphasizes know-how as emerging from the on-going and situated actions of local actors in the real work environments. Likewise, the study may inform policy, and contribute to the development and refinement of understanding of the technological change and dynamic competitiveness of emerging industries such as floriculture in Ethiopia. The empirical approach enabled the researcher to produce relevant practical implications for policy and practitioners.

Main research question

My empirical research on Ethiopian flower farms answers the following main research question: why and how do people and organizations know how to solve practical problems within and across boundaries of export-oriented farms in Ethiopia?

Design of the technographic study of situated activities

Data collection for the technographic study of social-technical practices and team work in the greenhouse (Chapter 2 and 3) was primarily based on observations, ad-hoc conversations, and semi-structured interviews. The research started with an inventory study in three locations identifying problems encountered in rose production (Appendix A). After selecting the case study farm (for research location see below) The researcher used guiding questions, based on Vellema (2002), Argote and Miron-Spektor (2011) and Jansen and Vellema (2011), to document how team members managed pest and disease problems, how the performance of

their tasks was organised, and how they used skills, know-how, tools and technique to achieve a practical end (namely reducing damage caused by pests), from what sources they obtained information, and what rules and routines directed coordination and interaction in these daily practices (Appendix B, C and D). In addition, the research mapped daily activities (Yanchar 2011) by interviewing key informants, in particular the farm manager and deputy farm managers, the head of the pest and disease management departments, supervisors, and members of the scouting and spraying teams. This information was used for mapping the allocation of tasks and materials among team members (Neville 2006) and their interaction (David 1994). Scouting and spraying activities were observed and documented by audio and video recordings. Intermediate analysis of interviews, video segments, as well as written descriptions of scouting activities, generated questions for follow-up interviews regarding instructive events and factors constraining the team problem solving process (Holtzblatt and Beyer 1993). Observations and collected company documents were used to describe the physical layout in the greenhouse and the biophysical environment that included greenhouse types and other materials, temperature, relative humidity, crop variety, pests (spider mite) and pest development trends.

Identifying and recording the sequence of tasks performed by the team was guided by questions about task arrangements (Walker et al. 2010) and the means of communication in and the organisation of team work (Adams et al. 2012). Observations of practices, meetings and team interaction, complemented with interviews enabled to document the intentions of the team, the type of problems they tried to solve, what type of tasks problem solving involved and the sequences of these tasks, how they made decisions in this process and the role of protocols in this, and what kind of materials, equipment, skills and know-how the informants identified during problem solving.

These data formed input for the network analysis of the connections and interactions between materials, biophysical environment, and team members and their environment while solving problems. Network analysis has been used in various fields such as sociology, social psychology, anthropology, epidemiology, and management studies (Cross and Sproull 2004). Walker et al. (2010) made use of it in their study of distributed cognition in air traffic control. In this study, network analysis mapped information flows during scouting and visualised the role of materiality in joint problem solving practices that include passing physical artefacts, text; graphical representation, telephone, electronic mail, face-to-face, or computer mediated communication (Hutchins 1995).

Data for the network analysis were gathered by presenting each respondent with a complete list (roster) and ask to which of the agents (people, materials and departments)

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mentioned in the list they turn to and to rank the information obtained from the identified agents. According to Giuliani and Martin (2005) this way of questioning specifically addresses problem solving and technical assistance because the answers describe not only the mere transfer of skills and knowledge, but also whether they are eventually absorbed in the process of problem solving. Informants were also asked to list skills and knowledge obtained from sources outside the farm boundaries. Specifically, respondents were asked to name possible external sources, such as universities, research institutes, suppliers, consultants, growers associations, government agencies associations. The data, identifying actor, organisations, and objects contributing to the process of problem solving were recorded in matrices with numerical values showing the existence and degree of interaction among the actors and the events (Wasserman 1994). Network analysis and visualization were done using the software programme UCINET (Borgatti et al. 2002).

Research location

According to EHPEA (2014), 84 flower farms operate in the major flower producing areas in Ethiopia (Figure 1): Sebata (21 farms), Holeta (27 farms), Sendafa, Suluta, Debre Brihan and Bahir Dar (9 farms), Debre Zeit and Awash (16 farms) and Ziway, Koka and Hawassa (11 farms). In total, flower farms cultivate 2600 hectares of land, of which around 29 % (756 hectares) was located in the Ziway, Koka and Hawassa cluster (ibid). The flower farms are located in different agro-ecological zones. Three clusters (Sebeta, Holeta, Sendafa, Suluta, Debre Brehan) are at an altitude over 2000 meters above sea level. The altitude of the other clusters (Debre Zeit and Awash, Ziway, Koka and Hawassa) ranges from 1600 to 2000 meters above sea level. The agro-ecological variation also affects the type of agricultural problems encountered by the flower farms, which is particularly visible in their handling of complicated biological processes, such as the reactions of plants to pests and diseases and their treatments, which are strongly context-specific (Nicholls and Altieri 2004; Wyckhuys and O'Neil 2007).

The research was designed as a case study of a cluster of rose farms operating under the umbrella of the Sher Company (<http://www.afriflora.nl/en/afriflora/sher-ethiopia>), which is located in the low land near Lake Ziway in the central rift valley of Ethiopia. The Sher Company, and its associated flower farms, manages 500 hectares of land leased from the federal government for growing roses under greenhouses for export to EU markets in this area. Sher Company clusters four farms of an average size of 40 ha, which together form the largest company in the Ethiopian floriculture sector. The company provides employment for an estimated number of 10-15,000 people. The research on the practice of pest and disease

management (Chapter 2 and 3) took place at one of the farms operating under the umbrella of the Sher Company: Herburg (<http://www.herburgroses.com/en/roses-ethiopie>). This farm was established in 2006 and has about 1500 employees. It produces roses under 42 hectares of greenhouses and has an export capacity of an average of 2 million stems per week and about 100 million stems per year. The Sher Company and the cluster of flower farms belong to the top five of rose exporting companies in the country. The case study company is specifically interesting for this study because it adopted international quality standards, such as MPS-A, MPS-SQ, and Global GAP (with specific requirements for floriculture). Moreover, the company builds on a history of engagement with sustainability and Corporate Social Responsibility strategies (Chapter 5) and with Fairtrade initiatives (particularly linked to the Fair Flowers Fair Plants foundation <http://www.fairflowersfairplants.com/home-en/organisation.aspx>, the International Code of Conduct for cut flowers, and the Ethical Trading Initiative). In the area, the company implemented several projects committed to the local community development programmes, such as establishing health and education services and constructing water points.

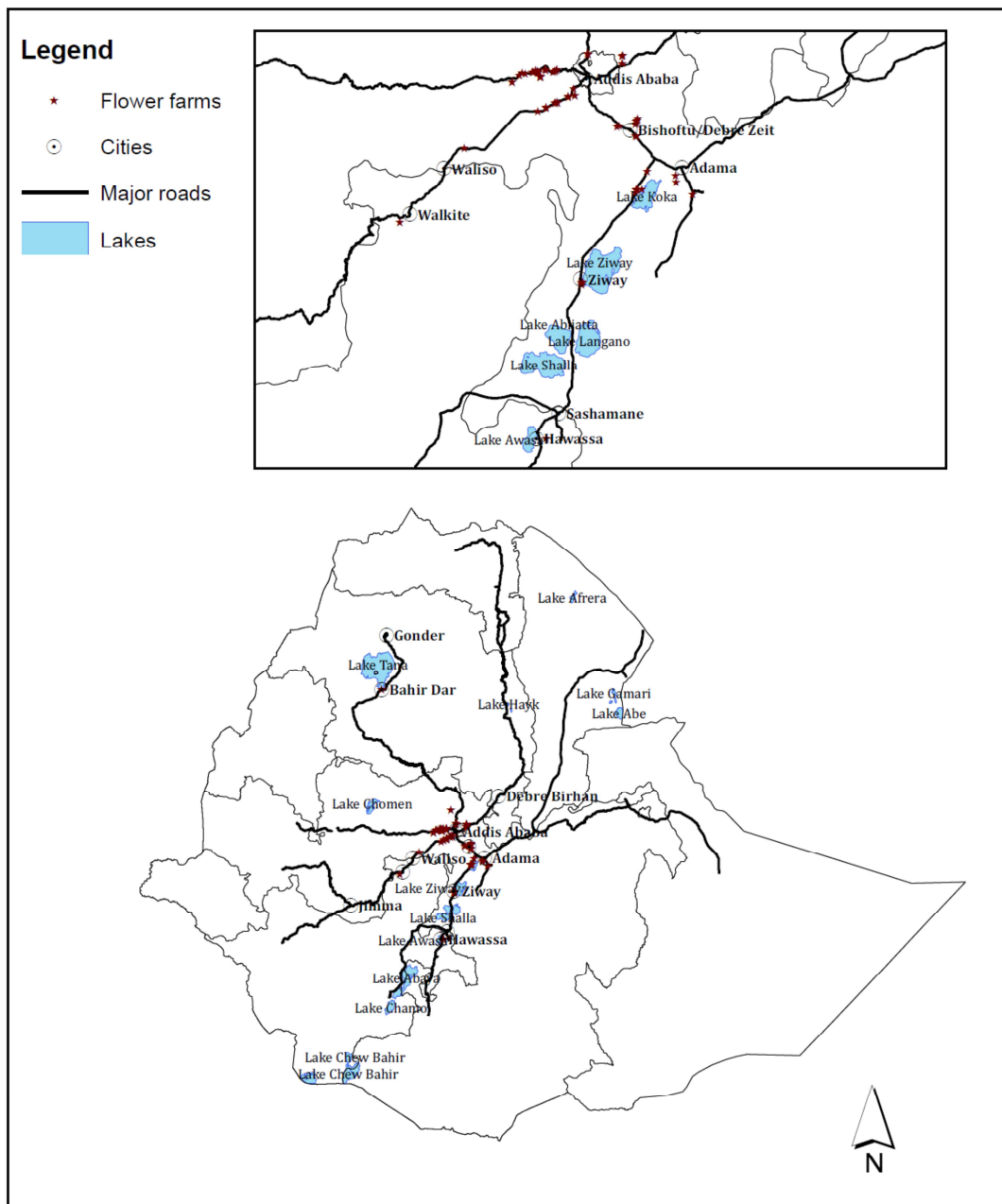


Figure 1. Distribution of flower farms in Ethiopia

Source: based on author's data

Thesis outline

My study in Ethiopian floriculture explored how a set of capabilities were formed and used in the situated and interactive processes of problem solving in real workplace settings. This first introductory chapter provides an overview of Ethiopian floriculture and introduces the model of technology transfer and upgrading present in the sector, specifically related to the introduction of a code of practice. The chapter introduces the methodological foundation of the research approach, anchored in technography and socio-materiality. It explains the main methodological choices and presents research objectives and questions. Four research chapters provide detailed accounts of problem solving dimensions within the boundaries of the case study flower farm (Chapter 2 and 3) and across their boundaries (Chapter 5). The chapters examine problem solving that occurs in a context which includes the team, organization, and the community, and wherein in which performance is embedded. Hence, I examined situated problem solving in two dimensions: (1) within farms and (2) across boundaries of the farms. Chapter 6 discusses the general insights and implications of the research and draws conclusions.

The investigation of pest and disease management practices within the case study farm (Chapters 2 and 3) explores how people use a code of practice for good agricultural activities. Specifically, these chapters study how people use an integrated pest management (IPM), as preferred by the code. IPM is one of the preferred recipes included in the code of practice developed by the growers association (EHPEA), which is stimulated by the Ethiopian government and the Ethiopian-Netherlands horticulture partnership. Its use responds to pressures exerted by consumer demands for healthy products, and ‘intensifying pesticide resistance’. It is a technological package that mixes use of chemicals with biological and cultural practices to manage rather than attempt to eliminate pests (Elsey and Sirichoti 2001). IPM is a “simultaneous management” of pests that includes monitoring of pests and predators integrated with other practices to produce crops in socially and environmentally responsible ways (Ehler 2006, Toth 2009; Abrol and Shankar 2012; Flint 2012). It involves biological control agents (BCAs) or predators as a tool, which does not have undesired consequences for pest resistance and occupational health (Colfer et al. 2003). In pest and disease management practices individuals and teams were responsible for the tasks of detecting the presence of pests and diseases and limiting the damage they may cause to flowers within greenhouses.

Chapter 2 aims to relate on-farm problem solving processes to the influence of routines and protocols in the process of using the practice of Integrated Pest Management (IPM) stipulated in the code of practice. It starts from the technical details of pest and disease management

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problems and aims to discover what explains the nature and direction of solving emerging problems as well as to describe the skills, techniques, and know-how used and formed in this process. It looked at the way teams coordinated actions, responded to the technical and managerial challenges, and took corrective measures. The focus of this chapter is on how people responded to the changing situations while trying to stick to using the pre-defined protocols that were embedded within the code.

Chapter 3 explores how people translate practices into codified information and work protocols and use these codified practices in solving practical problems. Specifically, it uses practices of a team using IPM in a flower farm. It investigates codification by documenting how people constructed figures and symbols and used them in decision making. And it demonstrates in what ways the process of codification involved skills, techniques, and knowledge of people performing various tasks. The chapter illustrates how people abstract actual practices to codes by referring to elements in the material environments such as tools, growing plants, pests, predators and the prevailing weather data.

In addition to the above detailed examination of farm management practices in the case study farm, the research investigates capabilities of employed university graduates in practices of solving situated problems within different flower farms (Chapter 4). Chapter 4 examines the extent to which graduates make use of knowledge and practices transferred to them during their formal university training. It discusses the emergence of know-how in workplaces as blending of pre-defined attributes of individual graduates and skills developed during job experiences. The chapter documents the functioning of graduates in selected flower farms and maps their networks. It analyses the way individual graduates combined pre-set attributes/prior capabilities, resulting from their education and job experiences, with know-how developed in a setting of hands-on problem solving practices within particular farms and shared across other farms through the network of graduates.

The scope of the investigation was extended to another part of the code of practice, i.e. the articles referring to corporate social responsibility (CSR), which defines guidelines on how commercial farms are supposed to deal with surrounding communities. It is interesting to explore what kinds of capabilities a company possesses to be able to manage problem-solving across and beyond organizational boundaries. For this purpose, the research studied how a cluster of farms associated under the banner of the Sher Company, including the case study farm, interacted with a select group of farmer / community representatives and public officials in joint problem solving practices related to the access to and use of water as a common pool resource (Chapter 5). It specifically focuses on access to a fresh water lake, used as a common pool resource by the cluster of farms producing flowers for export and by farmers from

surrounding communities for irrigation and livestock. It documents how the community and the company interacted in constructing and selecting a technical solution to the composite problem of arranging access to water. The code of practice stipulates that companies are expected to engage with local communities regarding their needs and concerns. In this thesis, managing interactions with stakeholders outside the boundaries of the flower farms is considered an important capability for business. The study suggests that companies tend to opt for hardware, such as building a hospital, and technical solutions, such as constructing new water points, and are less skilful in appreciating other values expressed by community leaders and in searching for solutions outside its direct span of influence and including multiple interests.

Finally, Chapter 6, by drawing up on the four empirical chapters, analyses problem solving capabilities as know-how beyond the pre-defined features such as codes and attributes of individual graduates or experts. It illustrates that the situated social and material arrangements and nature of emerging problems at the level of practice form integral parts of processes shaping how people act and interact. Finally, it translates the main findings into implications for policy, practice, and education.

CHAPTER 2

A code of practice in practice: learning and problem solving in integrated pest management (IPM) in Ethiopian floriculture

CHAPTER 2

A code of practice in practice: learning and problem solving in integrated pest management (IPM) in Ethiopian floriculture

Introduction

In Africa, Ethiopia has become one of the largest producers and exporters of cut roses to the global market, mainly Europe. However, quality and safety are of particular concern. Firstly, the market demands high quality product, free of pests and diseases. Secondly, standards¹ are increasingly exerting pressure on inputs such as pesticides to ensure wellbeing of humans and the environment. In response, the Ethiopian Horticulture Producers Exporters Association (EHPEA) has introduced a code of practice. The code further mandates the introduction of integrated pest management (IPM) as one of the standard practices to be used in the sector.

Codes (both regulatory and voluntary) in fresh agricultural products are designed to address concerns among value chain actors, mainly the wellbeing of consumers. Producers are expected to comply with predetermined quality and safety indicators embedded in the codes (Kemp et al. 2012, Gibbon and Ponte 2008). In addition to their regulatory character, these tools are increasingly recognized as means to improve performance by facilitating access to knowledge and learning, factors considered important to enhance capabilities of firms/farms in developing regions (Perez-Aleman 2011). However, the realization of these promises across different regional contexts has been a challenge. The problem is that the approach focuses more on prescriptions and outcomes in forms of audit and certification than on actual problem solving practices at the local level (Perez-Aleman 2011, Hatanaka et al. 2005, Nadvi 2008, Henson et al. 2011).

The approach relies strongly on predefined practices and outcomes overlooking the processes and conditions in which the codes are used. In other words, by emphasizing how actors should stick to standards, a code-driven approach tends to pay less attention to the underlying capabilities of actors to respond to changing situations. In this chapter, we make and exemplify the case that a focus on actual problem solving practices can help us to understand capabilities at the local level (Jansen and Vellema 2011, Gibbon and Ponte 2008,

¹ Nadvi (2008) defined standards as follows: commonly accepted benchmarks that transmit information to customers and end-users about a product's technical specifications, its compliance with health and safety criteria or the processes by which it has been produced and sourced. Further, both private standards and public standards ('regulations') are considered similar, as they overlap, interrelate, and operate in parallel ways (Henson and Humphrey 2010).

Kemp et al. 2012). Accordingly, we investigate how people use practices embedded in a standard/code during the process of solving practical problems at the level of primary agricultural activities. To this end, we selected the practices of IPM for studying the use of a code in a particular farm environment producing cut roses for export from Ethiopia.

IPM is one of the rigorous requirements of contemporary standards in the value chain of fresh agricultural produce (Busch et al. 2001, Aubert et al. 2013). It is an instance of standard setting that, in general, has had limited success both in developed and developing countries, despite the interest of scientists, policy makers and other pressure groups (Morse and Buhler 1997, Peshin et al. 2009). Given this background, IPM is an interesting and challenging domain to consider. Our research positions itself in the implementation phase of IPM, the period during which the practices were introduced into the work setting of the farm. Accordingly, we investigate how people integrated IPM with other possibilities in the process of solving practical problems in the greenhouses. Our analysis of IMP as a code in the process of problem solving will help to understand how codified knowledge accessed through standards can be endogenously transformed into capabilities in a specific context. It can also indicate dimensions to consider that might otherwise be overlooked while framing supportive policy and other actions of trainers and service providers working along the value chain. Through its focus on problem solving practices as a locus of learning (Gherardi 2009), the chapter contributes to a practice-based perspective on performance and learning not yet widely used in the literature on global value chains for fresh produce.

Below we describe research methods, followed by results. Then we present a discussion integrating empirical evidences with the line of argument advanced in the chapter. Finally we conclude by indicating some practical implications.

Methods

We conducted a study in a farm producing roses for export in Ethiopia from September to June, 2012. Our empirical focus was the practices of a pest and disease management team. We considered how people use biological control based IPM as a code of practice in the process of solving practical problems in greenhouses.

In the first phase of our field study, we focused on observations of the team activities (Jansen and Vellema, 2011). Then, we made open-ended interviews to get detailed information on respondents' experiences and perspectives. This is in line with the observation made by Kaplan and Maxwell (2005) that the open-ended nature of the interaction can help to reveal aspects about work process that actors themselves are not consciously aware.

Preliminary research identified a range of activities related to IPM in greenhouses. However, for practical reasons, we decided to focus on one particular task: scouting. Scouting involves regular monitoring through which a scout is collecting information on the presence, type, population, location of pest problems and extent of damage on crops and evaluate effectiveness of pest management practices. The actions of the scouting team are critical for IPM. The logic of this selection is that (1) the team used information generated through scouting as a reference for other key related practices such as release of biological control agents (BCAs) and (2) scouting was performed regularly. The team considered scouting an important task, and it was recurrent. The research had a specific interest in how the team acted and coordinated during sudden infestations. Its main focus was to record and analyse how the team responded to emerging problems in greenhouses. Documenting this process reveals the different ways in which people use and to some extent transform the codified procedures of IPM when solving both known and unanticipated problems.

Generally, research on this topic followed an iterative approach. Often the researcher complemented results from observation and interviews with documenting communications made by the team members, such as through phone conversation, exchange of reports and use of e-mail (Handley et al. 2007). Backed by pictures and video records, we also tried to refine our understanding through a series of focus group discussions with key actors. Furthermore, we attended meetings and referred to existing standards manuals. These ways, we documented how agents framed problems and navigated towards possible solutions.

Further, informed by the notion of collective socio-material dimensions of practice (Fenwick 2010a, Orlikowski and Scott 2008, Orlikowski 2010), a network perspective was adopted. For this purpose, data collected on practices on a particular occasion were used as a starting point for a network analysis (Salmon et al. 2010). Specifically, we identified information sources and information use as it ramified in the process of solving emergent problems. At this point, we limited our analysis to pest and disease management team members and to critical incidents. Accordingly, we made a number of pilot interviews and identified the key participants and the biophysical materials involved in the process.

After we refined the lists through further focus group discussions, we followed roster and recall methods, which typically consisted of a stem question (e.g. "To whom do you go for help or advice at work?", Butts 2008), and interviewed 17 members of the team - this group comprised a head, two scout supervisors and 14 scout members. Further, we complemented our interviews by iterating between observation, documents, and communications through telephone, exchanges of reports and e-mail (Handley et al. 2007). Then we identified how information from different sources was integrated into the process of problem solving and

mapped who turned to whom or to what kind information when they encountered problems during task completion.

Finally, we adopted a social network approach (Borgatti and Cross 2003, Pahor et al. 2008) to visualize information sharing and sourcing within and across boundaries of the farm. We made use of accounts of multidimensional networks suggested by scholars (Lee and Monge 2011, Contractor et al. 2011) and adopted the typology developed by Contractor, et.al. (2011) and included materials in the network.

Results

In this chapter we seek to understand the problem solving practices of a pest and disease management team using biological control based IPM as a code of practice. We conducted the study during the period when this particular pest management practice was introduced into the case-study flower export farm. We focused on two types of team problem solving practices of the team using commercialized Biological Control Agents (*Phytoseiulus persimilis* and *Amblyseius californicus*) to manage spider mite (*Tetranychus urticae*):

- (1) attempts by the team to follow standardized procedures embedded in recurrent IPM practices (Table 1)
- (2) practices addressing emerging problems that moved beyond the use of protocols and the formal boundary of the team (Table 2 and 3).

In this section we briefly present the context in which the code was implemented, followed by a more detailed analysis of actual problem solving practices, including use of standard procedures and recurrent practices embedded in IPM. Next, attention is shifted to problem solving practices that addressed newly emerging problems in the greenhouses, and identifies the importance of the use of various sources of information in addition to the codified procedures of IPM. Attention is paid to other agents and materials deriving from outside the boundary established for standardized procedures and codes of practice in the farm (Figure 2).

Setting: use of the code of practice in a flower farm

The farm started its operations in 42 hectares of greenhouses in 2006 and employed 1500 people. The company was organized along the following formal lines: (1) pest and disease management, (2) human resources management, (3) line production management (including the four greenhouses), (4) maintenance and finance management, (5) grading department, and (6) irrigation department. In the field it was ascertained that the pest and disease management

unit (the specific focus of this study) consisted of a head, two scout supervisors, 14 scout members, two spray supervisor and 36 spray team members.

The farm was divided into four blocks or greenhouses made of polyethylene plastic, 200 microns thick mounted on metal frames. Roofs and side ventilations were fixed, with a complete automatic control fertigation (combined fertilizer and irrigation) system comprising injectors and chemical tanks. All greenhouses had climate control systems. Each greenhouse was referred to as a line. Four lines covered nine hectares of land. Each line had 114 bays left and right divided by a long corridor. Each bay had four beds with two rows of soil-based growing systems. In each row, 250 roses were grown on a raised bed. Thirteen different rose varieties were grown. Across the front of the greenhouses, both east and west, there were grading and packing houses, cold stores, offices and other facilities.

According to interviews with the farm manager and his deputy the facility was among the top five largest farms in the country, with a capacity of about 2 million stems of roses per week exported to the Flower Auction in the Netherlands and other markets in Europe. According to these sources, the performance of the farm was crucially dependent on its compliance with sector level and international standards. Within this context, management stressed compliance and conformity to the code of practice to ensure product quality, human safety, and environmental protection. The EHPEA code of the Ethiopian flower sector was considered an essential tool to improve performance of the farm in a global market:

The objective of the EHPEA Code of practice is to provide a mechanism that enables the Ethiopian floriculture sector to achieve the highest performance standards by continuous improvement and sustainable development and thereby improving the farm's overall performance and competitive position in the market (EHPEA Code of Practice for Sustainable Flower Production, Version 2.0, Issued March 2011, p. 6).

On the basis of documents examined for this study, the farm was compliant with EHPEA (Bronze level)² and the MPS-SQ³ code of practice, respectively. IPM, the topic of the present

² 'This Code defines, at Bronze level, the minimum acceptable standards for operation of an export flower or ornamentals farm in Ethiopia. 'All exporters of cut flowers and ornamentals (cuttings and young plants) will be required to meet the minimum standard (Bronze level). However, standards for some markets and individual buyers and standards adopted by some farmers may exceed those described in the minimum standard. Therefore higher standards, a Silver Level and a Gold Level the Code are now being introduced' (EHPEA, 2011).

³ 'Includes requirements on health, safety and terms of employment, and is based on universal human rights, the codes of conduct of local representative organizations, and International Labour Organization (ILO) agreements. The Dutch Flower Consultation NBB (represented by FNV Bondgenoten, Both Ends and the Latin American Activities Organization [OLAA]) has been closely involved in incorporating these international codes of conduct (ICC) within MPS' (Riisgaard 2009).

study, was one of the highest standards (“gold level”) included in the sector level code of practice (EHPEA Code of Practice for Sustainable Flower Production, 2011 p. 76). Particularly, IPM was promoted in the regulatory context of the company, because:

There is a need to adopt an integrated pest management strategy [by Ethiopian horticultural farms], so as to manage pests in an environmentally friendly manner (State minister, Ethiopian Ministry of Agriculture, public statement during visit to flower farm, August, 2012)

Standardized procedures and recurrent practices in biological control based IPM

According to the pest and disease management team, two spotted red spider mites (sub-species of *Tetranychus urticae*), powdery mildew, downy mildew, botrytis, trips, nematodes, mealy bugs, aphids, and caterpillars were among pests and disease most likely to cause potential quality defects in roses produced by the farm. During field study, the researcher noted that spider mites were the major pest, particularly from February to May (Table 1).

An interview with the farm manager indicated that in early 2011, the farm introduced two commercial predatory mites (BCAs), *Phytoseiulus persimilis* (spidex), and *Amblyseius californicus* (spical) in combination as an IPM strategy to manage populations of spider mites in the greenhouses. Further, we were informed that the introduction of the practice was preceded by on-farm research carried out in different agro-ecologies of Ethiopia including the study farms (Belder et al. 2009).

From document analysis and observations, it was found that populations of spider mites were related to the temperature and relative humidity in the greenhouses (Figure 1). As can be seen in Figure 1, average temperatures and population of the spider mites both rose from January to March.

Informed by the above results, a range of activities was identified related to the new IPM practice in the greenhouses from September to May (Table 1). However, practical reasons of available research time it was decided to focus on the tasks performed most regularly, and regarded by the pest and disease management team as the most important component of the IPM strategy. Accordingly, this led to a focus on scouting (Table 1). The research investigated problem solving practices by narrowing this emphasis to a particular problem that could be observed in the farm during the period of study (Table 2).

Below, we present the IPM practices as they were embedded in the everyday activities of the team, followed by an account of how people used standardized procedures and assumptions regarding IPM practice in solving emerging problems in the greenhouses.

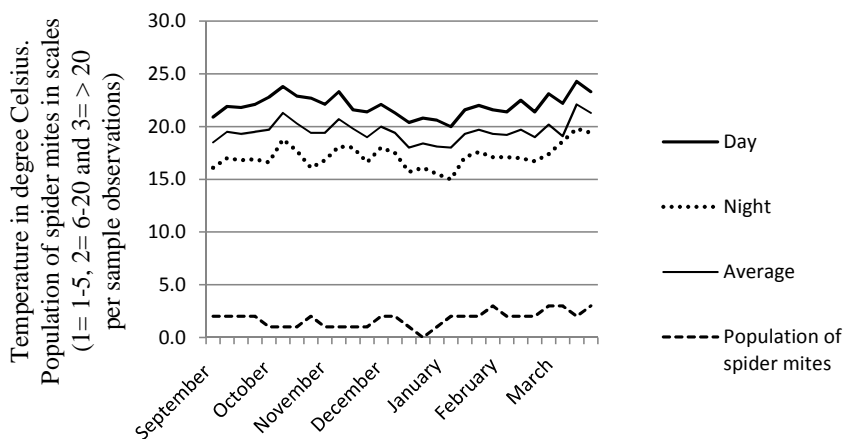


Figure 1. Temperature and spider mites population in the greenhouses of the study farm (September 2011- March 2012)

Source: calculated from weather and scout data of the study farm (September 2011- March, 2012)

In the field study, it was found that scouting related to monitoring of the spider mites and use of the BCAs as practices performed regularly by the pest and disease management team in the greenhouses (Table 1).

According to the farm manager and the head of section, prior to the introduction of the IPM, different monitoring procedures were used as a general guide to inform management decisions for using broad spectrum pesticides. However, it was discovered that with the new IPM practice new procedures of scouting were designed not only to monitor the population of the spider mites but also the BCAs. We also noted that these new ways of scouting were designed by experts from the company supplying the BCAs. These experts were also responsible as consultants to the farm on use of the IPM strategy.

It was observed that the new procedures basically combined techniques for recording population of the spider mites and the BCAs across bays, beds, rows, and varieties of roses in the greenhouses. Based on observation, while scout members, supervisors, and the head were required to follow new protocols to monitor the mites and the predators, they were also responsible for monitoring other pests and diseases based on the earlier procedures. In other words, they were now doing two jobs simultaneously, but following different techniques that increased the pressures associated with the scouting task. In addition, it was noted that the

team was also jointly applying/releasing the BCAs. Generally, the team was responsible for recurrent set of activities that included: (1) generating information or scout data showing the levels of the spider mite infestation and the population of the predators by following the new protocols, (2) producing scout data indicating the status of other pest and diseases by following the earlier procedures, and (3) release of the BCAs. As one worker put it:

... after the introduction of these notorious mites [BCAs], we are facing challenges on almost every scouting day. (A scout team member)

In particular, our findings showed that scouting needed more time particularly between February and May. In one week in this period scouting was scheduled three times with releases of the BCAs done two or three times per week (Table 1). According to discussions with scout team members and their supervisors, they need to monitor more plants per row during these seasons. Furthermore, we observed that the scouting data included abundant information related to the spider mites and the BCAs in each row, bed, and bay for each variety, taken every three days.

However, it was also noted that decisions regarding releases of the BCAs were often based on frequent and joint farm visits by the head, the supervisors, the farm manager, and his deputy:

Sometimes scout members, even experienced ones, can make mistakes while recording [the pests and predators in the standard format]. Moreover, as the BCAs are new to most of us, we do not trust what the members [of the team] recorded and we always go to the farm and revisit the growing plants ... especially areas with hot spots [specific areas or localized infestations by spider mites within the rows]. (A scout supervisor)

You must be careful about the accuracy of the data [scout data] ... though scout members were provided a number of trainings to identify the agents [BCAs], some still could not record properly. Every day I made three to four rounds of observations [in greenhouses] before I report problems. Likewise, my bosses [farm manager and his deputy] though they believe that scout data can provide an overview of the status of the pest and the BCAs, they do not depend fully on these data to endorse my decision. Informed by the scout report, we regularly make joint visits in the greenhouses in order to better understand problems. (Pest and disease management head)

According to the head, the farm manager and his deputy, the new practice required detailed information on the level of infestations by various pests, in addition to the spider mite and the BCAs. They indicated that the results of scouting could involve financial risk if not carefully handled. Likewise, it was observed during fieldwork that the use of the BCAs required using compatible chemicals/pesticides, such as insecticidal soaps and horticultural oils with a narrower spectrum, that specifically target other pests and diseases including spider mites but which would not kill the predators. According to interviews with the head, most compatible chemicals were more expensive than the previously used broader spectrum types.

IPM has serious cost implications as both the [BCAs] and the bio-friendly / biorational chemicals [that do not kill BCAs] ... we are using with the IPM are quite expensive. Thus we are very serious on monitoring. We do not leave the job [scouting] to the department [pest and disease management] alone. (Deputy farm manager)

Table 1. Incidence of major pests and diseases and related activities in a cut rose farm using commercial BCAs in greenhouses in Ethiopia

Months	Pests and diseases incidence	Major activities	Frequency
June-September	Downy mildew and botrytis	Scouting	Twice a week
		Chemical spray	Twice a week
October –January	Insects , caterpillars and aphids	Scouting	Twice a week
		Chemical spray	Once a week
February- May	Spider mites and powdery mildew	Scouting	Three times a week
		Application of BCAs	Two – three times per week
		Chemical spray	Once a week

Source: authors' data from observations and focus group discussions (September – May, 2012)

Biorational miticides, acaricides specifically tailored to the control of mites, are effective for controlling many different types of greenhouse pests and are generally less harmful to natural enemies (the BCAs) than conventional pesticides. The behaviour of the BCAs suggests that they are more likely to be compatible with natural enemies. However, it is

important to know which biorational miticide is compatible or not compatible with the natural enemies of mites (BCAs) in order to avoid disrupting successful biological control programmes (Cloyd 2005).

Solving emerging pest problems

In addition to recurrent practices situated in the everyday activities of the pest and disease management team, observation also focused on problem solving practices when specific incidents arose. The aim was to explore how team members solved critical problems of a less recurrent or perhaps even solely unprecedented manner, during the study period. These are here termed ‘critical incidents’. The critical incident here refers to an emerging problem regarded as serious by the farm manager and his deputy, the head and the scout supervisors (Table 2).

Our analysis of practices related to emerging critical incidents evidences two aspects: (1) the efforts that people made to follow and use the standardized procedures/ protocols embedded in the practice of IPM (Table 2), and (2) challenges and related practices that went beyond the use of the protocols (Table 3 and Figure 2).

Use of protocols

As can be noted from Table 2 (Event 1), spider mites affecting the roses in a greenhouse were particularly noticeable on some varieties. This is what we here term the critical incident. As can be seen from Table 2, it was assumed by management that improper release of the BCAs and spraying procedures of chemicals/pesticides were possible reasons for the problem. Consequently, the head decided to follow the process in person while scouting activities were taking place (Table 2). The standard operating procedures and controls were intensified, but with paradoxical results. This leads to a subsequent presentation of evidence concerning what happened when scouts began to operate beyond the standard controls.

First, we present observational findings on how people were spraying chemicals and releasing the BCAs using standard procedures. Related to the spraying, the spray team in the presence of the head was applying bio-friendly pesticides at least once every week to manage other pests and diseases including spider mite (see Table 1). We also noticed that the teams on these occasions were also using chemicals to complement the BCAs:

...with IPM, [there are] not only handling and the release of the BCAs but also other management practices such as chemical spraying that need careful follow up. (Pest and disease management head)

We observed that the head and spray supervisors were checking calibration and the spray nozzle of the spray machine to make sure that its pressure was appropriately adjusted to a lower level so that it would not blow away the BCAs (Event 1, Table 2). On the basis of fieldwork, we noted that the calibrations of spraying pressures were among factors affecting the level of predatory mites. We noted that the nozzles of spray equipment were designed for various pressures settings (higher, medium, or lower). According to our interview with the head, prior to the IPM, the farm was using a higher pressure, since this was useful to detach the pest (spider mite) from the growing plants. In effect, spraying had a washing as well as poisoning effect. However, on the observed occasion, it was noted that the spray team was using only low and medium pressures in order not to blow away predatory mites (the BCAs). In addition, we observed that the head was paying more attention to hot spots in the greenhouse where he was carefully ensuring that the applications of chemicals were done according to the standard procedures.

Further, and in regard to release of the BCAs, from observation and discussion with the head, we noted that while the predatory mites were released they were expected to live on the growing plants while preying on the spider mites. From the document analysis and interview with the head, we noted that the use of the two predatory mites, the spidex, and the spical, in combination was expected to provide a broader and better control of spider mites under various temperature and relative humidity regimes. We further noticed that the expectation was rooted in their characteristics, which are described differently by the experts:

Spidex can do well in moderate temperature and high relative humidity. We also noticed that spidex is also known as a heavy feeder and hence assumed to rapidly decrease the spider mite populations. In contrast spical is known a slow feeder, but, in contrast to spidex it also known to survive without spider mites as it is known to feed [on] other sources such as other mites and pollen. Further, it is known to withstand stresses such as higher temperatures and chemical spray unlike, the spidex.

(Extracted from the website of the company supplying the BCAs:
<http://www.koppert.com>)

Observation indicated that the head and the scout supervisors were strictly guiding the scout members while applying the BCAs (Event 3, Table 2). Particularly, observations were made on two scout supervisors as they were releasing BCAs in the hot spot areas of varieties A and O and it was noticed that the focus was on following the procedures recommended by the BCA supplier company while applying the mites (Table 2). It was further noticed that the

two supervisors and head were recurrently checking handling of the container (bottle) by members and rate of application per a unit area. We observed that every member slowly shook the container and then dusted the mites on the leaves (Event 2 in Table 2). We also noted that procedures were in line with those written on the container of the BCAs.

Through observations made during and after the incident, we noted that in the morning and late afternoon⁴, the head frequently visited the greenhouses with the scout supervisors, line production managers, the farm manager and his deputy. We also observed that he was spending a few hours in his office (mainly in the afternoon) referring to the website of the company, supplying BCAs, books and manuals.

Finally, as can be seen in Event 3 in Table 2, despite the supervised steps, the infestation of spider mite was increasing and advancing to attack more rose varieties in addition to the previously affected ones, varieties "A" and "O". According to our discussion with the head and supervisors, recent scout data also showed more hot spots than earlier. According to the supervisors, the problem was frustrating because since the incident, the head had been strictly following all the activities in line with standard procedures. Further, the present researcher noted that spider mites caused an increased number of rejected plants. It was as a result of this productivity signal that the farm manager and his deputy joined a pests and disease management team in the process of observing the problem (Event 3, Table 2).

The events and actions recorded in Table 2 were, of course, not exhaustive. They are presented to illustrate specific problems encountered in the actual use of BCAs following standard procedures. By extending our focus to the specific practices in event three (Table 2), below, we will now illustrate problem solving practices beyond the use of the standard procedures (Table 3). These can be considered locally adaptive responses, and show how protocols can be elaborated or modified at the margins. Responses to emerging and unanticipated problems signals that the world envisaged by the company website or the manual of standard operating procedure can be at variance with what is actually occurring on the ground due to the practical agency of those implementing the task, thus endorsing the findings of Harris (1987) concerning "hidden worlds" of practice within the workplace.

⁴ Scouting and spraying were done in the morning and late afternoon through early evening, respectively.

Table 2. A critical incident and associated events observed in a cut rose farm using commercial BCAs in greenhouses in Ethiopia

Events	
(1)	On Tuesday morning, 29 of March 2012, the head, the scout supervisors, and line production managers noticed that infestation of spider mite was increasing in a greenhouse, particularly on varieties “A and “O”. It was suspected that the problems might be related to improper release of BCAs and spraying procedures of pesticides. Then the head decided to strictly and personally follow both the spraying activities and reapplication of BCAs
(2)	On the same day, in the late afternoon, the plants were sprayed in the presence of the head and the spray team supervisor. Two days later, BCAs were applied according to recommendations of both the company supplying the predators and a consultant.
(3)	Two weeks later, the head noticed increasing infestation of spider mites again. As compared to the previous incident, this was more serious. In addition the varieties A and O, the problem advanced to other varieties. Consequently, the head organized a meeting with the scout supervisors, spraying and grading supervisors, the head of irrigation departments, and line production managers. After discussing for about one hour they all went to the greenhouse. They observed rejected plants on-harvest and the flagged hot spots along rows, beds, and bays. Later, the farm manager and his deputy joined the group.

Source: author’s field work (March-May 2012)

Problem solving practices beyond protocols

According to our interviews with the farm manager and the head of pests and disease management, the problem related to the spider mite infestation was serious and consequential in terms of quality of roses and costs.

As can be noticed in Table 3, people working in different sections came together in the process of problem solving. They included line production and irrigation managers, grading supervisors, farm manager and his deputy and expert from the supplier company of BCAs. As indicated in the table, participants were looking for possible reasons for the challenges faced in the course of management practices associated with practices of irrigation / fertigation and spraying, as affected by weather conditions and varietal differences. However, there was no clear agreement on the indicated causes, and further steps were taken including inviting inputs from the company expert (Table 3).

Table 3. Interactions among actors on a particular occasion of solving emerging problems in a cut rose farm using commercial BCAs in greenhouses in Ethiopia

Pest and diseases management head:	In addition to varieties “O” and “A”, the problem advanced to other varieties... it has become more serious, since the last incident, I have been strictly following all the activities done in line with the standard procedures...
Grading supervisor:	We made a number of rejects of these varieties[“O” and “A”] in the packing house
Line production manager:	This time, there is an increase of the number of rejected harvested roses for other than “O” and “A” varieties
Scout supervisor:	I also noticed the larger pile of rejects in the greenhouse and this is strange...
Head:	How about irrigation?
Irrigation manager:	Nothing special has happened regarding the schedule, except that due to increasing temperature we increased the volume of water
Deputy farm manager:	Did you check the handling of the BCAs before we received them?
Head:	All were packed properly when we unloaded... in other[neighbouring] farms they [BCAs] are doing well and we received them the same day
Farm manager :	Though not as serious as in our case, problems were observed as well in some [neighbouring] farms
Head:	I think the history of spraying could be a reason
Deputy farm manager:	Why then the irregularity in hot pots observed among varieties?
Head:	I refer to three years of spray history.
Line production manager:	It could also be related to attributes of the particular varieties?
Irrigation manager:	Excess water may be the factor for susceptibility[of varieties]
Farm manager:	What did “J” [expert from the BCAs supplier company] tell you? Did you [the head] call him?
Head:	Yes, he [the expert] told me that he looked into the scouting data but he was suspicious of how we released the beneficials [BCAs], the spraying, and accuracy of data. I told him that I followed all the procedures strictly. He advised me to check their website [of the company] and also consider issues related to temperature and RH [relative humidity] ...
Farm manager:	The website can tell you nothing
Deputy farm manager:	Do not forget that we have already used more beneficials and chemicals than expected. These chemicals [BCAs friendly chemical] are extremely expensive. These days I and “Y” [farm manager] are having a trouble with the owner.
Farm manager:	I will call “Z” [farm owner] and try to invite “J” [the company expert who is living The Netherlands]
Meeting with the expert:	The expert from the supplier company arrived

Source: author’s field work (March-May, 2012)

The research took note of the arrival and incorporation of the company expert into the problem. On his arrival, the expert directly went to the office of the head and a few minutes later, the deputy farm manager joined them. Then they headed to the greenhouses while the scout members and supervisors were on duty. We noted that the expert was closely observing the plants and the activities of the scout members and taking pictures. Later, after about half an hour the farm manager arrived. Generally, observation indicated that the company expert did not locate the exact causes of the problem and finally with the head, the farm manager and his deputy, they decided to continue application of the BCAs.

Informed by the above results we conducted further observation and detailed interviews with the head, the supervisors, and the scout members. In particular, research explored how experiences from different sources were integrated into the practices of solving emerging problems. Using a network analysis approach, we mapped and visualized (Figure 2) the following sets of interactions: (1) within the team members of pest and disease management; (2) among the team members and other people responsible for different tasks within the farm and across its boundaries; and (3) between the team members and material environments. Figure 2 illustrates information sharing among people and information sourcing by people concerned with material dimensions of emerging problems in the context of a new practice, i.e., biological control based IPM. Specifically, results reveal networks showing that the pest and disease management team members interacting not only among themselves but also with other people by crossing the formal team and farm boundaries (Figure 2). These boundary-crossing practices involved a quite diverse group as important sources of information: other members responsible for other tasks such as irrigation and line production managers, grading and harvesting supervisors, friends in neighbouring farms, breeders, and consultants and experts in chemical supplying companies.

Figure 2 also shows that some actors that were central both as information receivers and disseminators. Specifically, the figure shows that the pest and disease management head was an influential actor in dispersing information to many others, followed by scout supervisors (SS 1 and SS 2). Our results reveal that people were routinely interacting not only with each other but also with the material environments. Artefacts like websites, weather data, and scout data were among materials used as sources of information in the process of problem solving. However, we observed that plants were used as an important reference by the all actors including the expert of the company supplying the BCAs.

From observation, a strong nexus of interests becomes apparent focused on the growing plants related to the biophysical environmental conditions, including relationships between plants, the pest and the BCAs, i.e., the spider mite feeds on plants while the BCAs feed on the

pests, which were also dependent on the prevailing weather conditions such as temperature and relative humidity (see Table 3). Further, we also noticed that the interactions were also related to conditions that could affect other management options such as frequency and rate of release of BCAs, irrigation schedule and amount, spray pressure, crop and other pests and diseases that may in turn affect the plant (Table 3). Generally, our findings are that most of these interactions were visible to the actors through frequent observation of the growing plants (Table 2, 3 and Figure 2), beyond and apart from the data recorded on the standardized formats.

Analysis shows that the standard protocols for biosafety embedded in the practice of IPM tell only part of the story. Emerging problems generate problem solving practices in response to critical issues, and these reveal the relevance of multiple sources of information and a more complex web of interactions between social agents and material environments. The findings make it apparent that the nature of emerging problems induced new arrangements that engaged other people and material objects, centred around the plant, and a central crisis issue - the growing pile of discarded roses. In these contingent and pressing circumstances problem solving was not limited to the standard procedures and the formal members of the pest and disease management team and the farm. Other agents became engaged, and new informal sources of hypothesis formation and knowledge gathering became apparent, perhaps not excluding gossip and rumour. Specifically, the real activities represented as networks were formed in the process of solving emerging problems beyond the use of the protocols or the code and formal organizational boundaries. Discussion will now centre on how significant these new and often informal modes of problem solving were, and whether they significantly affected the application of a code and protocol approach to plant protection and biosafety. In short, is the rule the enemy of effectiveness?

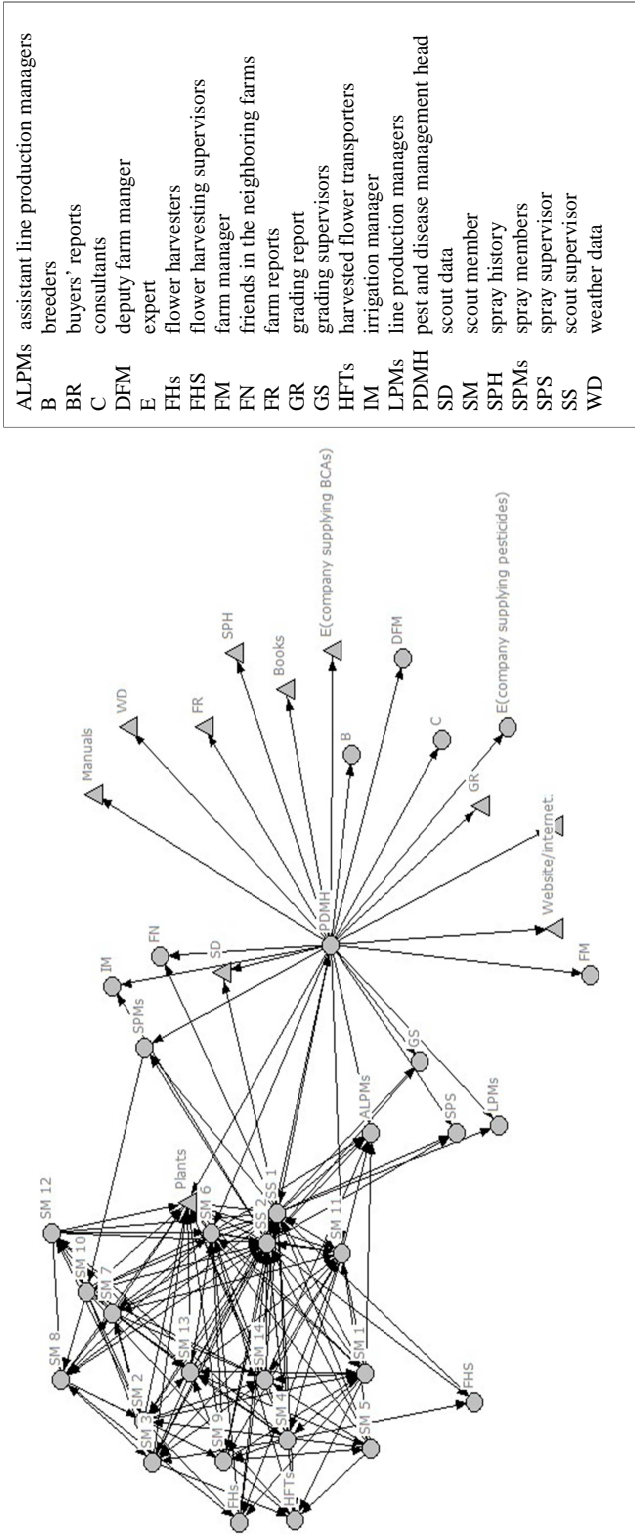


Figure 2. Multiple sources of information used by pest and disease management team used during solving emerging problems
 Note: An arrow from i to j indicates that i receives information from j . Circles and triangles represent people and materials, respectively.
 Source: UCINET 6 (Borgatti, 2002) on author's data (March – May, 2012)

Discussion

In this chapter, we have studied how people use a code of practice in solving practical problems at the level of primary agricultural activities. We empirically investigated how the pest and disease management team in an Ethiopian flower growing farm aimed at foreign markets used biological control based IPM in the process of solving emerging problems in the greenhouses on a farm. Our findings revealed that problem solving practices at the practice level were not limited to the use of the prescribed protocols and the participation of the formal team members (Table 2, 3 and Figure 2).

Integrative analysis of the use of codified procedures (Table 2) and the practices of solving unexpected problems (Table 3) uncovered three aspects: (1) practical problem solving involved use of multiple information sources that included people with different tasks beyond the team and the farm boundaries (Table 3 and Figure 2), (2) the nature of emerging problems at the practice level induced new arrangements, e.g. of consultation and information exchange (Table 2, 3 and Figure 2), and (3) sources of information were not just limited to the team and the code but also covered living material elements, specifically the growing plants (Figure 2).

First, related to the first dimension, our study showed that the problem solving practices were beyond the formal boundary of the team (Table 3). The findings showed multiple actors across the boundary of the team and the farm involved in the process of problem solving. The network analysis (Figure 2) demonstrated that problem solving practices are joint activities that can be seen from a perspective of distributed cognition (Hutchins 2006). Looking at the practice through this lens questions the explicit focus on standardized procedures and trainings limited to formal, functional lines of approach delineated in manuals of pest and disease management practice (see Table 2). When an unexpected crisis emerges tactics and procedures are diversified, and are subject to hybridization.

Second, as can be noted in Table 2, the head, along with other actors, tried to experiment with the procedures and protocols underlying the use of BCAs in IPM. However, the problems were challenging (Table 2, event 3). This can imply that solving emerging problems goes beyond the application of existing experiences and standards. Results in Table 3 indicated possibilities that the spider mite infestation was not necessarily limited to performance of the BCAs. The true causes needed to be found, thus agents needed flexibility to experiment with a range of solutions. Generally, the events in Tables 2 and 3 showed how people were confronted and how they experienced new problems in spite of trying to strictly follow the prescribed procedures.

More specifically, we observed that the efforts people made to stick to the standardized procedures were not enough to get possible answers (Table 2). This deficiency entails that both problems and solutions are made open (Fenwick et al. 2012) in the process of solving practical problems. According to the findings, the members were continuously and interactively framing and re-framing the problem, i.e., they were navigating towards unknown possibilities in various ways (Table 3). These unexpected problems brought people together from different task areas within the farm and beyond, in such a manner that they were linking ideas from multiple sources including the material environments and navigating to understand the problems (Table 3). In other words, our study illustrated that the nature of the emerging problems informed the process of problem solving. In short, it induced the practice using a new structure, emergent and visible in the organizational structure of the farm (Figure 2).

Third, our research further revealed that people were using information from different sources and not limited to established referents, codified procedures and a fixed set of materials (Figure 2). We observed that the actors included experienced consultants/experts living in distant locations (Europe) but frequent visitors to the greenhouses to be able to offer advice on the uncertainties and emergent nature of the problems. This aspect demonstrated how collecting data on material features (e.g. through use of a camera) was an active aspect of the process of problem solving. In short, materialities were not fixed in advance, but were recognized even by experts as labile issues.

There was a strong interest in growing plants (Figure 2) for obvious reasons: it required understanding of the behaviour and status of the pest, i.e., the spider mites and their natural enemies (the BCAs) (Ehler 2006, Toth 2009, Abrol and Shankar 2012, Flint 2012). It further needed agents to reconsider their understanding of biophysical environmental information such as interactions among weather, plant characteristics, and pest and predators, and other management practices that included spraying and irrigation schedules (Table 3).

Further, plants, as the focus of visits, played a role as a reference for interactions indicative of complex materiality (Hung and Der-Thanq 2001). Here, our study illuminated how materials created forms and spaces for people to act and interact (Orlikowski 2007). Specific features of materials, for instance colour of plants, was used as a clue for suspecting infestation by the spider mites. This aspect reveals how close materials dimension such as plant appearance were to the centre of the action in the problem solving network (Figure 2) (e.g. see Butts 2008). In effect, the plants provided the crucial clues to agents struggling to get their minds around an unprecedented problem, so they were closely watched, by team members, and experts/consultants alike.

Furthermore, artefacts like websites, weather data, and scout data were also important components in the puzzle-solving nexus. Prior studies (in settings different from our case) indicated that people were as or more likely to turn to friends or colleagues for answers than to established sources of information (Cross et al. 2002). In our case, we observed people turning to scrutiny of materials when seeking information (Figure 2). This aspect of direct human interaction with material dimensions situated in the workplace, it can be argued, tends often to be overlooked by approaches rooted in use of codified practices and audit and certification procedures.

Finally, based on Tables 2 and 3, we argue that the existing explicit focus on compliance to standards, visible in the policy discourses exemplified in this chapter, with the implications that producers should stick closely to rules and procedures, can be problematic. This focus is problematic because it tends to assume that procedures perform as intended across time and place (Orlikowski 2007). In other words, standards presume that both problems can be anticipated and answers can be programmed (Nicolini et al. 2003) including solving emerging problems. Or put another way, they leave no space for complex genotype x environment x agent interactions. Our empirical research, however, has demonstrated that problem solving practices in the Ethiopian flower industry were not limited to conformity and compliance to pre-defined procedures. In fact, compliance apparently exacerbated the problem, in the case outlined above. Accordingly, it is perhaps only if codes be seen not as external standards but as irreducibly integral parts of capabilities to solve practical problems that they will function effectively. Generally, our study implies capabilities and performance in agriculture/horticulture/floriculture, which is highly contextual, will potentially be limited and damaging if there is too much reliance on prescribed procedures.

It also raises a further question. If the protocol is no longer an accurate guide to the steps taken what then is the status of the certification it underpins? Should the Bronze standard mark also include a caveat warning to the consumer that the producer reserves the right to vary the procedures in an attempt at crisis modifications? Or should the company simply allow the reject pile of discarded flowers to continue to grow? The notion of performance (Richards 1993) puts an emphasis on code-in-use, rather than on the pre-defined and 'ready-to-use' codes and standards. This code-in-use concept, it is argued, can help better to promote diverse promises latent in code and protocols in changing situations, and would be compatible with capabilities to compete in the global markets while espousing sustainability objectives.

Conclusion

Our integrative analysis of the use of codified procedures and the practices of solving emerging problems in the Ethiopian flower industry demonstrated three main features. First, the process of problem solving involves multiple sources of information including people with different tasks, and from beyond the team and the farm boundaries. Second, the nature of emerging problems at the practice level shaped the problem solving process by inducing new arrangements emergent and visible within the formal organizational set up of the farm. Third, the sources of information for solving practical problems were not limited to the social milieu but related also to other materialities, specifically the growing plants. This is more than a claim that technical matters are important. Problem solving requires that materialities be addressed in certain-context specific ways. Local knowledge and a capacity for informal experimentation matter a great deal. These skills are necessarily present in communities of practitioners, but they are systematically taught much less than they might be. The teaching medium would be to offer learning opportunities in practical problem solving in team contexts. Finally, our findings suggest that a code of practice, and hence other standards and related training programmes, need to be considered as integral elements of and irreducibly and interactively related with the problem solving capabilities of individuals and organizations. Quality standards and safety protocols should be seen as tools to hand rather than pronouncements from on high.

CHAPTER 3

The codification of practice: knowing how to manage pests and diseases in Ethiopian floriculture

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Introduction

With the promise to integrate producers in less developed regions into global markets, there is an increasing emphasis on codes of practice/standards in the form of prescriptive manuals. The empirical focus of the present study is the case of Ethiopian floriculture where codes of practice are important aspects (see EHPEA 2011). As a co-ordination mechanism (Cowan et al. 2000), the manuals are expected to facilitate interaction among actors such as producers, buyers, auditors and consultants. In other words, by guiding practices from a distance, codes are considered to be instruments of assurance guaranteeing uniformity of products and processes across time and space. The assumption is that the upgrading of firms is realized through adoption of standards/codes, which are often in effect a techno-scientific script reflecting practices adopted in the context of developed countries (Srinivas and Sutz 2008). At issue is whether these scripts translate across countries and regions of the globe, and whether they allow enough scope for local practices to develop adaptive solutions (previous chapter). Taking into account uncertainties recognized in agriculture/floriculture (for instance see Vellema 2011, Goodman 1999) exploring standards in problem solving practices can be taken to be a key area of research on critical agrarian questions. Furthermore, the present study has relevance to debate about how and if standards contribute to the global concerns related to residue-free and pest free cultivation (Gradish et al. 2011).

Nevertheless, an exclusive focus on codes has limitations. The approach tends to entertain the view that problems situated across places and time can be solved through predefined recipes. In other words, it overlooks situated and interactive aspects of practice (Orlikowski 2006, Jansen and Vellema 2011, Fenwick et al. 2012, Styhre 2003, Gherardi 2000). Thus, by disregarding what people actually do, and how they do it differently in different places, the creation of standards and protocols implies a fixed state of capabilities running across all contexts, and conveys the message that complex production process should be judged against a known and agreed international best practice. Problematically, for local producers, this best practice seems almost invariably to be defined by strangers in distant places. However, a rival approach stresses that a practice based approach informs us better how to understand capabilities as emergent from everyday activities, specifically, in regard to the skills and

knowledge generated in social and material processes of transformation (Orlikowski 2002, Orlikowski 2006). Typically, this second perspective regards material environments in which people interact as integral parts in the process of problem solving.

Here, we argue in favour of this second approach by seeking to demonstrate that codes cannot replace capabilities to solve practical problems by actions that go beyond predefined rules and procedures of known patterns. Furthermore, as Fenwick (2006a) argues, capabilities are better understood as the know-how of specific people and as constant capacity to cope with changing situations in the material and social environments. Accounts of this know-how can help to reframe codified practices, and loosen some of their inherent rigidities. This is a fresh perspective in which hybridization of the two approaches just outlined is advocated. The argument emphasizes the need to know about how agents can make creative use of codification to solve situated and emergent problems.

In this chapter, we seek specifically to explore how agents of flower cultivation in Ethiopia translate practices into codes and use codified practices to solve practical problems. We investigate processes of codification by focusing on how people construct figures and symbols and use these as guides in decision making. For this purpose, we have selected the case of pest management practices in greenhouses on a flower farm in Ethiopia. In particular, we focus on the practices of a team using integrated pest management (IPM) as a tool embedded in a large internationally-oriented code of practice (EHPEA 2011). IPM is a simultaneous management of pests that includes monitoring of pests and predators integrated with other practices to produce crops in socially and environmentally responsible ways (for detailed accounts see Ehler 2006, Toth 2009, Abrol and Shankar 2012, Flint 2012).

Below we describe the research setting followed by an account of research methods. Then we present results and discussion. Finally, we put forward conclusions and implications of our findings.

Methods

We conducted a study in a rose flower farm in Ethiopia from September–March, 2012. Our empirical focus was on problem solving practices of a team responsible for managing pests and diseases by using integrated pest management (IPM) as a tool embedded in a larger code of practice. Specifically, we explore scouting practices and investigate how members translate practices into codes (codification) and use these codes in solving practical problems in the greenhouses. Scouting, which is the monitoring of pest populations and crop developments, is a fundamental activity in implementing IPM (see also Chapter 2). It improves a grower's

ability to make sound pest management decisions through knowledge of the pest and natural enemy populations. If used carefully, scouting helps prevent crop damage while eliminating unnecessary pest control treatments (Dreistadt 2001).

The researcher made observations, field notes and videos of activities in a participant-observation setting (Vellema 2002) to map processes of codification, focusing on how construction of figures and symbols occurred in the practice of scouting. Then, how people used the codes in solving problems and making decision in practice was established. At this stage, the focus was turned to events in the process as follows: (1) the tasks of agents and how they performed them and (2) materials used as sources of information. Simultaneously, we made presentations and discussions with individuals and groups of practitioners to refine our data on in the processes of codification and problem solving. We further combined the results with information from standard manuals, including codes of practice, interviews with members, focus group discussions, and participation in trainings and meetings (Vellema 2002, Jansen and Vellema 2011). Findings were further contextualized by consulting organizational documents and data bases.

Then, we extended our analysis to a network perspective and used the data to illustrate linkages/interactions among members performing different tasks both within and across pest and disease management team boundaries. At this stage further observations and detailed interviews were undertaken with 17 members of pest and disease management teams, including the head, 14 scout members, and their supervisors. After we refined the lists through further focus group discussions, we followed a roster and recall method, which typically involved a stem question (e.g. "To whom do you go for help or advice at work?" Butts 2008). The members of the team studied included a head, two scout supervisors and 14 scout members.

To visualize information sharing among people and sourcing by people from the material environments in the workplaces we adopted a social network perspective (Borgatti and Cross 2003, Pahor et al. 2008). This built on accounts of multidimensional networks suggested by scholars (Lee and Monge 2011, Contractor et al. 2011) and adopted the typology developed by Contractor et.al. (2011), and also included materials in the network (SNA) (Cross et al. 2002) to map and visualize networks of members, tasks and material environments by using UCINET software for social network analysis (Borgatti et al. 2002).

Then, drawing on perspectives of multidimensional networks in social and material environments (Lee and Monge 2011, Contractor et al. 2011) we explored the role of materials in the process of problem solving. Furthermore, informed by the notion of collective socio-material and network dimensions of practice (Fenwick 2010a, Orlikowski and Scott 2008,

Orlikowski 2010) we extended our focus to embrace what might be termed network analytic perspectives. By this we mean an attempt was made to visualize perspectives from the actual network established, rather than from the perspective of functionaries located in their institutional organogram. Data collected on actual, observed practices served as a starting point for network analysis (Salmon et al. 2010).

Results

This chapter is focused on the process of codification, and seeks to ascertain how people use codes in solving practical problems. Our empirical focus concerns practices as generated by a team using IPM from the perspective of implementing code of practice in greenhouses on a large greenhouse-based flower farm in Ethiopia. We focus on how members were transforming actual practices into codified forms and using the latter for problem solving and decision making. Our empirical findings showed that codification plays a part in regulating a series of activities in the practice of scouting (Table 1 and 2). As codes were encountered and understood they were extracted and translated into abstract symbols and numbers (Figure 1). Further, they indicate problem solving practices go beyond the direct use of the scout data (codes) and individuals within the boundary of scouting, and that these practices are distributed among people responsible for different tasks (Table 3 and Figure 2). Our results demonstrate problem solving practices as interactions among people with various tasks within a layered organization, and also between people and materials (Figure 2).

Below we first describe the general setting of the case study followed by an account of how members were performing the task of scouting and doing codification in practice of scouting. Then we present a section indicating how the team used the codes/scout data in the process of decision making/problem solving. Finally, we present the process of decision making as distributed among various social and material environments.

Setting: pest and disease management

The case study was conducted in a rose farm established in 2006. During our research we observed that the farm was producing roses using 42 hectares of greenhouses. The documentation of the farm showed that it had an export capacity of an average 2 million rose stems per week and (thus) about 100 million stems per year. It also indicated that the farm was among the top five biggest exporting companies in the country. From the farm's data base we also noted that the major market destinations were the Flower Auction in the Netherlands and direct markets in Europe. According to the documentation, at the time of the research the farm employed about 1150 people.

Structural organization: the formal farms structures included the following teams: pests and diseases, line production (there were four line production teams), irrigation/fertigation, grading, maintenance and finance and human resources. Further, the pest and disease management team, focus of the present study, consisted one head (leader), two scout supervisors, 14 scout members, 4 spray supervisors and 18 spray members.

According to focus group discussions (consisting of farm manager, deputy farm manager and pest and disease management head), the head was responsible for monitoring scouting, selecting management options, implementing and evaluating the options in consultation with the farm manager. Further, according to farm profile, the head had a university qualification (first degree) in agriculture/horticulture and the two supervisors had graduated in diplomas from vocational training centre. The remaining 14 members were had high school educational backgrounds. In addition, they had work experience of seven, five and three years, respectively in growing roses.

Biophysical environment: the farm covered 42 ha land with four greenhouses. Each greenhouse (also known as a line) was built 100 m X 900 m (9 ha). There were four lines referred as 6, 7, 26, and 27. All greenhouses were made of polyethylene plastic, 200 microns thick with metal frame, fixed roofs, and side ventilations having a complete set of automatic control fertigation system with injector and chemical tank connected to ground level micro sprayers. All greenhouses had climate control systems. Grading and packing areas, cold stores, offices and other facilities were set across the full width of the front of the greenhouse area. Further, each greenhouse had 114 bays left and right divided by a long corridor. Each bay had four beds each with two rows. On each individual rows there were 250 roses, (500 on a row), grown on raised soil bed. There were 13 different rose varieties grown.

According to the management team and our own observations, the pests and diseases that had potential to cause quality defects were: the two-spotted red spider mite, powdery mildew, downy mildew, botrytis, trips, nematodes, mealy bugs, aphids, and caterpillars. We further observed that the two-spotted spider mite was the major problem, particularly from February onwards, and the intensity of the problem was closely related to temperature and relative humidity. This was in line with the established evidence that cut roses (*Rosa* spp.) in a greenhouse are frequently often simultaneously affected by many pests (Bout et al. 2010) among which two-spotted spider mites (*Tetranychus urticae*) is the most important in Ethiopia (Belder et al. 2009). In the export market for roses tolerance for mite damage is usually zero (Gerson and Weintraub 2012). Accordingly, the farm had adopted IPM to manage pests, and the spider mite in particular.

Codes and codification: the skilful practice of scouting

The farm adopted the coded of practice implemented by the Ethiopian Horticulture Producer Exporters Association (EHPEA) (Bronze level)⁵ and MPS-SQ⁶, sector and international levels codes of practices, respectively. During our study the farm introduced IPM as was required by the higher level of standards known as Silver and Gold. Producing flowers in a socially and environmentally acceptable ways were among the key aspects of the code with the following set indicators (EHPEA Code of practice, 2011, version 2. 13, p. 57):

- Implement Good Agricultural Practices and ensure that pest management [is] achieved with a minimum use of pesticides and impact on the environment [by using IPM] ;
- The person technically responsible for pest control has [to have] up-to-date awareness and training in IPM.

As can be noted from the above points the code emphasizes reducing the use of synthetic pesticides to ensure production of roses in socially and environmentally responsible ways. Further, it is explicit in focusing on documented technical capacity of the individuals responsible for the managing the task of IPM.

Generally, within the context of IPM, and its code of practice, our research homed in on two issues: (1) damage due pests and diseases on plants, and their impact on appearance, were the major concern for growers, and (2) use of synthetic pesticides was considered equally unacceptable by the market and by the code. Accordingly, we observed that the farm took an option to use imported commercial-available biological control agents (BCAs), i.e. pest predators, as an IPM strategy. According to respondents, the two BCAs *Phytoseiulus persimilis* (spidex) and *Amblyseius californicus* (spical) were to play a role similar to that of pesticides in specifically reducing population of a key pest known as the spider mite. This option has been found to be effective to manage spider mites in Ethiopia, including the case of the present study farm (Belder et al. 2009).

In the study, for practical reasons to do with fieldwork, we identified a task that was considered by the farm as critical in the process of managing the pest: scouting. Scouting

⁵ 'This Code defines, at Bronze level, the minimum acceptable standards for operation of an export flower or ornamentals farm in Ethiopia. All exporters of cut flowers and ornamentals (cuttings and young plants) will be required to meet the minimum standard (Bronze level). However, standards for some markets and individual buyers and standards adopted by some farmers may exceed those described in the minimum standard. Therefore higher standards, a Silver Level and a Gold Level the Code are now being introduced' (EHPEA, 2011).

⁶ 'Includes requirements on health, safety and terms of employment, and is based on universal human rights, the codes of conduct of local representative organizations, and International Labour Organization (ILO) agreements. The Dutch Flower Consultation NBB (represented by FNV Bondgenoten, Both Ends and the Latin American Activities Organization OLAA) has been closely involved in incorporating these international codes of conduct (ICC) within MPS' (Riisgaard 2009).

comprises two main activities: (1) monitoring and recording of the status of pests and indicating level of infestations and (2) release of BCAs and inspecting their population. We further noted that members monitored the population of the pests and BCAs every three days in each greenhouse while the release of BCAs was done two to three times per week depending on the level of infestation. In this chapter, we focus on practices of scouting related to monitoring of spider mites and the BCAs. Scouting included two phases (Table 1 and 2): (1) generating scout data and (2) using the data for decision making or problem solving. In this section we describe the actual practices through which scout data were produced. Accordingly, we followed a team performing the practices on specific events for two weeks in March 2012. Members of the scouting team, supervisors, and the head of the team cooperated in the initial phase of scouting (Table 1). In the particular problem solving event, we noticed three main activities: (1) planning or preparation, (2) actual scouting activities, and (3) transforming practices to codes or codification. It is this third aspect which is the special focus of the present chapter.

Planning for scouting

As can be noted in Table 1, reporting on a meeting of the team, the head raised concerns and referred to previously made errors by some members despite their trainings. However, one of the supervisors questioned the adequacy of the trainings. According to her, identification of one of the predatory mites (Spical) was found to be difficult even for the supervisor. Here, we were informed by the farm manager that the supervisors were appointed based on experience in terms of time length served, and their demonstrated capabilities. In addition, the management of the farm insisted on following procedures in order to produce reliable data (Table 1). Further, discussions by the head and supervisors emphasized the need for accuracy in recording populations, particularly of BCAs. This requirement reflected financial implications, since the imported predatory mites were expensive (interview with farm manager). In addition, factors such as temperature and relative humidity had to be taken into account (Table 1).

Actual practices of scouting

Table 2 illustrates the actual practices of scouting. As can be noticed, effects of spider mites on the plant guided scout members to locate the pest. We observed that members were frequently looking at the underside of the leaves of a suspected plant, which demanded a magnifying tool or hand lens to help make the spider mites visible. According to our observation, members counted tiny walking dots (spider mites and BCAS) in webs. We also

noticed that absence or limited number per sample leaf or location observed did not necessarily imply the real status of the mites. Accordingly, members had to repeat observations several times across samples to minimize risk of missing instances. We noted also that the recurrent observations were associated with activities of the spider mites, since they were not staying in a particular place and often hid in locations difficult to observe, such as in a leaf or deep within the plant canopy. In addition, we noticed that the head took serious note of haste when following the team scout members, and often discouraged any racing behaviour (i.e. attempts to get through inspections and recording in shorter time periods) (Table 2).

The activities performed by the head, supervisors, and members on the particular scouting events observed (Table 1 and 2) were not exhaustive, and are in effect a sample limited by research time available. Nevertheless, the tables demonstrate that the practices of scouting took much time and required considerable patience. They show that information was flowing in all directions among company agents, both within and across the pest and disease management team boundary. Put differently, the practices also involved people from other tasks areas such as spraying, production, irrigation and grading.

Further, the results of observation reveal that scout members, the head, and the supervisors all made much use of materials - the condition of plants - in addition to people when seeking information to determine the status of the pest and BCAs. Our findings showed how plants provided members of teams clues about the problems they faced. As can be noted from Tables 1 and 2 different features of the plants were used. These included visual and spatial signs such as colour and underside of the leaf, stem and lower part or skirt. Colour was also used as an indicator of level of infestation by the key pest, which in turn guided the scouts to locate the pest and predators (Table 2). The fact that the mites (both pests and predators) were often found in the lower canopy and lower surface of the leaf is associated with their negative response to light (see Ohtsuka and Osakabe 2009, Villanueva and Childers 2005). Similarly, effects on the colour leaf can be related to the damage they cause as they feed on cell chloroplasts just under the leaf epidermis, causing yellow colour (for a detailed review see Gerson and Weintraub 2012). In addition, research participant observation also noted that using plants involved both supporting tools such as hand lens and a standard format for recording observations. According to our data, use of the tools was related to the activities of handling plants, counting the number of the predator BCAs and identifying and assessing the condition of the crops by the factor of colour across variety, beds, bays, and lines.

Table 1. Sequence of actions during one observed process of the planning for scouting

Activities
(1) The head arranged a meeting with two supervisors in the morning (8:00 am) in a room next to his office and that was close to greenhouses of the farm.
(2) The three spent about 30 minutes discussing what was expected of the supervisors and scout members.
(3) The head and supervisors referred to the scouting data collected during the last three days, arguing over the accuracy of the records provided by the scout members.
(4) One of the scout supervisors was nervous as the head emphasized mistakes made by members under her supervision. However, the head added that almost all members made some mistakes while recording the population of the BCAs.
(5) The supervisors stated that it is challenging to identify and record the mites. Nevertheless, the head did not accept the argument and mentioned that although members of the scouting teams were given a number of trainings to identify the agents, still some did not record properly.
(6) One of the supervisors insisted that those trainings were not enough; even she had problem in identifying and differentiating mites, particularly the Spidex. However, the head shouted and mentioned the name of one scout he found almost running instead of walking slowly while inspecting the plants. He further asked how they could inspect the skirt [lower part] of the rose plants in that way. At this point, the head demonstrated a particular way of observing plants and recording both the spider mite and predators directly on the white board.
(7) They raised issues related to temperature and relative humidity and implications for pests and diseases with a focus on spider mites and released BCAs.
(8) The head stated that he received information from production managers of Line 26 and 27 that the condition of some rose varieties in some beds and bays was not good. He urged supervisors to focus on bed one, three, and five of line 26. He also reminded the supervisors to closely supervise the scout members while they record the population of the BCAs. He further stated that the case of rose varieties in bed one in line 26 was still under investigation and promised to join them on that particular spot.

Source: author's field work in March, 2012

Table 2. Description of activities during a particular practice of scouting

Activities:
(1) The two supervisors spent about 10 minutes talking to each other on the issues they raised with the head, specifically the difficulty of identifying the BCAs, particularly the spider mites.
(2) The supervisors walked into a greenhouse and joined all 14 scout members.
(3) Simultaneously, the head checked the presence of the members of the team, having passed through the corridor that divided his office and the gate of the greenhouse.
(4) After a short conversation (10-15 minutes), the supervisors looked at the members and asked whether all have the required materials at hand (hand lens, scout record keeping format and pencil and clipboard).
(5) The supervisors led the members and entered the greenhouse. Immediately after crossing the gate, seven of the members remained with one supervisor at the corridor close to the gate (West) while the rest went with the other supervisor to the other end (East) of the greenhouse.
(6) Before this group reached the other gate at the East end, a production manager of line 26 stopped the supervisor. He took a leaf and showed it to the supervisor. Then she observed it by using the hand lens and mentioned to him that bay one of line 26 needs serious follow up as the population of spider mites was increasing despite the control measures. Then they both agreed to further give attention to that particular bay.
(7) The supervisor of the East end group said to the scout members who entered the rows within the greenhouse that they must look closely at the skirt and stem of the plants and also to walk slowly while inspecting and record the results properly.
(8) Each scout member quickly entered the first bed along the rows in the first bay from the right. Scout members started walking slowly and visually observing mainly the skirt (lower part) and stem of the plants in the greenhouse. Moving back and forth and up and down, they observed the plants along the beds.
(9) One member of the team was asked how she could identify plants affected by spider mites. She said that it was possible to judge by the leaf colour: "for example, when you observe leaves with pale colour, you just look out at the underside of the plants, by bending the stems slowly, and you may see webs". She showed more than four plants suspected for spider mites.
(10) The second scout member cut a leaf from lower parts of the plant and placed it under the hand lens by inverting the underside of the leaf upward. Then she held it on the clip board and observed it through the lens. The researchers saw one mite with grey colour, which was moving slowly. Then she told me that it was a Spical.
(11) The third member handed over a 10X hand lens to the researcher and asked to look through the lens and to differentiate the colour of the mites. First she told me to look for the red mite with two spots, pale and yellowish. Then she explained to me that the first one was the spider mite. The remaining ones were predators that feed on the mites. She also instructed the researcher how to observe the speed of the two predators.

Source: author's fieldwork data in March, 2012

Generally, results showed that inspecting, identifying, and recording the pests and predators were not easily handled by an individual scout, working alone:

Last week I had a problem in one of the rows in bay 11. Some roses were not looking good. But I could find neither spider mite nor BCAs on the skirt of those specific plants. Then I approached my friends for help and they advised me to further continue with my effort. Again I found no mites. After several unsuccessful trials, “X” [supervisor] gave me support. Not only did she solve my problem but also continued to give feedback, till I confirmed to her I fully understand the way I have to conduct observations. (A scout member)

Likewise, the practice was challenging, not only for the scout members, but also for others to record signals that were associated with peculiarities and similarities of the pest and predators (Table 2). Others indicated that (small) size of the mites is among the primary features that constrain people’s capacity to manage these pests:

A female [spider mite] completes a generation in 2 to 3 weeks, lays (on suitable plants and under benign conditions) more than 100 eggs, and produces copious amounts of webbing, within which... [it] lives its entire life. Because the mites can quickly overexploit their environment, dispersal is essential for survival...in greenhouses, dispersal occurs primarily by walking or by being passively carried on or by human activities. (Villanueva and Childers 2005: 269)

[Spidex]... is a fast-moving, proactive predator that feeds only on web-producing spider mites; its long legs allow it to move easily within the webbing. Being a voracious feeder, this predator may overexploit its prey and then disappear. [Whereas Spical]...a generalist that can survive on pollen during periods of low prey density. ... [tolerant] to a wide range of temperatures and humidity. (Gerson and Weintraub 2012: 231)

Gerson and Weintraub recognize that the conditions that promote the development of spider mite populations are fairly well known. Yet, the ability to detect nascent populations is still a challenge in practice in the industry (Gerson and Weintraub 2012). Hermann et al. point at on-going efforts to look for possibilities to assess leaf damage from a distance. However, the common practice, also in the study farm, is to manually scout and inspect individual leaves for the presence of spider mite (Herrmann et al. 2012).

Transforming scouting practices into codes

For the scout members, supervisors and head, time was required not only for inspecting plants, the pest, and BCAs, but also for recording data properly in standard formats produced by consultants (Figure 1). We observed that in a particular case of a 9 ha greenhouse, 14 scout members, and two supervisors needed four to five hours to complete scouting that included recording. We noted that the use of standardized formats was strongly valued:

We have developed four formats: ... it is important that your farm is going to work with... [it]... (An e-mail message from a consultant)

Our observations indicate that in the process of data generation scouts tried to capture and record information related to presence of spider mites, level of infestation (spots and hot spots) and population of BCAs (as present or absent) across the greenhouse locations and varieties. Accordingly, participant observation identified the following main activities of scout members and supervisors:

- using hand lens, recording of the pest and BCAs on a pre-designed format with columns and rows representing beds, bays, and lines;
- identifying visually varieties of roses in the greenhouse, differentiating normal growth from abnormal, normal leaf colour from defective colour, damage due to spider mites from diseases, disease and pest damage symptoms with other causes;
- translating the number of pests, diseases, and beneficial predatory mites into codes in line with the scout format.

The daily practice of an individual scout member can now be used to illustrate how observations translate into codes or codification. Figure 1 illustrates a set of the scout data (code) produced by the individual scout responsible for bed “1” in a greenhouse (line 26). We observed that four such items of data were produced by the scout member on every scouting trip per single greenhouse. There were 114 bays in a line of which each had four beds with two rows, and on each row 250 roses were grown.

In the process of codification, scales and colours were used to represent the infestation rate by the pest (spider mite) and the status of BCAs (spidex and spical) (Figure 1). As can be noted in the figure, yellow, grey, and red represent slight, medium, and serious infestations across varieties, beds, bays, and lines respectively. Similarly, the presence of BCAs was denoted by green (Figure 1). For instance, we observed that the scout member classified infestation as a hot spot when she found more than 20 mites on the sampled leaf or as spot

when she found between 6-20 mites (Figure 1). This was coded as a red colour representing higher infestation of spider mites, implying that bed “1” in bay “1” had three hot spots in a population of 500 roses. Spots / points were identified as areas that needed serious attention.

Figure 1 illustrates the stage at which the team, by using the standard format, codified the activities/practice of scouting into simple scout data relating to a particular event. However, according to our observation we noted three stages of recording before reaching this phase. First the scout members made records in the greenhouses. Then, data produced by the scout members were evaluated for accuracy by the supervisors. According to our observations, the scout supervisors cross-checked data produced by scout members with their observations before submitting it to the head. Specifically, we noted that the supervisors:

- were often observing rejected harvested roses in the greenhouses, and that they compared numbers on these rejects with data recorded by scout team members;
- considered comments (verbal and written on pieces of papers/memos) received from line managers, supervisors of harvesters and transporters of flowers and spray and grading divisions;
- consulted the irrigation manager for further information on hot spots (areas with high population of spider mites).

Finally, scout data were checked and revised by the head and in the presence of the two supervisors, and with further comments, re-written by a secretary in his office, where the standard formats prepared by the consultants were strictly followed. At this stage, the data generated by the practice of scouting (Figure 1) were ready to be communicated among different actors, the farm manager, deputy farm manager, the farm owner, consultants and experts from the supplier company.

In general, we found that the code/scout data (Figure 1) to be a rather complex encapsulation of several kinds of observations reflecting practices and experiences of the scout members, supervisors, head, and other people interacting among themselves and with the material environments, comprising particularly pests, predators, plants and the physical environment such as temperature and relative humidity in the greenhouses. We further noted that it had in fact become a communication tool, facilitating further navigation, and signalling the status of pests, BCAs, and the plants. Nevertheless, further analysis revealed that scout data were not the only instrument used to reach management decisions about pests. In the following section we will present further courses of actions that could be undertaken to contribute towards the decision making process. In this section we will focus on the manner in which problem solving practices were informed by scout data.

SCOUTING REPORT-				SCOUT Agiti		BED DAY		Spider mite code		Spidex and Spical code	
GH NO.	26	WEEK	13/2	Monday	5	0	0	1-5	1	Absent	0
DATE	28-03-12	WEEK	13/2	Monday	5	0	0	6-	2	Present	1
								>20	3		
LEFT						RIGHT					
Bay #	Spider mites	Spidex	Spical	Spots	H/spots	Bay Spider #	Spider mites	Spidex	Spical	Spots	H/spots
	Skirt	Stem	Skirt Stem	Skirt Stem			Skirt Stem	Skirt Stem	Skirt Stem		
1	3	1	1	1	4	1	2	1	1	1	2
2	1	2	1	1	0	2	2	1	1	1	3
3	1	2	1	1	2	3	2	1	1	1	3
.	1	2	1	1	0	.	1	1	1	1	0
114	1	2	1	1	0	114	2	1	1	1	0

Figure 1. Scouting data generated during a particular scouting day
 Source: Based on the study farm database

Codes and problem solving practices

Here, emphasis is placed on how team members tried to manage key pest spider mites in greenhouses by using BCAs. During field research, we noted that in the context of IPM, use of BCAs did not stand alone. According to our discussions with the farm manager and the head of pest and disease management, the farm was also using predator-friendly pesticides both for spider mites (in spots and hot spots) and other pests and diseases in the greenhouses. Accordingly, scouting was associated with release of commercial BCAs and also with spraying of eco-friendly chemicals. This account selects the activities related to release of BCAs to illustrate the process of problem solving/decision making. There is also a focus on how the head of section used scout data generated during a particular event to make decisions regarding use of commercial predators.

Table 3 demonstrates how the head tried to formulate the problem and to make informed decisions. For reasons of time limitations, observation focused on specific instances in which spider mite infestation increased, and BCA decreased or was absent in some beds across bay one in line 26. We selected the case of variety “X” grown in a specific bed under threat of spider mite damage. Findings indicate that agents with various formal tasks were involved in the process, both within and across the boundaries of farm and team, and also became involved with materials used in the process of navigation (Table 3). Specifically, our results reveal that the process of problem solving involved different actors responsible for different tasks. The list included the farm manager and his deputy, the farm owner, line production managers, consultants, irrigation manager, friends in the neighbouring farm, and marketing agents at the auction (Table 3). Further, Table 3 illustrates that materials such as previous scout data, e-mail communications with unpackers (those who made grading at the auction); farm reports, weather data, irrigation schedule, and grading reports were among some of the other varied information sources or references used.

Generally, practices of problem solving involved interactions among people beyond the formal organizational boundaries (Table 3). In other words, members across various tasks participated in the process of decision making. Further, as can be noticed in Table 3 materials were central to interactions among people performing different tasks. Nevertheless, use of materials by agents was not limited to pre-existing data sources such as codified scout data, but involved others material indicators such as plants and weather data (temperature and relative humidity):

We [farm management members] always send scout data to consultants and experts in the supplier company, with management measures we employed including the prevailing weather data. ...in fact consultants and experts “X” and “Y” [from a company supplying BCAs), who already have the knowledge and skill enjoy physical visits to farms before suggesting solutions. (Pest and disease management head)

As can be seen from the above instance, while the scout data created new opportunities for decisions, navigation to add further information was continued. Decision making did not solely depend on the code or the team members formally responsible for the task of pest and diseases reporting, but consultants also became involved. Here, it can also be noted that the consultants, who developed the protocol, still relied on farm visits to translate / interpret their code.

As can be noted in Table 3, problem solving/decision making was not limited to interactions among people but also included interaction with various materials. Materials were central to interactions among agents performing different tasks. Informed by network analysis (see above) we further tried to visualize interactions by considering events indicated in Table 3 as particular instances. We tried to map the interactions that can illustrate the network of people, their tasks, and their material environments decision making at a particular time (Figure 2). Figure 2 illustrates how people doing different tasks were connected to each other and their environment in the process of problem solving/decision making. In addition to codified scout data, plants and weather data were the most important nodes to which most of the people involved in the problem solving practice were connected (Figure 2).

Table 3. Activities of head demonstrating how people, materials, and tasks interact in the process of decision making

1	Meet with line 26 production managers for about 20 minutes in a greenhouse. The head had a note on a piece of paper and used a 10X hand lens. They were focusing specifically on variety "X": They noticed an increasing number of spider mites. Further, they referred to data generated during the last two scouting events. He also reviewed reports he sent to the farm manager and consultants on a particular variety: "the old spots from last week are getting improvements in all varieties but still we saw some new spots in some beds."
2	Monitor daily grading reports from the pack house. His attention was on the number of rejects made the last three days due to pests and diseases for each variety. He specifically looked for remarks made at the end of the grading reports and noticed few rejects of variety 'X' in line 26 on a particular day. Of the 291 rejected cut roses of variety "X, 117 were due to pests and diseases (defects resulting from other diseases and pests including spider mite being reported together)
3	Review 'unpack' / buyers reports from auction in The Netherlands. He read reports sent via e-mail the day before by buyers and referred to remarks made on each variety. He did not find remarks on the variety of great interest: "... "Y" [variety] bit damaged but not much..." "X ...beautiful. In general, the flowers are getting nicer".
4	Check spray history, records of released BCAs, and irrigation schedule. He focused on last three days history and last three weeks released BCAs: <ul style="list-style-type: none"> • Spray history: "we have some spots on bay No 1&2 (action taken—we did spray on Monday by meltatox (120)+collis (10) and we are going to repeat by meltatox (120) + collis (10) top spray" • Release BCAs: "On line 26 ...we did spray and we apply extra Spidex then we will follow the result".
5	Arrange unplanned meeting with farm manager and his deputy. The head went to the office of the farm manager with few leaves and hand lens. They planned a joint farm visit that involved close observation of the plants in the greenhouse focusing on BCAs. They confirmed that the problem was serious, but were suspicious about the doses of chemicals sprayed last week that might have affected the BCAs. Head explained all the efforts he made. And also agreed to consult the Supplier Company, after informing the owner. The farm manager asked the farm owner for advice.
6	Meet with deputy farm manager, line production managers, irrigation manager scout supervisors, and scout members. They referred to weekly and daily weather data using the computer networks of the farm. The head referred to temperature and relative humidity. They associated higher population of spider mites with increasing temperature, but issues of population of BCAs in line 26 were not clear.
7	Check web sites of the company. He explored topics related to spider mites and their natural enemies. He could not get satisfactory answers, particularly for BCAs.
8	Consult friends in other farms. He discussed farm management problem with friend in neighbouring farm 'A'. The head also made calls to several friends and discussed farm management issues
9	Meet with expert from supplier company. They jointly visited farm and referred to reports. They did not find the exact reason for the problem but agreed to reapply the BCAs and wait for the results.

Source: author's field work in March 2012

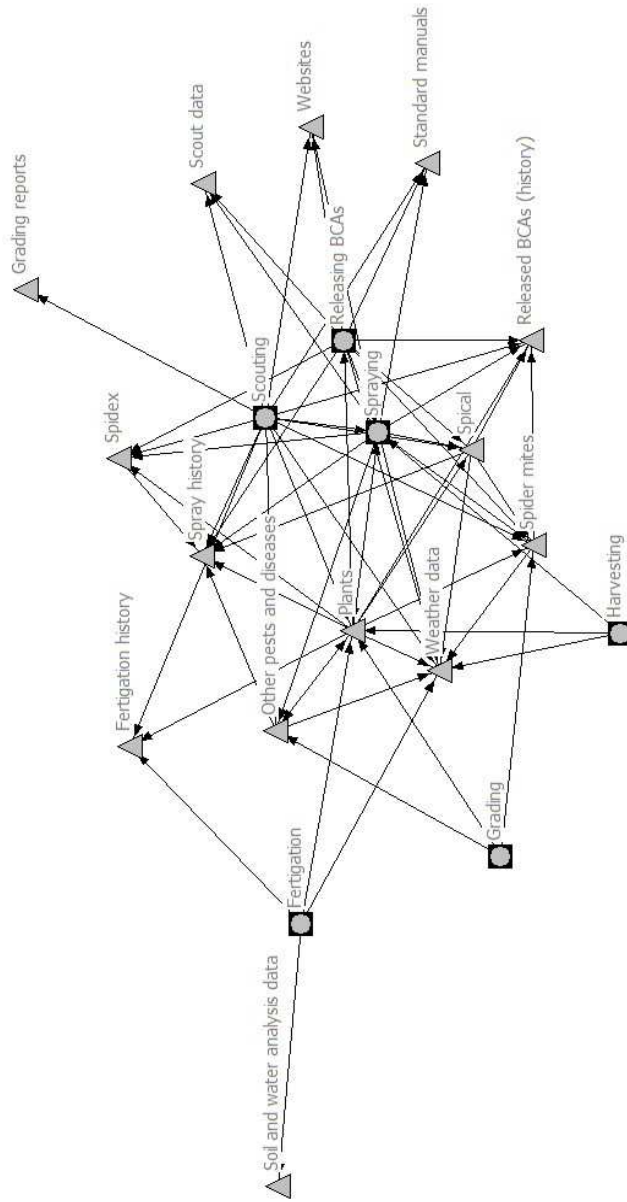


Figure 2. Network of people, task and materials (circle in square represents people and task and triangle signifies materials)
 Source: using UCINET6 (Borgatti et al. 2002) on authors' field work data

Discussion

We explored how people translated the actual practices of scouting into codes and used the codes in solving practical problems in pest and disease management in greenhouses. Specifically, we investigated how people abstracted practices in forms of figures and symbols and used them in decision making. In this section, we first discuss the process of codification and the use of codes in problem solving. Then we integrate our empirical findings with the overall argument developed in the chapter.

Skill in practice

First, the findings show that practices of codification in scouting required skills, techniques and know-how related to using tools, handling plants, identifying symptoms and presence of key pest, differentiating pests from BCAs, and making judgements about their interactions and the effects of the pest on plants across variety, beds, bays and lines (Table 1 and 2 and Figure 1). The following activities constitute the composite and skilful practice of scouting:

- using hand lens, recording data on a pre-designed format, understanding farm maps in line with the format (columns, rows that represent beds, bays, lines);
- visually identifying varieties of roses in the greenhouse, differentiating normal growth from abnormal, differentiating normal leaf colour from defective colour, resulting from damage due to spider mites or diseases, distinguishing different sets of disease and pest damage symptoms;
- knowing how to translate the number of pests, diseases and BCAs into codes in line with the scout format;
- knowing how the biology of rose plants, its pests and diseases, and BCAs interact;
- knowing how physical and biological factors affect the number and distribution of pests, diseases and beneficial biological agents;
- knowing how changeable conditions determine the life cycle and manifestation of pests and diseases of roses in the greenhouse (such as variation in specific temperature and humidity).

We noted that using the hand lens was a skilful activity. Likewise, our findings indicated that identifying the pests and BCAs required considerable know-how (Table 1 and 2). According to the results, locating the mites was not an end in itself, and scout team members were further required to determine the population or degree of presence (Table 2 and Figure

1). Further, our study showed that inspecting population of the mites needed a careful handling of roses (without damaging the plants). Similarly, our observation revealed that bending the plants slowly requires experience, techniques, and skills (Table 2). However, the process integrated skills and knowledge and techniques of people performing various tasks in addition to the team formally responsible for scouting (the head, supervisors and scout members) (Table 1 and 2). Further, as can be noted in the actual practices of scouting (Table 2) the process was not limited to interactions among people but also included interactions with materials, where a knowledge of variations in conditions became important.

The codification of practice

The codes generated in scouting were used to represent the status and relationships between the pest, the predators, and roses in the greenhouses (Figure 1). The codification incorporated the prior concepts of consultants in terms of a standard format, but also included observations and experiences of the scout members, supervisors, the head, and practitioners, resulting from interactions among themselves and with their various material environments. This second set of elements was in effect exogenous to the thinking and knowledge that had gone to make up the code. Much of this local knowledge was emergent in practice, in response to material intractabilities, such as the inability to truly understand certain durable hot spots of pest damage. Codification was thus not really an externally-imposed template but a hybrid mix of external norms and abstractions or extrapolations based on collective skill, techniques, and knowledge manifest in actual practices of scouting in a real and perhaps changing environment.

Hybrid codification also served as a communication tool among a group of key decision makers that included the head, farm manager and his deputy, farm owner, consultants and experts from the supplier company of the BCAs. Specifically, they were a mechanism to evaluate the management options taken and to justify/guide future courses of actions such as spraying and release of BCAs. In effect, abstracted past practices entered the equation as codes for solutions that had already worked and thereby served to shape future plans/intentions rather more flexibly than is implied by a single documented code. Codes emerging from practice related to the distribution of problem solving practices/capabilities and were not limited to the generation and use of scout data. Rather they played a role in the coordination of distributed tasks and various people responsible for different tasks and other materials, including preceding scout data (Figure 2). In short, actual management was much more than simply following a prescription. It has to respond to the discovery of real and unanticipated problems.

The codification of practice

In this way codes by practices ramified outwards and upwards potentially shaping interactions among different people and materials across space and time in a less determinate way than might be imagined from reading the written protocols (Table 3 and Figure 2). These practice-based codes also enabled interactions between people via plants; the ability to exchange observations made of what happened at the plant informed the process of problem solving/decision making situated in the real environment. This indicates the relative importance that agents attached to materiality (Figure 2). Here, plants and plant health represented an intersection in a complex web of relations, which included interactions with people managing other practices, such as irrigation and spraying, as well as interaction between the plants, pests, and predators. We are now moving far away from the idea of a narrow protocol guaranteeing biosafety. Our results suggest that in reality individuals interacted via the situated aspects of materials, and that the pesticide protocols were only part of a much larger and locally specific interactional nexus.

The limits of codes and codification

On the basis of the empirical findings of our study, we argue that an exclusive focus on codification and codes offers an unrealistically limited view of the situation (Duguid 2005). First, an emphasis on codifications and codes is often associated with the idea of transferability of capabilities. This perspective tends to focus on individuals as key and central to task performance. This is in contrast to our empirical evidence, which has shifted attention to problem solving as a joint and distributed activity, linking tasks across a task-specialized social and materially complex set of environments (see Tables 1, 2, 3, and Figure 2). The conception of technical performance here outlined thus has much in common with the conception of distributed cognition as advocated and exemplified by Hutchins (2006), as an activity integrating social and material dynamics, but only lightly regulated by rules. Hutchins (1995) shows, in relation to the process of harbour and anchor navigation in the US Navy that the rule book is present (probably in a navigation deck locker) but no one uses it - the capacity to navigate safely has been evolved by the team through the practice of successful and safe navigation. The rules are distributed across the group as distributional codes reflecting practice as much as theory. This is what we have described above, about actual practices of successful pest control. The rules are not unimportant but they are not the full story.

Agricultural practices involve dimensions beyond human intentions (Biggs and Clay 1981, Vellema 2011): problem solving and decision making then becomes an on-going struggle involving emergent social organization and evolving materiality; it involves capabilities that

cannot be just limited to individuals but are situated in the nexus of interaction across the relevant social and material environments (Orlikowski 2005, Fenwick 2010b, Orlikowski 2006, Jansen and Vellema 2011, Fenwick 2010, Fenwick et al. 2012, Johri 2011). Our results show how decision making or problem solving capabilities involve more than just interactions among people, the aspects on which most transfer approaches depend, but also on interactions with the material world (Figure 2). The situated aspects of the material environments, such as how plants grow and resist pests (Figure 2), can help to identify unrecognized distributed features of team problem solving capabilities (Orlikowski 2006, Pea 2004, Johri 2011) but these cannot be captured by codifications and codes. Table 4 attempts to summarize how codification contributes to problem solving.

Table 4. Contribution of codification to problem solving processes

Contribution	Process	Manifestation
Codification	Capturing and abstraction of skills, techniques and knowledge people used in the practice of scouting into scout data/code in forms of the symbols and figures	Scripted practices representing interactions of individuals, materials, and pre-defined concepts
Coordination	Connecting different actors to: (1) evaluate actual management options and include past management options; (2) use signals of the current states for future options; (3) share information among team members and farm managers, owners, consultants and supplier	Representations of relationships between pests, predators and roses in the greenhouses
Problem solving Decision making	Including multiple sources of codified and real information based on know-how and skills distributed across members with different tasks, in addition to the externally induced codes based on expert knowledge	Verbal or written communications in everyday encounters of members and non-members of the team.

Acknowledging the incompleteness of codes, either translated from practice or induced via standards, our findings revealed that team members, including experienced consultants at a distance, were frequently evaluating scout data by referring to what the plants told them in the course of decision making (see Table 3). May be this is not “talking to plants” but certainly it is knowing how to listen to them. Understanding how materiality constitutes, enables, or constrains situated everyday activities and interactions among people can inform the know-

how of people to make use of emerging or induced codes in solving practical problems (see Fenwick 2006a, Jansen and Vellema 2011, Johri 2011). Likewise, a practice based view of knowledge and skills leads us to understand capabilities as know-how that emerges from everyday activities and thus is always in the making (Orlikowski 2002, Jansen and Vellema 2011, Fenwick et al. 2012). This perspective on know-how emphasizes capabilities in practice beyond the codified features (Gherardi and Nicolini 2000). Yet, our results also imply that the emergence of codified practices reflects problem solving capabilities. In its place, codification is not to be despised.

Conclusion

This chapter has described how people transform practices into codified forms and use these codes in solving practical problems. Regarding codification and codes and their use in problem solving, our research demonstrated three main findings. First, the data generated in the scouting practices were used as codes to represent the status and relationships between the pest, BCAs, and growing roses in the greenhouses. Second, codification involved skills, techniques, and know-how of people performing various tasks distributed within and across the boundaries of the team and farm. Third, in the process of translating actual practices into working codes people made effective use of material environments (tool use, and knowledge of growing plants, pests, predators and the prevailing weather data). The navigation towards decision making was not limited to using the scout data. Instead, shared material environments such as growing plants and weather data were central to interactions among the task groups. On the whole, our findings illustrate the situated and interactive aspects of problem solving capabilities as know-how, and demonstrate the role of codification and codes in the way know-how is constituted and distributed among interacting social and material environments. Codes shaped in distant capitals may be a snare, but codes and distributed routines reflecting living local knowledge are essential to technical practice.

CHAPTER 4

Competence as know-how in practice: the performance of university graduates in the Ethiopian flower sector

CHAPTER 4

Competence as know-how in practice: the performance of university graduates in the Ethiopian flower sector

Introduction

During the last decade a number of African countries have experienced a rapid growth in exports of horticultural products such as flowers to Europe (Wijnands et al. 2007). Ethiopia has become the second largest flower producer and exporter in the region next to Kenya (Melese and Helmsing 2010, Mano et al. 2011). EU markets (notably The Netherlands, Germany, and UK) and Switzerland, and Russia are the main export destinations. In the floriculture sector in Ethiopia over 80 flower farms operate (of which more than half are the product of direct foreign investment). The flower farms create substantial employment for agricultural workers and hire graduates for several farm management tasks. Hiring graduates is important for the capability of flower farms to meet the higher quality requirements of the export markets, which are often accompanied by various certification schemes. These, and the challenges of intensive primary production, make the flower industry knowledge intensive (Mulder et al. 2007). Accordingly, the competence of employees, many of whom are recruited as university graduates,⁷ receives increasing attention by the sector as a consideration if emerging agri-industries are to be competitive in the global market.

This relates development of the Ethiopian floriculture sector to ongoing debates about how to conceptualize and understand competence in contemporary workplaces. Sandberg and Pinnington (2009) identify two major perspectives within these debates. The first perspective sees competence as individual acquisition and possession of knowledge, skill, and attitude. The second perspective stresses that competence is embedded in (workplace) relations and knowing-in-practice. This chapter tries to address the limitations of the first approach, which mainly pays attention to pre-specified attributes of individuals. For instance, Hager and Hodkinson (2009) raised critical concerns over the notion of competence of listed statements, i.e. pre-defined knowledge, and skill and attitude that can be transferred (see also Dall'Alba and Sandberg 1996, Sandberg 2000). In response to these concerns, some scholars (Paavola and Hakkarainen 2005, Fenwick et al. 2012, Sandberg and Pinnington 2009, Landri 2012)

⁷ Graduates in this chapter represent individuals with a formal education and training background in a specialized field of study, such as agriculture in a university.

also argued that this conception of competence has limitations since it tends to overlook the influence of context and disregards the kinds of knowledge that emerge via hands-on practices in work environments.

The objective of the chapter is exploratory and it may become a jumping off point for further research unpacking the interconnectedness between both perspectives on learning and competence (a practical illustration of the analytical trajectory opened up by the thesis is presented towards the end of chapter 6). The argument developed in the chapter resonates well with the argument in current literature (see Mulder 2014 for a review) that maintaining a dichotomy between formal and informal education and learning is difficult. By its analytical move to a practice and network-based understanding of competence, it may also be possible, by pursuing this agenda further, to inform the process of developing educational programmes and assessment tools to prepare and support young professionals attempting to come to terms with the socio-material and network complexities of contemporary work practice.

To contribute some empirical findings to debate these issues, the present study selects the case of graduates employed by export-oriented flower companies in Ethiopia. Workplace practices by graduates in sectors like agriculture is highly dependent on its context, because agriculture varies a great deal according to regional, natural endowments, and technical factors (Biggs and Clay 1981, Clark 2002). Professional competence has been conceptualized in multiple ways by several scholars (Kouwenhoven 2009, Mulder 2004, 2012, 2014, and Sandberg and Pinnington 2009). The research relates to management and competence literature studying performance of professionals in the context of firms in manufacturing and service industries in developed economies. This chapter complements this literature by an empirical study of competence in the context of a developing knowledge-intensive flower industry in a less developed region. This makes it both interesting and challenging as field within which to study skill and knowledge.

The specific empirical focus of this chapter is on practices of university graduates working in Ethiopian flower farms and looks specifically how they develop competence in relation to pest management. Quality problems due to pests and diseases which include mites, insects, and diseases are among the major constraints to Ethiopian flower sector. Quality aspects such as 'pest-free and residue-free' are increasingly exerting pressures on export of horticultural crops. This makes pests and diseases management an essential activity in the Ethiopian greenhouses (Gradish et al. 2011). While greenhouses are designed to optimize the growing conditions for flowers, they also have favourable conditions for pests (Brødsgaard and Albajes 2002, Gerson and Weintraub 2012) affecting quality (Belder et al. 2009). In response, using chemical option can result in problems such as the development of resistance in pests,

increasing public concerns over the effect of pesticides on the environment and human health. For instance, spider mites are rapidly developing resistance to chemicals (Khajehali et al. 2011).

The chapter first it examines how graduates form and use competence in their everyday encounters with social, managerial and material and technical problems in their daily work environments. Actions and interactions in the workplace are documented to identify features of how competence may be formed and used. This inquiry looks for approaches that do not exclude and strip away important contextual features of competence formation and deployment. Richards (1993) has focused attention on these contextual factors by stressing the need to see “agriculture as performance”. Accordingly, informed by the technographic notion of performance (Jansen and Vellema 2011) and in line with the integrated socio-material perspectives (Fenwick et al. 2012), the field study focused on graduates’ problem solving-practices at a specific locale, as seen through an investigation of their daily and regular practices in the work place. The perspective adopted emphasizes the notion of competence acquisition in terms of a professional practice that integrates social and human dimensions with acquisition of skills in moulding material environments. The concern of this chapter is to see how these two aspects interact in generating overall competence (Fenwick et al. 2012).

An additional aim of this thesis is to bring out the network dimensions of professional competence. Many technologies require a capacity to work in teams, and here distributed cognition is an important aspect (Hutchins 1995). Social-material practices require networking skills as a key part of teamwork, as discussed in chapter 2 and 3. The current chapter expands the network analysis to interactions between graduates at different farms linked in a network of professionals. To this end, we aim to map the collective and network dimensions of socio-material practices (Orlikowski and Scott 2008, Orlikowski 2010, Fenwick et al. 2012). Therefore, the study makes use of social network analytical perspectives (Borgatti and Cross 2003, Pahor et al. 2008) to map the multidimensional networks (Lee and Monge 2011, Contractor et al. 2011) between and among graduates working at and moving between different farms and sharing information and experiences via different means. The emphasis on emerging practices and interactions in multi-dimensional networks can provide insights into competence in solving practical problems. In organisational and management studies, learning in teams is considered as a key mechanism through which organizations or firms can be competitive in a dynamic environment (Edmondson et al. 2007). Therefore, the study focuses on the interactions between people, tasks, tools, and their networks, wherein mechanisms through which know-how can be created, retained, and transferred can be found

(Argote and Miron-Spektor 2011, Edmondson 2002, McGrath et al. 2000). The focus of the present research is on task-mastery and the related group process.

Below we describe the research methods and discuss results. Then, we integrate the empirical analyses and discuss how they inform theoretical arguments presented in this thesis. Finally, a conclusion indicated implications for learning and education.

Methods

The performance and network linkages of employed university graduates were examined at different export flower farms in Ethiopia in the years 2011 and 2012. In the first phase of field study, the researcher made field visits to and observations on 20 rose farms. Then, the researcher organized three different group meetings at three major rose growing sites (Addis, Debre Zeit, and Ziway, Appendix A): a total of 60 employed graduates (31, 13, and 16 in the three respective sites) were involved. At the time of the study, all had first degrees in horticulture or other related agricultural fields, except one with a master's degree, and they had standing careers and professional experience (Figure 1, Table 2). Group discussions exposed the experiences of the graduates and perspectives on their activities and the ranges of tasks they performed in the flower farms.

In addition, 80 key informants were interviewed (Appendix E): 40 employers (including farm owners), five representatives of growers' association, and 35 educators from universities. The focus of enquiries was restricted to how these professionals perceived competence and their views on and experiences with graduates working in the flower sector during the study period. Furthermore, the researcher attended workshops relating to capacity building in the sector.

Thirty eight graduates (from 10 farms) were selected for further study of practice. Here, the aim was to explore how these professionals execute their tasks. During several farm visits for a period of six months, interviews were held and observations were made while the graduates were on the job (Appendix F). These enquiries and a survey (Appendix G) investigated competence from the perspective of graduates in their everyday practice in their workplaces, which concentrated on the pest and disease management. This focus was motivated by the insight that pest and disease management was a main technical and organisational challenge in the production of roses. However, in the work of graduates there was not a strong separation between pest and disease management and other practices in the greenhouses, and this gave an opportunity to understand from a technographic perspective how specific practices fit within a broader field, and how employees handle integration challenges.

Respondents frequently mentioned integrated pest management practices in greenhouses, which gave confirmation that this focus would provide important insights about how problems of embedded tasks would be handled in professional practice in the sector.

The field study observed and documented interactions (e.g. e-mail, telephone conversations, and farm visits) of graduates with other graduates, non-graduate colleagues, employers, and consultants focusing on pest and diseases problems solving practice both within and across farms. A matrix was used to identify sources of information and interactions of graduates in the last six months, three months, and three weeks. This is consistent with technography's focus on task groups and how task groups handle complex, integrated tasks (Richards 2000). The description of such interactions across farm boundaries provides further clues about the way graduates use of their professional association to make sense of the results of treatments and to establish what specific elements of their workplace situations may explain these.

Generally, the research followed an iterative observational approach. Primarily this meant a focus on graduates working in situ, performing tasks. Results from observation and interviews with respondents were supplemented by considering farm reports and e-mail exchanges made by the graduate employees with different, distant people such as consultants. The observer also participated in occasional visits made by graduates to other farms. Additional focus group discussions were organized at all three sites. These discussions were used as opportunities to refine data and to document further how graduates framed problems, navigated towards possible solutions, and evaluated these solutions. At this juncture key data collected during observation, group discussion, farm visits, and occasional interviews with individuals were presented to stakeholders to refine findings.

Results

The study identified different dimensions of graduate practice in the Ethiopian flower sector. First, this section presents the different views on competence expressed by interviewed key actors in the sector. According to the results, competence of graduates is a key concern among employers, educators, graduates, and consultants in the sector. However, there appeared from these data to be a difference between competence of graduates and the needs of the sector (Table 1). The main concerns of the respondents and their views on competence are shown in Table 1. Generally, competence was regarded as individual attributes, representing knowledge and skill acquired through involvement in pre-defined events, such as internship, training, or

formal instruction. Similarly, the time of job experience (Table 2 and Figure 1) was emphasized as an important feature of competence.

Second, competence was explored in the graduates' everyday encounters in the workplace, focusing on pest and disease management. The study investigates what sources of information employed university graduates actually used to respond to pest and disease problems emerging in particular work settings. Findings illustrate that graduates navigated towards possibilities for resolving pest and disease problems through multiple sources of information, and in particular through person-to-person interactions (with both graduates and non-graduates) (Figures 2 and 3).

Third, the field study documented interactions among professionals (both university graduates and consultants) as a source for learning from comparative experience. Interviews, telephone and e-mail conversations are used to describe how graduates talk about technical details of urgent or confusing results of treatments, use the network interactions to borrow from what others did or tried, and make close and detailed observations of material environments, both within and across farm boundaries, during visits to other farms.

The following sections present the details on these findings.

Views of professionals in the floriculture sector

In interviews, employers, asked to describe the competence of graduates, often mentioned lack of experience, knowledge, and skills (Table 1). In their views, graduates, in their early period of employment, did not demonstrate the knowledge and skill needed for effective professional work. Underlying these shortcomings, their university education appeared as being among the main reasons. The employers mentioned in particular that university courses were not up-to-date to address requirements by the sector. Consequently, they suggested exposure to the work environment and on-the-job training to enhance competence.

Graduates voiced similar views as the employers regarding the usefulness of their educational backgrounds. Table 1 emphasizes the following conditions that might enhance competence: internship (exposure to workplace environment) and replication of workplace environments (such as having work environment prototypes at universities).

Table 1 further indicates how educators consider competence. While sharing with others the concern on the experience and knowledge bases of graduates at universities, educators at times attributed deficiencies to lack of resources and excessive student population. Further, one educator mentioned that the competence of graduates was also limited in relation to the "fit" between theory and practice (Table 1). Even experienced graduates could not give scientific explanations of their everyday practices, it was alleged.

Table 1. Selection of views on employed graduate competence in export flower sector in Ethiopia expressed by interviewed key informants

Respondents	Main concerns / issues	Focus of competence
Employers	<ul style="list-style-type: none"> ○ graduates lack experience (farm owner) ○ graduates lack skill to effectively perform a task with people that have different backgrounds, ... they need an extended internship (farm manager) ○ local university courses are traditional, theoretical, and not practical at all (farm manager) ○ professionals lack exposure, they need continuous short term training (farm owner and board member of growers association) 	<ul style="list-style-type: none"> ○ individuals' experience (past) ○ knowledge bases at universities ○ training ○ exposure to workplace environments
Educators	<ul style="list-style-type: none"> ○ employed graduates have rich experiences in the industry, but they cannot explain their experience scientifically (university professor) ○ these days due to increasing student population, budget is becoming a constraint to focus on practical approach, ...internship is crucial (university professor) 	<ul style="list-style-type: none"> ○ individual technical knowledge and experience (past) ○ exposure to workplace environments ○ replicating workplace environments (example greenhouses)
Graduates	<ul style="list-style-type: none"> ○ a bachelor's degree is enough to work in a greenhouse, and a master's degree is of course required to be a manager (graduate working as a production manager) ○ courses in [local] universities are theory focused, not practical (a graduate) ○ teaching materials in universities are too old, laboratories and greenhouses are obsolete (graduate) 	<ul style="list-style-type: none"> ○ individuals' technical knowledge ○ knowledge bases at universities ○ individuals' experience (past) ○ exposure to workplace environments ○ replicating the workplace environments

Source: authors' field work

Investigation on past experiences showed that that most graduates had worked for more than two companies/farms (Figure 1) and with responsibilities attached to various tasks (Table 2). As can be seen from Figure 1, and as is to be expected, the number of farms graduates worked with increase in years of experience. The reason behind this mobility was not the key concern of this chapter. Rather, experience across employments is seen as part of the context of the study. In general, according to respondents, length of time over which experience had been accumulated (Figure 1) was considered an important aspect of competence. All respondents emphasized the role of training.

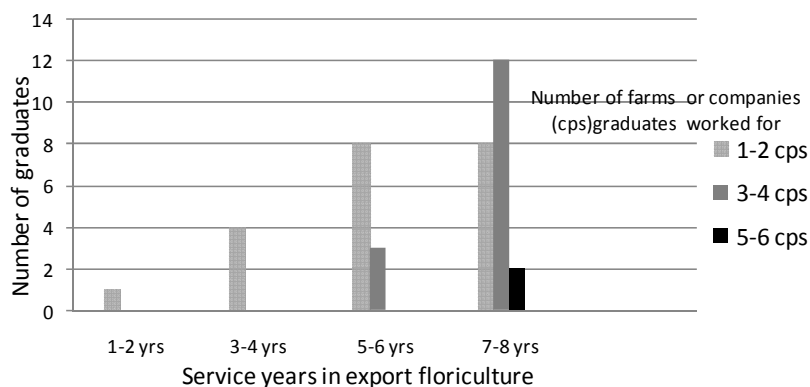


Figure 1. Length of work experiences and mobility of graduates in the export floriculture in Ethiopia (2000 – 2013)

Source: authors' field work (n=38)

Table 2. Instances of work experiences of graduates in different export flower farms in Ethiopia

Graduate (G)	Year of graduation (first degree)	Number of farms he/she worked for since first employment	Formal position(s) in the farms
G1	2003	5	agronomist, assistant production manager, horticulture expert
G2	2004	4	trainer, organization manager, pack house supervisor, greenhouse supervisor
G3	2004	4	supervisor, production manager,
G4	2005	2	junior supervisor, senior agronomist , department head and production manager
G5	2005	2	technical supervisor, production manager, farm manager
G6	2005	5	greenhouse supervisor, senior supervisor, horticulture expert, production manager, farm manager

Source: authors' field work

In effect, while employers emphasize that students tend to be all theory and no practice, the view of an experienced educator was that graduates tend to be all practice and no theory (or, more specifically, that they cannot formalize their practical experiences in generic terms). This comment points to one of the “gaps” that technography aims to fill - by offering a better

account of a "theory of practice" (see Bourdieu 1977). The next section aims to identify the sources and contents of information used by graduates in addressing pest and disease problems in the greenhouses.

Everyday encounters in the workplace

A major concern of the study was to identify the information graduates relied on for making decisions in everyday practice of graduates through focusing on pests and disease-related problems. The results clearly indicated a range of information sources in the process of solving practical problems in pest and disease management. Figure 2 documents sources of information in some of the interactions of graduates, including contacts with consultants, and both graduates and non-graduates, within and across farm boundaries. It also brings out the role of material environments such as living plants, websites, standard manuals, and books in graduates' everyday practice. Further, it indicates activities like farm trials and farm visits used as sources of information to support tasks. As a whole the results illustrate how information circulates among graduates and other people.

The findings show the extent to which the graduates used their colleagues and material environments as sources of information for solving practical problems (Figure 2). All twenty six respondents valued the importance of communicating with non-graduates during problem solving in their workplaces. A majority (77%) said they interacted with other colleagues (graduates) in the other farms, and a comparable proportion (81%) also used web searching. A slightly smaller number (73%) also interacted on specific issues with consultants. Farm trials were an important source of information for only a minority (42%). Farm trials here represent activities on specific demonstration sites in a farm or greenhouse intentionally devoted to trials. A striking finding is how few respondents used standard manuals and text books (19% and 30%, respectively) to solve practical problems. Chapters 2 and 3 report in more detail on how graduates in the case farm use material environments in the process of problem solving.

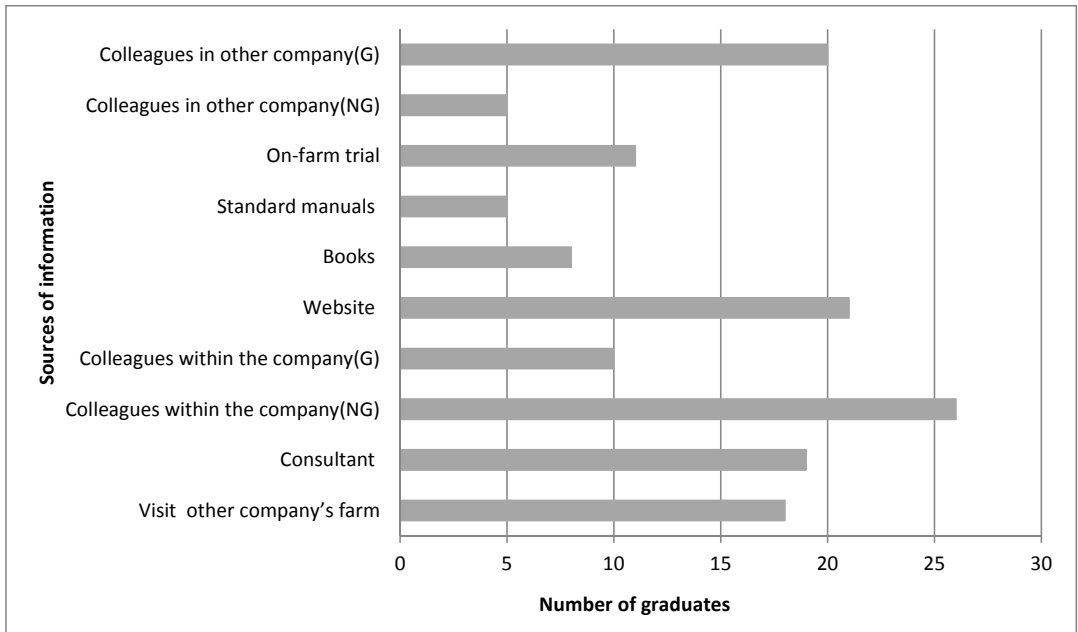


Figure 2. Sources of information used by graduates to generate possibilities for solving problems encountered in the workplace

Note: G and NG represent graduate, and non-graduates, respectively.

Source: author's field work 2012 – 2013 (n=26)

Interactions in professional networks

The empirical findings above suggest that graduates in employment are not working exclusively “according to the book”, but from guidelines set by what works. Moreover, the findings reveal that graduates engage with other graduates while making daily decisions on how to respond to pest and disease problems. Both observations suggest that graduates try what works and respond by learning from comparative experience. This further illustrated by presenting the content of information circulating among graduates and non-graduate actors. Here, the focus was on some instructive conversational extracts distilled from interactions among graduates across the organizational boundaries of the flower farms. The following provide a flavour of the contents of interactions among graduates and between graduates and consultants working in different farms: An e-mail conversation between two graduates (G20 and G15) describes how they exchanged experiences in solving a pest problem by trial and error:

G20: the powdery [mildew] this week is becoming serious problem on “O”, “A”, and “DL” [rose varieties]. We took the following actions:

- we changed the spray
- we vary the rate of amino gold [chemical] 20
- we [are] trying to change the chemical (meltatox) = it was better to spray with collis but we could not find it
- we are going to use a mobile machine on “A”
- we will follow its status and close the side plastics, also at urgent places [in the greenhouse]

G15: We also have serious powdery problems. We did full spray with amino gold (20) + sulphur jet (50) yesterday and we are planning to do a spray tomorrow with Meltatox (120) + Sulphur Jet (50)

G20: Still we have some fresh damage, especially on variety “A”, we did an extra spray...I got remarks from unpackers [auction from Netherlands] this morning: “ [“A”]: ... bit damaged but not much. [“O”]: also a bit damaged and the flower is better than last week but still not as it should be” [from an e-mail message sent by an unpacker]

G15: Compared to last week it is better [and] still needs more attention. I checked this morning...Currently we have more pressure from the spider [mite] [than from] other diseases...

G20: After long time that we had big problems ...it now looks to be improved ...by spaying ...Meltatox (120) + Collis (10) full and top spray twice a week. This is a good experience that we get from spraying twice; one full and one top spray, which can help in serious cases of powdery problems.

In their interactions, graduates and consultants regularly referred to practices and treatments tried by other graduates. The following e-mail of a consultant (C1) reflects that searching for workable solutions seems to be a kind of a collective endeavour of a network of graduates employed in the floriculture sector:

C1. The young leaves also look a little bit grey and are hanging; probably because of stress. We [including a graduate] have spent most of our time to calibrate the fertigation unit, I installed the software to read data from the weather station, and the format for production data is updated. “G11” [graduate employed at another farm] already started working with all the formats. Perfect!! ...Please start sending the data to “Consultant 2” on

Monday and Thursday. I explained how to send this. You can find the .dbf [pdf] file in folder data on your desktop.

In the professional networks graduates have access to, there appears to be little hesitation to share information. The research mapped different kinds of interactions about pest and disease problems, which is visualized in Figure 3. Besides using e-mail and telephone, graduates preferred to actually visit other farms, and to observe real manifestations of pests and diseases and the multiple facets of locally induced solutions. The problem-oriented interactions among graduates sustained a network connecting many of the flower farms. Some of the farms (ET, ED, HR, and EL in figure 3) regularly received visits from graduates employed at other farms, and the employed graduates at these farms were well connected to other graduates. These particular farms pro-actively experimented and practiced Integrated Pest Management. Their management was open to sharing experiences with other farms, and the farms were centrally located in the different flower producing areas.

Observations made during farm visits of graduates revealed that graduates had a strong interest in actually observing material features, which included the responses of growing plants to conditions in greenhouses, production and protection procedures, intensity and severity of pests and diseases, in a range of specific contexts. The key phrase here is learning from contextual knowledge. As one of the graduates explained how farm visits served to get understanding related to his/her own situation by comparing context and drawing inferences from comparison:

A graduate managing spider mite in the greenhouse does not visit a similar farm to see what spider mites and roses looks like, but specifically to see them “in practice” in that particular farm.

The relevance for graduates to be physically present is substantiated by two examples:

G 6. Last month I visited “PR” [a farm], they have propagation facilities and the latest tissue culture laboratory. We get planting materials of some varieties [of roses] from this farm. Their greenhouses are well managed... really better than ours. I tried to apply some of their experiences, related to the field hygiene, but I need more labour, but here [in the farms I work for], the focus is more on grading after harvest... [in other words, throwing away the bad stuff on the speaker's own farm is seen as compensating for lack of technological control] (E-mail conversation shared by graduate)

G20. I visited “HR” [a farm] next to our farm, yesterday. I was surprised by what they were doing. The workers were turning rejected roses [into] to the beds [where roses are growing]. This is contrary to the principles of field hygiene. I will not recommend this to fellow workers in our farm. [But] in fact “M” [pest and disease management head] told me that it was to return [to use] the beneficiaries [natural enemies released to control a target pest] on the rejected roses [harvested roses injured by a target pest). [Implicitly, the speaker is wondering whether or not this practice, contrary to his formal understanding, might not actually be a viable part of an ecological control strategy]. (Interview with graduate)

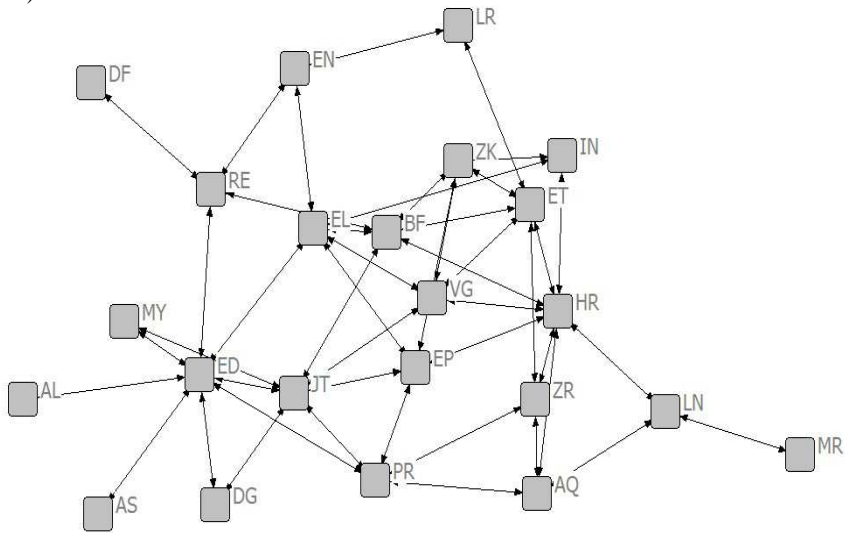


Figure 3. Flower farms connected through interactions (e-mail, telephone, farm visits) among graduates

Note: Boxes with letters represent farms and arrows indicate interactions between graduates

Source: UCINET 6 (Borgatti 2002) on author’s fieldwork data

Discussion

“In a relatively known and predictable world rational solutions can be planned, for training as for anything else. A programme can be organized and implemented so that a workforce acquires the skills [competence] it needs. These skills will be the possessions of individuals ...: where else can learning be located but in the individual, whether in his or her head or hands? But perhaps we are beginning to see the limitations of this way of understanding things.” (Bryans and Smith 2000: 251)

The message in this citation challenges the idea that knowledge and skills required by a task job can be acquired as individual attributes, and absorbed through, for example pre-planned courses or other training events. The task of this chapter is to use an empirical study of the performance of graduates in Ethiopian flower farms to address the concern raised by Bryans and Smith and to arrive at a more complete understanding of how competence is formed.

The strong focus on individual attributes acquired through formal education and training was a shared assumptions behind competence reflected in the views of key actors in the floriculture sector (Table 1). Common to the respondents views was a focus on knowledge and skills of individuals and on assessing past experiences as features of competence. The interviews with key informants as well as with the employed graduates focal to this study, suggest that competence was generally referenced to an individual’s attributes and represented as knowledge and skill acquired through involvement in pre-defined events, such as training, internship, education, or previous job experiences. Our fieldwork data on actual task performance, however, bring out shared and distributed aspects of competence which seem to be excluded from informants’ discursive accounts of what competence comprises and how it is formed.

It is not disputed that pre-planned events (Table 1) or past experiences (Table 2 and Figure 1) contribute to graduates’ performance in the workplace. However, our study on practice of graduates also identifies other sites of competence generation, especially during on-going and evolving practices of problem solving (Figure 1 and Table 2). These sites were situated in a web of social and material interactions both within and across the farm boundaries (Figure 2 and 3). Sometimes inference from comparative experience was apparently at variance with formally-acquired knowledge. The results also show the role of interactions with material aspects of a problems, which was also recognized by graduates who appreciated farm visits to grasp the nitty-gritty details of new pest manifestations or the effects of selected treatments. This implies that competence can emerge from both interactions among people and from

people with material environments (Gherardi 2009, Dean et al. 2012, Johri 2011, Johri and Olds 2011, Geels 2004, Leonardi and Barley 2008, Lave and Wenger 1991). This is also in line with Mulder who underlines that “competence development is a socio-constructivist learning process in which social interaction and situation-specific searching for quality improvement of working processes is of utmost importance” (2014: 19).

Wrestling with the material properties of (in this case) plants and insects implies the need for an extended discursive and conceptual framework based around assessments of tractability and intractability. These issues of materiality are not well-represented in “standard” modes of classroom or other forms of formal learning. This is not to say that “hands-on” experience is excluded from the curriculum, but it is often hard to couple what is learnt through hand and eye (for example) with formal theoretical schemes (Richards 1993). One educator understood this, and neatly inverted the usual complaint that graduates only know classroom knowledge, by complaining that graduates found it hard to translate back their practical knowledge into formal, scientific explanation. In other words, an extended framing of the issues is need, not a narrow dichotomization into “theoretical” and “practical” knowledge.

On the basis of these findings, the study suggests that the competence of graduates is: (1) formed and reshaped in actions performed to solve situated and often unanticipated problems and not via the schematic application of prior capabilities, but that this knowledge is (2) distributed in networks of people and material environments and not limited to individuals, but also it is (3) reproduced in embodied problem solving capabilities and not limited to cognitive knowledge (Fenwick 2009). This conceptualization is related to the work of Paavola and Hakkarainen (2005), who view competence as participation in practice and associate it with know-how distributed across teams rather than being in the possession of individuals. Below, we elaborate on this conceptualization of competence as situated, distributed, and embodied.

Competence formed in situated action

Graduates continuously develop competence through their situated actions (Suchman 1987), wherein they often have to improvise, repair, and select possible recipes out of what is available. Interestingly, graduates shares their doubts about used treatments and interacted in order to find plausible explanations for what they observed. Hence, considering competence in terms of situated actions exemplifies that problem solving capabilities are not limited to pre-defined, formalized, and institutionalized sources of information (such as books and standard manuals) and past experiences (such as formal instruction). Rather, they also emerge in practice as confrontations with the challenges and problems associated with particular

situations. The notion of situated action in relation to the specific biological features of floriculture/agriculture can move the notion of competence beyond human intentions or plans (for instance see Biggs and Clay 1981, Vellema 2011). Therefore, the study has highlighted how, in line with Fenwick et al. (2012), new possibilities emerge for consideration in everyday encounters with biological processes partly independent of human intention and intervention. The key point here is plants, pests, disease and ecosystems have life of their own, and new farming contexts engender emergent properties. A key issue is how well prepared are employees - especially those acculturated to formal learning environments, with reliance on authoritative - to cope with these emergent properties. If graduates are key recruits for a “smart” flower business in Ethiopia where does their smartness arise? Obviously, this aspect of competence is neither pre-planned nor predicted/anticipated, but emerges in the actual process of solving problems. Here, it is clear that learning from a reference group, and learning through comparison, is of vital significance, and that improved graduate performance in the workplace depends on ensuring adequate networking opportunities to provide the necessary comparative challenges.

The interactions of graduates with specific contextual conditions of flower growing illustrate how knowledge and skill is constructed in everyday practice in the workplace (see also Chapter 2 and 3) and through the sharing of information about these specificities among peer professionals working in different farms (this Chapter). This has indicated how situated problems can pose productive comparative questions, and has emphasized the need for spaces for interactions among graduates to integrate experiences from different sites into the problem solving capabilities of graduates working at a specific farm (Figure 3). The contents and orientation of this exchange of information differs from manuals presenting generic best practices. Farm visits made it possible for graduates to integrate experiences from various contexts in solving situated problems in their own work environments. During these occasions, graduates interacted with materials, such as plants, to find clues for solving practical problems.

It is important to stress that comparative learning is more than the simplistic notion dug into the foundations of international development thinking concerning development as the transfer of the best practices from one farm to the other. Indeed, this was not the case in the example discussed here. Graduates did not simply turn round and apply what they saw on other farms. Graduates found that farm visits posed questions. They asked “why would that work there but not here?”. Knowing how to look at the interactions between plants and their growing conditions was part of the process wherein graduates gradually formed competence and incorporated experiences at other locations (Chapter 3). Potentially, this sparked a series

of hypotheses about adaptation, which some graduates appeared willing to test, if managements would give them the scope. We have seen evidence that some graduates were smart enough to realize that farming is much about (if not entirely dominated by) emergent properties, and thus practices established as solutions by people in one farm were not directly used in another farm, but were “food for thought”. This confirms Johri’s insight that “practices developed by and within the context of a combination of people and material will not automatically transfer to another scenario; even in slightly different contexts.” (Johri 2011: 215). Problem solving capabilities are significantly and irreducibly contextual (Hager and Hodkinson 2009).

Competence to be part of collective performance

Graduates develop competence in continuous interactions with other people, such as consultants, other graduates, non-graduates, and with the material environment both within and across the farm boundaries (Figure 2 and 3). These findings demonstrate that no employee works alone, but constantly cross-references and coordinates actions with other actors and materialities. According to Hutchins (2006), this represents a distributed cognition, and it must first be understood in specific contexts, and then be catered for in forming specific competences. Results here (and in chapters 2 and 3) specifically demonstrate that pest and disease management in flower greenhouses was a species of collective action. They also indicate how experiences from consultants working at a distance (i.e. the Netherlands) were integrated into the problem solving activities of the graduate. The result is extended problem solving capabilities stretching beyond the boundaries of the individual graduate and forming a nexus of distributed competences belonging to teams operating in the workplace (Figure 2) and in environments outside the farm (Figure 3). In sport (in soccer, for example) it is well-known that team performance is more than the sum of the parts, even if some club managements still think they can buy a successful team “ready-made”. Successful performance of graduate employees in the flower industry in Ethiopia may also depend on skilled team building, and this is not well reflected by assessments that focus too much on individual skills.

Thus, competence needs to be viewed as a property generated by a team solving problems collectively (Chataway and Wield 2000). Besides the distribution of competence in teams, the study also signals that people connect via materials that create forms and spaces for people to act and interact (Orlikowski 2007). Therefore, features of graduate competence transcend individuals and formal structures of organizations and need to be traced to the way

interactions among people are mediated through the interactions between people and their material environments (Hager and Johnsson 2012, Fenwick et al. 2012).

Competence generated in embodied practices

The descriptions of farm visits by graduates and the actions of consultants indicate that some features of problem solving capabilities were only possible when graduates or consultants were physically or bodily involved. Not everything can be done by email in virtual reality. This was illustrated by the fact that consultants made international travels to interact with plants and the material environment on the spot in order to be able to assess the time and place specific manifestation of composite problems. Graduates also needed physically to inspect other farms to understand comparative questions. It was not enough to compare notes with friends in the industry after work. Pest and disease management has a complicated nature and making decisions in the context of actual infestations entails a range of actions for which the graduate or consultant needs to be physically present in order to use bodily skills to determine what happens on or in the plants.

In a sense, this is a claim that practitioners often “feel” their ways to solutions, something well illustrated by Dant (2005) when he shows that car repair manuals are pristine in garages, and that repairers “know” in their fingers and arms how to fix the fault. The books are never opened in the garage because much car repair is “felt”. Fiddling with the machine to get it to work is an under-estimated competence. Knowing how hard to hit it is only learnt through bitter experience. This part of competence is especially difficult to transfer, since such skills travel with the body and are mainly replicated by seeing someone else perform the task. As observational data offered by Dant attest the apprentice often finds his or her limbs are actually guided in the task by the supervising master mechanic. This “embodied” perspective can advance our understanding of competence beyond the previously acquired attributes of individual graduates; but data can often be gathered only through participating in the actual practices of the workplace (Gherardi et al. 1998: p. 279).

Conclusion

This chapter has explored how graduates formed and used competences in their everyday encounters in work environments in Ethiopian floriculture. There appeared to be a difference between competence of graduates and needs of the sector. In response, main actors in the sector put an exclusive emphasis on individuals’ attributes represented as knowledge and skill acquired through participation in pre-defined events, such as training or education.

Here, it has been that an exclusive focus on formal training and past experience can be limiting, since it assumes competence and experiences as fixed attributes possessed by individuals, separated from distributed problem solving focused on (intractable) materialities. Understanding and evaluating graduate competences can be limited if the focus is exclusively on a pre-defined list of competence statements. Acquired capabilities or experiences of individuals can be useful to indicate the individual's past trajectories or identity. They may reflect the tasks graduates performed in different contexts in the past. However, it cannot represent knowledge-in-use for the task in hand, unless assessment is in effect an audition, not an exam. Therefore, competence of graduates develops not only through formalized ways and past experiences, but also emerges from graduates' interactions with their social and material environments. These findings suggest shifting attention from an acquisition perspective emphasizing individuals to a concern with capabilities emerging in interaction with the materiality of situated problem solving and to collectively generated know-how.

This insight has two important implications for education policy and practice. First, it challenges the assumptions underlying the views expressed by graduates, employers, educators, and policy makers, who tend to address the workplace-education gap by planned education or training. This study shows that competences are also formed in situated practices, in a web of social and material interactions in everyday encounters of graduates.

Second, the insight helps to reconsider current Ethiopian university education and its tendency to adopt a confined focus on designing curricula and other training programmes with the objective to define competence on the basis of pre-defined skill, knowledge, and attitude that can and must be acquired by graduates through university courses (for an exception see Mulder 2012). This study presented this as past experiences that are one ingredient of the competences of graduates performing in the workplace. It seems worthwhile to revisit the way competence of employed graduates is assessed by drawing on the conceptualisation of situated, distributed and embodied competence. Accordingly, a focus on the past may provide possibilities for improving practices, but it cannot determine the present or future (Dall'Alba 2009). This is coincident with the idea formulated by Larsen-Freeman (2013) that learning is something that takes place within a certain specific context., which sees competence as know-how in practice or as situated problem solving (Spackman and Yanchar 2013). Practice-based accounts offer an integral conceptualization of know-how, and consider, as proposed by Gärtner (2013), pre-reflective embodied knowledge.

The perspective developed in this chapter can help to direct education policy away from an exclusive focus on universalized or standardized pre-set attributes of graduates with assumed predictable outcomes, and to enrich education with an interest in situated problem solving

capabilities, competence-in-use, or know-how. More research is needed to discover whether and how both types of competences do or do not merge in the realities of the workplace.

CHAPTER 5

Crossing organizational boundaries and joint problem solving: community-firm interactions in the context of corporate social responsibility in Ethiopian floriculture

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Crossing organizational boundaries and joint problem solving: community-firm interactions in the context of corporate social responsibility in Ethiopian floriculture

Introduction

Floriculture has become an important component of the export agricultural sector in Ethiopia. Since 2000, foreign companies have joined the sector, mainly from EU countries which are the major export destinations as well (Weissleder 2009). The Ethiopian Horticulture Producers Exporters Association (EHPEA) developed and introduced a code of practice. The code, primarily a private initiative, was endorsed by the Ethiopian government as a Council of Ministers Regulation on the Code of Practice of the Floriculture Sector. The code is developed by the local horticulture growers and exporters association to facilitate compliance with international standards such as Global GAP (EHPEA, 2011). This code not only stipulates practices meant to mitigate potential negative environmental effects that arise from their operations (examined in the previous chapters) but also includes articles directing flower farmers towards engaging with local communities to address local concerns and to solve societal problems. To reach the highest level specified in the code (gold), flower farms should go beyond mere compliance with production practices prescribed by the code, and move outside their organizational boundaries to work with other stakeholders in addressing multi-dimensional problems, in the case of this study arranging access to a lake by both flower farms and farmers from surrounding communities. With this focus on Corporate Social Responsibility (CSR) this chapter aims to broaden the discussion in this thesis and to assess the capabilities of firms to engage with joint problem solving processes.

In general terms, CSR deals with the interaction between the firms and their environment, which may include both management and conservation of natural resources in the community and direct benefits provided to the community (Wood 2010). CSR in the context of global value chains encourages firms to not only comply with quality and safety requirements, and get involved in local change processes (Sayer 2005, Portney 2008). This is motivated by the idea that the private sector and foreign direct investments (FDI) have a critical role to play in local development projects. In the case of the Ethiopian flower industry, this is primarily defined in terms of earning foreign currency and offering job opportunities for citizens. Both the Ethiopian government and the associated firms in the flower industry recognize CSR as an

essential component of the code of practice introduced in Ethiopian floricultural industry and perceive the code of practice as a tool to ensure the industry's contribution to the wider community, which reflects the general perspective on CSR (Jamali and Mirshak 2007). CSR is increasingly emphasized as a means not only to ensure the success of investment operations but also to create development opportunities for local communities (Kapelus 2002) and space for businesses to manage their relationships with the local community.

However, contrasting issues regarding the realization of the promise of CSR have also been noticed in literature (Blowfield 2005), particularly at the level of resource poor communities in which the companies operate (Borras and Franco 2010). There have been concerns on how this promise is related to the poor groups, whose existence is directly determined by access to natural resources such as land and water (Sayer 2005, Deininger and Byerlee 2011, Borras and Franco 2010, Abbink 2011). Another concern is that the compliance focus and audit culture in codes or standards relating to CSR reduces potential for fostering genuine local community development (Frynas 2005) and may not work for managing joint problem solving in the context of more complex business-community relations (Kemp 2010, Macintyre et al. 2008).

In the context of Ethiopia, the relationships and competing interests of local users and foreign companies has been subject of discussion. Concerns have been raised in relation to competing claims of local communities and businesses that obtained the right to access common resources via a lease agreement concluded with the national government (Bues 2011, Abbink 2011). Bues (2011) notices power difference in the distribution of water between local users and floriculture farms, which indicates that the entrance of foreign companies reshaped the arrangements for accessing natural resources by local farmers.

The interest of this chapter lies in developing a grounded understanding of the operationalization of CSR embedded in a code of practice adopted by the entire flower industry. It further contributes to the observed need for more empirical studies of CSR focusing on practices at a local level in the context of developing regions (Lund-Thomsen and Nadvi 2010, Mehta et al. 2012). The example of access to water has been identified as a critical area of research for understanding the connection between the business and the local users (Woodhouse 2012, Mehta et al. 2012). The study documents particularly how the perspectives of local resource users are accommodated in processes and practices of joint problem solving (Newell and Frynas 2007, Prieto-Carrón et al. 2006), which complements the interest in assessing business performance by centring on compliance with specified CSR components.

The chapter presents a case study of joint problem solving by a company, which includes different farms producing cut roses for export, and farmers that use fresh lake water for irrigation and livestock. The case study documents interactions between floriculture firms and representatives of surrounding farming communities. It traces processes wherein different actors construct possibilities to address the concerns of both the business and the community. The analysis of the concrete CSR practices provides insights that can benefit practitioners working with codes and CSR policies at the supply base of the value chain of fresh agricultural products.

The chapter first present the methods used. Then, it reports the findings that illustrate the dynamics of company-community relations in the context of CSR and joint problem solving in the situation of multiple uses of a common pool resource: water. Finally, the empirical findings are used to discuss the capabilities of flower farms to incorporate CSR, as stipulated by the sector-wide code of practice, and to show practical implications of the analysis.

Methods

The case study of floriculture-community interactions was done in the area near Lake Ziway between June 2012 and February 2013. A cluster of flower farms occupies about 500 hectares in this area. Flower production under greenhouses in this area was initiated in 2004 by two Dutch entrepreneurs with experience in setting up a socially responsible flower farm in Kenya (see company website: <http://www.afriflora.nl/>). Requested by the federal government of Ethiopia, the project constructed greenhouses and since 2006, several rose farms, with Ethiopian and Dutch ownership, are in operation. The ideas underlying Fair Trade, sustainability, and CSR feature prominently in the public communications of the company leading the Sher project, and are reflected in the strategies of the other flower farms clustered in the project as well. The flower farms are physically located between the lake and the farming communities accessing the lake for irrigation and livestock. This provided the setting for investigating company-community relations in relation to the strategic orientation towards CSR and the local concerns about access to the lake.

In the first phase of the field study, focus group discussions were organized with public officials regarding company and community relations. The discussions involved government employees from offices of agriculture, natural resource and land administration, livestock and fishery and water resource development. Similarly, open ended interviews with managers of individual flower farms operating under the umbrella of the company were conducted to

identify corporate activities related to investments by the company in community service and the concrete practices induced by CSR frameworks.

Then, three administrative units of the surrounding farming community sharing boundaries with the company were selected for conducting open-ended interviews (Appendix H) with two community leaders (chairman and vice chairman of the unit) and two elders from each administrative unit. In addition, open ended interviews took place with nine development agents (three from each site) and their supervisor, who were responsible for activities related to agriculture at the local community level. Then, informed by the results obtained, field work concentrated on the issue of access to the lake by livestock from farmers in the three villages. Next, three focus group discussions with farmer representatives took place at the three selected administrative units. These focused on recent encounters related to the access of water resources by the community and company. To further trace the processes leading to joint problem solving, individual interviews with community elders (six) and leaders (five) were held to document historical events and recent encounters between the community and the company.

In order to map the nature and extent of the problem around access to water, the number of livestock passing the main road linking the communities to the lake was recorded continuously for fifteen days during one of the driest months of the year (January). This road was also the main access road to the company. During these two weeks, occasional interviews with farmers were done.

Furthermore, a specific process of joint problem solving related to access to water was investigated. Interviews were conducted with three members of the technical committee that was established to manage the conflict between the community and the company in relation to access to water by livestock. Specifically, this committee handled issues related to water development project for the livestock. The committee consisted of experts from government offices at district level that included agriculture, water resource development, livestock and fishery, environment and pollution management, natural resource and land use, and an engineer from the company. Documenting this process was further supported by collecting and analysing relevant documents.

Finally, additional focus group discussions were organized at the three farmers' sites and at district level. During these discussions, the researcher presented preliminary findings and used the forum to refine data.

Results

The field study traces problem solving activities, which represent processes of actors' engagement with and navigation towards possibilities to address the concerns of both the community and company in the context of CSR embedded in the code of practice (EHPEA, 2011). The case study centres on the interactions between a cluster of flower farms, acting under the umbrella of one company / project (here referred to as the company), and local leaders from surrounding farming communities using fresh water from the lake as a common resource for agricultural activities. The company was established and started operations in 2006 and devoted about 500 ha to growing roses under greenhouses for export to EU market. There were four farms within the company using water from the lake for irrigation. The area has semi-arid agro ecological conditions. Farmers in the surrounding communities depended on livestock production and the lake was an important source of fresh water, particularly during the long dry season (September –June). The lake was also serving other agricultural activities, such as companies growing grapes, fruits, and vegetables, and it was a source of drinking water for the surrounding communities including the capital town of the district.

The company and the communities were connected through the use of common pool resources, mainly water. The lake was the only source of water for both the community and the company, and there was quite some pressure on the use of water during the dry season. The study centres on four dimensions of the company and community relations: (1) company practices in the context of CSR; (2) use of common pool resources; (3) company and community perspectives associated with uses of the common resources; and (4) processes of bridging the company and the community perspectives and joint problem solving practices.

Company practices in context of CSR

Realizing CSR was conditional for reaching of the highest standard (“gold level”) stipulated in code of practice implemented adopted in the Ethiopian floriculture sector:

The farm [company] is actively implementing a CSR project that is of direct benefit to ... the local community ...the [company] is committed to engaging with the local community...regarding the farm [company] and community needs and concerns (EHPEA Code of Practice Version 2.0, Gold Level, March 2011, p 68).

Likewise, the company indicated the notion of CSR as one of its core values:

Long before social trends such as Fairtrade, sustainability and Corporate Social Responsibility (CSR) gained prominence; today's approaches employing these concepts had already been taken on board by [the company] and included as core values in the company philosophy. (The company's web site, <http://www.afriflora.nl/en/>)

In interviews corporate managers of the company estimated that the company created job opportunities for about 20,000 people; its website reports 10,000 jobs with a potential growth towards 15,000. The company also invested in community projects such as schools and health services. These investments were recognized and appreciated by government employees at the district level. As can be noted from the statement by a government employee, the projects were providing benefits to the community. He stated that:

(1) the company tries to contribute to the development of the district in various ways. For instance, it built a hospital, school, and offices for the district court. The projects as a whole costs more than the tax the farmers can pay

(2) the industry [company] built a hospital... that was appreciated by the federal government and people employed by the company

(3) we believe that our government committed land to the investor [company] to enhance technology transfer... as this [company] came with knowledge and technology, it will eventually help the community and the country at large, though this is not visible for our farmers, they [farmers] see immediate benefits...

Interviews with elders indicated how they evaluated the activities of the company in the area by looking at impacts outside the community projects. One of the elders said:

The projects of the company have much to do with the problems of the company itself. For instance, the school and hospital were established mainly to serve the employees of the company. Similarly, it built the court offices as disputes on wages, thefts, and other labour issues are frequent. Yet, the company is blocking our livestock to access to the water source.

A chairman of one of the formal farmers' administrative units, locally known as *Kebele* or *Ganda*, clarified:

We [farmers' representatives] are really under pressure to convince the farmers regarding benefits the company can provide, such as job opportunity. For farmers, access to water points by the livestock is another key concern

This statement by the community leader indicates that the company and community relations were not limited to the established community services, such as schools and medical services. Use of common pool resources, and in particular access to the water source, was another major issue (see Table 1 and Table 2).

Use of a common pool resource and CSR

The field study included detailed observations and interviews focusing on access to the common pool resources or water. The lake served different purposes, including irrigation, livestock, fishery, tourism, and drinking water supply both for people of the rural and the town. In interviews, government employees listed emission of chemicals into the water and access to water by livestock from the farming community as major issues. The latter was further emphasized by farmers in a group interview. The focus of the present study is on issues related access to the water.

Regarding access to the water, three issues related to public and voluntary regulation were raised (Table 1): (1) the legal right of farmers to water (access to water by livestock was a major concern for farmers); (2) right of the company to use water arranged by a lease agreement with the national government; (3) the requirement to consult the local community stipulated in the EHPEA Code of practice. The evolving practice of sharing physical infrastructure to access the lake and the company's vicinity will be discussed in more detail below.

Observations and interview with farmers' group and corporate managers confirmed that the company's location at the lake shore made access difficult for livestock from the surrounding community (Table 2). The five hundred hectares of fenced greenhouses were situated in an area surrounded by three farmers' administrative units in the west, the lake in the east, the town (capital of the district) in the north, and a company growing grape in the south. Moreover, the highway from the capital Addis to the southern regions separated the farming community and the company. The livestock population using the same road as company trucks and employees (Table 1) to the water source hindered the company's operations and caused traffic jams and dust mainly from September to June. Sharing the same infrastructure was mentioned as a problem by farmer representatives and corporate managers.

Table 1: Public and private regulations affecting access to water

Issue arranged	Reference
National proclamation of the water resources in the country grants farmers a legal right to water access as a common property	All water resources of the country are the common property of the Ethiopian people and the state. Domestic [local community] use shall have priority over and above any other water uses” (The Ethiopian Water Resources Management Proclamation No 197, March 2000)
Land lease agreement between company and national government and related water use permission arranged company’s right to use water resources	...lessee [company] has the right to build infrastructure such as ... irrigation system at the discretion of the lessee upon consultation and submission of permit request with concerned authorities, subject to the type and size of the investment property whenever it deems so appropriate (the Ethiopian FDI land lease agreement).
CSR component in code of practice creates space for the local community to regularly discuss concerns with the company:	..local leaders will visit the farm at least twice in a year ... for discussion regarding the farm and community needs and concerns[including issues related to common pool resources]. (EHPEA Code of Practice for Sustainable Flower Production Version 2.0 Issue Date March 2011 Page. 70)

Table 2. Average number of livestock passing every day⁸ through two major roads from the community to the Lake (December-January)

Livestock	Road 1 (shared with the company)	Road 2 (alternative to the road closed)
Cattle	1200	1500
Sheep and Goats	250	300
Donkey and others	200	250
Total	1650	2050

Source: records of 15 days observation (December 20 - January 20, 2013)

⁸ Farmers bring their livestock to the lake every other day (interview data).

During 15 days, the researcher observed and recorded the daily realities of sharing the same infrastructure along two roads serving as passages to water points by the livestock (Table 2). Regarding the first road, the survey indicated that about 1650 livestock were passing through to the Lake every day. Road 1 was shared by the company and the community. It was an all-weather road, dusty and narrow (10m width). It was one of the major roads that connected the community from West to main *Melkas* in the East (in the local language, *Melka* refers to water points at the lake accessible for livestock). Similarly, it was the only one that linked the company from its gate located in the West to the main Highway in the East: the road was serving employees and vehicles of the company. In addition, the road linked the hospital (built by the company along the road) to its main gate and the highway, the only route that people were using to reach the hospital. This situation made movement difficult for all users (company and the farmers) particularly between September and June (dry seasons). During these periods, due to the livestock population passing by the road to the lake, the company had to use vehicles to spray water along the road to settle the dust. In addition, during the dry season, farmers used green areas on the shore for grazing pregnant and calving cows.

Related to the second road (Road 2), results show that it was serving about 2050 livestock every day. According to ad-hoc interview with farmers, it was not the preferred route as it diverted them from the closer water points or *Melkas*. According to elders, there were other roads closed or fenced that were serving as main routes to *Melkas* before 2006 (before the companies were established). The road located south of the company had a border with a grape producing company. Discussions with elders revealed that this road was fenced by both companies. Interviews with the government employees indicated that five alternative roads were closed due to the expansion of the nearby town that was also located on the lake shore.

Company and community perspectives

The previous section sketches the problem of accessing the lake and sharing infrastructure. Company and community leaders had different views on how to arrange and manage the resource use. This section explores the company and community relations in terms of access to water points in the lake by livestock from the surrounding community.

The company's presence in the community created jobs. Moreover, the company supported the construction of schools and community health facilities. A farm manager in the company said:

The company invested a lot in schools and health services to help the farmers. The government had committed to creating an environment conducive to foreign investments and an infrastructure supportive to the operations of the company, which related to other challenges such as traffic jams and dust by livestock passing by.

Table 3 . Summary of historical events related to access to water by livestock

Events	Land ownership*	Issues related to livestock
Before 1974 (Haile Selassie regime)	mainly a traditional grazing land owned by the community	grazing and access to water were not a problem
1974- 1986 (Derg regime)	mainly a traditional grazing land owned by the community	grazing and access to water were not a problem
1986- 1991 (Derg regime)	the land was taken over by the state and become a state farm	grazing became a problem, while access to water was not a serious problem
1991-2006 (EPDRF)	the land was owned by the state farm	grazing became a problem, while access to water was not a serious problem
Since 2006- (EPRDF)	the land is used by the company through a lease agreement with the national government	both grazing and access to water have become serious problems

Source: authors' interview with farmers' group (that included elders and leaders) (December-January, 2013)

* Land located between the community and the Lake

Note: EPRDF = Ethiopian People's Revolutionary Democratic Front

On the other hand, interviewed elders related the ways in which access to water was arranged to the history of changing land ownership in the community (Table 3). One elder stated that the challenges of access had become serious since the land was leased to the company:

We have been here since the earth was created....all my grand, grand fathers had been closely attached to this lake and the land until the previous regime [regime before the current government] drove us from the land by force and denied our natural right to the land. On one hand, the current government respected our right to the land and the water by law. On the other hand, it is not clear why this newcomer [the company] is trying to limit the right of our people and livestock to the Lake.

Despite, the competing interests and different views indicated in this section, the field study also showed interactions among different actors (the community, government and the company) to solve the practical problems related to access to water by the livestock. In the following section we present the process of bridging the community and company perspectives, which engaged elders and leaders of the farming communities, government employees, the company, and technical experts.

Bridging the company and community perspectives and joint problem solving practices

The sequence of events listed in Table 4 reflects a process of joint problem solving practices in the context of access to water points by the farmers. The process started with the appeal the community made in 2007. This section documents the particular events that followed. The empirical findings highlight three dimensions of the process: (1) community-government interactions, (2) community-government-company interactions, and (3) a technical solution as an intervention to bridge the community and company perspectives.

Community–government interactions

Interviews with community leaders and elders at the three administrative units related how the community appealed through elders to the district council in 2007 regarding access to the water points. In Ethiopia, districts are governed by a council whose members are directly elected and who are expected to represent the interests of farmers as members of the community. Furthermore, the council is the highest authority that makes decisions on budgets, development activities, and projects affecting the wellbeing of the community at the district level. Government employees told that the council also included elders. In interviews, elders shared how they organized meetings with the community to raise constraints, which were then presented to the council. Access to water by the livestock was the key issue brought forward during the interviews, which was associated with the establishment of the company that fenced the roads to the water points.

The series of events (Table 4) shows the involvement of community elders and leaders in bridging the distance between the community and the government at district level. Particularly, interviews with elders indicated that the task of the elders was rooted in their position in the community in managing conflicts. Elders in Ethiopia play a key role in settling conflicts over the use of common pool resources, such as water. The performance of these responsibilities is guided by the allocation of political power on the basis of age, called the *Gadaa* system (Endossa et al. 2007).

Company-government-community interaction

Interviews with public officials indicated a pro-active role of the government in the process of bridging the community and company perspectives. In the reported sequence of events (Table 4), government employees coordinated and mediated between the company and communities. The results illuminate the following outcomes of their actions: (1) the actions connected elders and leaders from the three administrative units, (2) established a technical committee that connected experts of government offices with the company, and (3) linked the technical committee with elders and leaders and the company. The technical committee had a decisive central role in the process, particularly through proposing the construction of a livestock water trough as a new way to manage the problems related to access to the lake.

Table 4 Events in the process of joint problem solving problems of communities and a floriculture company (related to access to water by livestock)

Event	
1	In 2007, farmers appealed to the district council through elders during the annual meeting.
2	The district cabinet organized meetings with farmers in the three administrative units in 2007. In the same year, each of the three units chose two or three elders to join farmers' leaders (chairman and vice chairman) in further handling the issue.
3	The district administrator established a technical committee with representatives from departments of agriculture, natural resource and land administration, livestock and fishery, water resource development department and development agents from the three units in 2007.
4	The district cabinet organized a series of meetings with representatives of the company that included the owner, the public relation officer, a technical expert on water, and the technical committee from 2007- 2009. During this period, the construction of a water trough in one of the farmer's village by pumping water from the lake was proposed. Further, it was decided to include an expert (engineer) from the company as a member the technical committee
5	The cabinet organized a meeting of the technical committee and elders and leaders from three units in 2009. Here the cabinet introduced the proposed projects to the participants
6	A district administrator organized another meeting in 2010 that included the technical committee, the elders, and leaders. Participants were assigned to convince the whole community in the three administrative units of the proposed solution.
7	Members of the cabinet, the elders and leaders and technical committee held a series of briefings regarding the construction of the trough across the three units in 2010.
8	One year after event 7 took place, the elders and leaders reinitiated the issue in 2011. Then the cabinet organized meetings with the company owner and the technical committee
9	In 2012, the elders and leaders with the technical committee selected a location for the trough on communal land in one of the villages (10 kilometres away from the Lake)
10	In 2013, the water trough design was prepared by the technical committee and materials purchased and put in place by the company

Source: authors' field work and interviews with government employees, elders and community leaders, and technical committee members (July 2012 - January, 2013)

A technical solution mediating company-community-government interactions

As can be noted in Table 4, establishment of new water points for the livestock through pumping the water from the lake to the village was proposed as a technical solution to the access problem. In the process, the district cabinet, elders, and leaders, and the technical committee (from the company and the government offices) were actively involved. The cabinet played a coordination role, and the elders and leaders communicated the solutions proposed by the committee to the wider community. Interviews with the technical committee members, elders, and leaders show that elders and leaders were actively involved in the process of selecting a possible site for the new project. The new project site was on a communal grazing land 10 kilometres away from the lake and located in a village in one of the three administrative units. Agreement regarding site selection was reached due to the fact that it was not that far from most of the villages and closer to the lake.

Interviews also revealed different views among actors regarding the proposed project in the process of solving the water access problems in the community. On one hand, according to the company, government employees, and the technical committee, the new project was expected to build relations between the company and farmers. In interviews, government employees and corporate farm managers stated that the project had potential to address not only the gap between the community and the company related to the access but also to solve the problems that existed even before the company arrived, i.e., distant water sources for the farmers. A member of the technical committee mentioned this:

The problem with livestock now got a solution, though late. This will help our farmers to save time for other activities...

On the other hand, farmers raised concerns about the proposed technical solution. The field study revealed that farmers' perspectives included other dimensions: (1) problems the new project may induce and (2) issues and concerns beyond the target of the new project, i.e., physical access to the water sources. Regarding the former, an interview with a farmers group in one of the three administrative units indicated that the new project was expected to induce coordination problems, costs of fuel or electricity and maintenance. In the interview, farmers also expressed other concerns, such as disputes around water use among the community members. Some of the farmers also indicated their fear for conflicts that may arise because the new project creates pressure on the grazing area located near the new project. This is reflected in the following conversation among farmers:

Farmer Village 1: they [elders, leaders, and government representatives] do not necessarily reflect the interest of the farmers, because they also have their own individual interest.

Farmer Village 1: who is going to cover the maintenance cost, I think this will not be an easy task.

Farmer Village 2: they [company and government actors] are going to make us dependent on electricity for watering our livestock.

Farmer Village 3: issues related to organization and coordination will not be simple.

The focus of the proposed intervention, the construction of the water trough, targeted problems related to physical access to the water, but did not include other values, with respect to ownership and control over the lake. These were expressed by the elders interviewed and found more important than finding technical solutions, as stated by an elder from village 1:

We always enjoy going to the lake shore with our livestock, children, and dogs. ... it was a gift by God to our people. It is the place that reminded us of our childhood...for us it is a sign of hope and inspiration ... it is also a place where we pray to God... for example when there is a drought...

An elder from village 3 held a similar view:

We prefer *Hara* [water points at the Lake] instead of piped one... but experts and *Ana* [district] tell us that piped water is better than water from the lake.

A supervisor of development agents at the district agriculture office pointed in the same direction:

Farmers are used to feed their livestock while they bring them to the lake. It is not just a simple move to the water point as we experts often consider.

The statements by these elders reflect the general statement made by Williams et al. (1992: 44):

[...] resources are not only raw materials [...] but also, and more important, places with histories, places that for many people embody a sense of belonging and purpose that give meaning to life.

Discussion and conclusions

This chapter explores the relations between a recently established flower company and local communities in the context of the CSR-dimension included in an industry-wide code of practice. The investigation expands the scope of CSR beyond investments in community projects, such as schools and a hospital, and looks into the ways the company engages with community leaders and public officials in addressing problems that cross their organisational boundaries, specifically access to water. The study introduces other dimensions of the company and community relations and extends CSR practices to a process of joint problem solving. It illustrates the roles of community elders and leaders, government actors, and technical experts in a process of bridging the community and company perspectives. Finally, the study documents the sequence of events leading towards joint problem solving and identifies different perspectives on this intervention.

The investments made by the company in the context of CSR, such as community schools and medical services, were in line with the intention of the company to comply with the sectorial code of practice and to implement the CSR policy embedded in the code. The company generated jobs and invested in community services. These activities are largely within the direct span of influence of the company. The required process of consulting community representatives about emerging concerns and sharing responsibilities for addressing problems linked to multiple users of a common pool resource was more challenging for the company. Specifically, access to the water resource by livestock revealed competing interests and different perspectives among the parties.

The study shifts attention to the nature and quality of the process linking community leaders and elders of different community groups, employees, and experts from the company, and government offices. Interactions evolving around a possible technical solution created conditions for bridging company and community perspectives. The study extends the discussion of CSR to an interest in the realities of joint problem solving and achieving settlements between, in this case, the different views of community leaders and elders, government employees, company managers and experts on the technical committee set to recommend technical solutions: the construction of a water trough for the livestock.

Community leaders and elders found that the problem of access to water had dimensions beyond those intended to be addressed by the technical solution. They also expected new problems to emerge with the new intervention: unpredictability of electric power, fuel, and related costs of pumping water from the lake. But they also anticipated coordination problems and conflicts that may surface among the community members. Experts, government employees and the company approached the problem of access to water mainly from within the boundaries of the technical solution. The proposed technical solution, i.e. the construction of a water trough, was externally imposed; the choice was made by the company, government employees, and experts, assembled in a technical committee that had the power to define the nature of the problem and hence its solution. Yet, as Kemp (2010) states, technical solutions may have practical value to both the company and the community temporally. This may lead to new connections between the company and community leaders that prefer development on their own terms, compared to development imposed by external actors (Whiteman and Mamen 2002). The outcomes of those new connections mostly depend on the actual interactions between actors in a specific natural environment, rather than on CSR intentions included in a code of practice.

Therefore, the chapters argues that compliance with the CSR dimension in the code of practice adopted in the Ethiopian flower industry may benefit from a broader approach that includes the recognition of other values, such as joint ownership and control over the resource. The findings help to recognize that the company cannot be expected to address the multifaceted problems of the community, even in the water domain. The study shows the limitation of the focus of many codes and CSR initiatives on compliance and audit reports that are used to indicate the performance of the business (Newell and Frynas 2007). However, the study indicates that the company played a key role in bridging the community–company relations and enabling joint actions around possible technical solutions to address problems that otherwise may not be solved by the local actors alone (Elliot 2013). The study suggests that, in the context of CSR, joint problem solving can be viewed as, to use the words of Maon et al. (2010: 23), “a dynamic, continuous process, without clear stopovers or breaks and with potential trial-and-error periods”. However, the capability to engage with such a process and to recognize that business performance is also rooted in less controllable interdependencies with other stakeholders may be difficult to capture by codes and indicators.

CHAPTER 6

General discussion and conclusions

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Introduction

Ethiopia has become the second largest flower producer and exporter in Africa, next only to Kenya. EU markets are major export destinations, which are demanding in terms of product quality, sustainability of production, and corporate social responsibility. In a newly emerging sector, such demands imply new forms of professional competence and know-how. Associated exporters and flower farms, and public policy in Ethiopia emphasize compliance with a recently introduced code of practice, the involvement of (foreign) experts and university graduates, and the importation of hardware and tools. In this chapter, I begin my discussion with two empirical examples introducing the research problem central to the thesis.

First, the exporters and flower farms expected that conformity to standards holds the promise to bridge the technological gap between the emerging floriculture sector and requirements set by the export markets. More specifically, the Ethiopian Horticulture Producer -Exporters Association (EHPEA) introduced a code of practice to assist compliance with international standards, such as Global GAP (for a detail account of the code see Stebek 2012).

Second, during the Horticulture Investment Summit, organized in 2012, participants expressed similar expectation about the outcomes of introducing the code of practice. This summit brought together about 400 key actors, including local producers and exporters, leading buyers from Europe and Middle East, government officials, researchers from local and international universities and research institutions, and NGOs and development partners. In a panel discussion, local producers and exporters shared views strongly in favour of pre-set capabilities. Their views reflected the assumption that for enhancing the transfer of technology across borders, mainly from advanced regions, and for making the sector competitive, a code of practice essentially based on a given set of indicators, the involvement of (foreign) experts and university graduates, and the importation of hard ware such as equipment and crop varieties were needed. The participants tended to discuss local problem-solving capabilities in terms of: (1) scripted past practices or code, and (2) an individual prior capabilities such as experiences/educational backgrounds. The approach represented by both

the code of practice and views of the participants in the summit limits problem solving practices to pre-set arrangements or plans/intentions.

However, my empirical research questions views that limit capabilities to access and use of the pre-set arrangements, which exclude other aspects of solving problems situated across contexts and tends to reduce capabilities to a capacity to choose and use externally sourced technology or knowledge. In this perspective, important aspects of problem solving practices can be left unrecognized. In other words, it directs actors in the sector away from possibilities of solving situated problems beyond those that can be planned or programmed.

Yet, the issue of my research was not to undermine possibilities by which problem solving capabilities can be informed, guided, or confirmed by pre-set arrangements or, to use the words of Spackman and Yanchar (2013), by an enabling past. My concern was that a strong and exclusive reliance on prescriptions with a tendency to predict capabilities such as supplying quality flowers to the global markets pays less attention to situated problem solving practices. This thesis emphasizes situated problem solving practices as context for emerging know-how to handle unanticipated or composite problems within the everyday socio-materiality in the greenhouse and beyond. In particular my study addresses the main research question of why and how people and organizations know how to solve practical problems within and across boundaries of export-oriented farms in Ethiopia.

In order to move beyond the notion of transfer of, access to, and use of pre-defined approaches, I explored practices of solving situated problems in farms/workplaces and across boundaries of the farms. I investigated how people use skills, tools, techniques and know-how, how they interact interpersonally as well as with plants and materials, and how they coordinated actions to manage pest problems in the workplace (Chapter 2 and 3). I focused on practices of people using a code of practice for good agricultural activities. Specifically, I explored practices of people using IPM, as a code, in solving situated problems at farm level. I explored the functioning of employed university graduates in a setting wherein improvisation, repair, and adjustment are essential for finding workable solutions (Chapter 4). I focused on pre-set attributes of individual graduates such as educational background and job experiences and know-how of solving emerging problems in workplaces.

Next, by extending the scope of my research I studied the way a cluster of corporate farms interacted with the surrounding communities to manage access to and use of a common pool resource: water (Chapter 5). In this regard, I explored joint problem solving practices as a manifestation of CSR, stipulated by the code of practice, in the context of use of the resource.

In summary, I empirically explored problem-solving capabilities in Ethiopian floriculture through case studies of farms using IPM and CSR as codes/standards for good agricultural

practices and a field study of the performance of university graduates at work as experts. My thesis demonstrated capabilities as know-how beyond pre-set arrangements or plans such as codes and attributes of individual graduates or experts. I noted that situated social and material arrangements and the intractable materialities of emerging problems at the level of practices were integral parts of the way people solved practical problems in the workplace. I proposed to enrich the approach narrowing capabilities to the use of pre-defined practices with an interest in interactive and emerging know-how in the process of solving problems situated in social and material environments. Therefore, the thesis develops a grounded conceptualization of know-how, which goes beyond the use of pre-defined practices in codes of practice or attributes of individual graduates or experts.

Main findings

The main research question addressed in this thesis is: Why and how do people and organizations know how to solve practical problems within and across boundaries of export-oriented farms in Ethiopia? The main findings are presented by labelling three different dimensions of the formation and use of know-how identified in thesis: situated activities, materiality and embodied skills, and distributed cognition.

Know-how emerging in situated activities

My thesis showed that problem-solving capabilities entailed more than using a code of practice (Chapter 2, 3, and 5) or hiring university trained graduates (Chapter 4). Informed by the notion of plans and situated actions (Suchman 2007), I argue that an (exclusive) focus on pre-set approaches can lead to the neglect of the situated and interactive aspects of capabilities that unfold in situated problem solving in practice.

Results in chapter 2 demonstrated that in the process of using IPM as a code, people were recurrently framing problems and possibilities due to uncertainties and the dynamic nature of problems, even in the greenhouse environment that is often supposed to be uniform or controlled. Particularly, there was a strong interest in visits to other farms, during which employees were able to actually observe behaviour and status of the pests and their enemies (BCAs), the biophysical environments such as weather conditions, plant characteristics, and the interactions with other management practices such as irrigation schedule (Chapter 2 and 3). My empirical findings revealed that solving problems of pest and disease in greenhouses of the study farms was not limited to the use of prescribed procedures (Chapter 2 and 3) and the prior capabilities (educational background and experiences) of university graduates

(Chapter 4). Results indicated that problems people encountered in practice dictated the process of decision-making (Chapter 2, 3 and 4).

The analysis of situated problem solving activities of people informs my discussion on the main assumptions underlying capability building efforts in the Ethiopian floriculture, which tends to put exclusive focus on the transfer of scripted past practices (code) and prior individual attributes. Taken as a whole, my research shows how people responded to situations changing beyond the plan. These instances of situated problem solving practices led me to extend the existing notions of capability and competence to an interest in emerging know-how.

Further, my thesis demonstrates the process of collective problem solving and decision-making when people navigate in changeable conditions and look for fresh information from multiple sources including social and material environments (Chapter 2, 3 and 4). The results illustrate emerging webs of relations among team members responsible for different tasks (Chapter 2 and 3) and graduates located at different farms (Chapter 4).

In particular, through practical farm visits, experiences from different contexts were integrated into the process of problem solving in the workplaces. Particular features of materials, such as plants and weather data, were used as clues for solving practical problems (Chapter 2 and 3). As illustrated in Chapter 2, people observed plants, with supporting tools such as a hand lens and standard reporting format, as reference for unravelling the interactions between key pest (spider mites) and their predators (BCAs) and for assessing the effects of the pest on plants across variety, beds, bays, and lines in the greenhouses. In this process, people privileged the material aspects and their everyday encounters over the codified protocols (see Chapter 2 and 3). This brings forward the role of everyday observation related to biological characteristics of floriculture/agriculture that involves dimensions beyond human intentions or plans (Biggs and Clay 1981, Vellema 2011).

These results suggest that new possibilities are continuously unfolding in practice (Fenwick et al. 2012). Apparently, those aspects of capabilities were neither pre-planned nor predicted/anticipated, but emerge as know-how in solving situated problems. Put differently, know-how (including those of university-trained graduates) is continuously constructed in everyday encounters. Therefore, my thesis conceptualizes know-how as an emerging outcome of situated practices and suggests that problem solving capabilities and know-how emerging in situated problem solving are an assemblage of prior and new capabilities. In daily life, problem-solving practices mix with scripted practices or codes (Chapter 2, 3 and 5) and prior capabilities (experiences and educational backgrounds) of university graduates (Chapter 4). More specifically, as demonstrated in Chapter 3, the practices of scouting were transformed

into scout data that served as a communication tool among key decision makers (head, farm manager and his deputy, farm owner, consultants, and suppliers) and became scripted practices. People used the script/data to evaluate prior management options and to justify/guide subsequent courses of action such as spraying and release of BCAs. In other words, codes/past were employed to interpret behaviour of plants and pests and to solve situated problems.

Know-how, materiality and embodied skills

The thesis focuses on pest and plants, which was chosen to include complicated material and biological dimensions in the study of performance and team work. This research concentrated on studying work of teams and professionals in the Ethiopian greenhouses that centred on controlling the conditions under which plants cope with pests and under which pests and their predators work. Actors interact around this in a setting of situated cognition (Lave and Wenger 1991). Capabilities to solve practical problems involved not just interactions among people, but also their interaction with the material world. As the findings in Chapters 2 and 3 demonstrated, materialities captured by codified procedures were central to interactions among people. These interactions revealed that materialities were not only expressed in a pre-set code, but also in codified information induced by practice. Particularly, observations of growing plants and reading of weather data were important for decision making in farm management; all workers used plants to find clues to carry out their tasks. In particular, plants represented a set of relations/interactions (Chapter 3) between the people releasing BCAs and managing other practices such as irrigation, spraying, and between plants, pests, diseases and predators/BCAs and other biophysical environment in the greenhouse.

The thesis adds to the predominant focus on the social nature of learning (Lave and Wenger 1991) an interest in how actors in the workplace learn how to make justifiable interpretations and decisions (Akkerman and Bakker 2012) in processes regulating biological and agro-ecological processes in strata acting largely independent from human intention and generating a wide range of uncertainties and contingencies (Vellema 2002). The thesis reports how the observations about behaviour of plants and the interaction with human interventions are conversationally shared (Akkerman et al. 2007) and related to the use of bodily skills required to interpret behaviour of plants and pests. From these main findings, I conclude that material environments involve interactions among people and guide them in using prior experience and the codes available to them to solve situated problems (see Fenwick 2006a, Jansen and Vellema 2011, Johri 2011).

The study identifies aspects of the material world (such as growing plants and pest and disease in the greenhouses across different farms) as an important component of competence development, as explained by Fenwick et al.:

Humans, and what they take to be their learning and social process, do not float, distinct, in container like contexts of education, such a classrooms or community sites that can be conceptualized and dismissed as simply a wash of material stuff and spaces. The things that assemble these contexts, and incidentally the actions and bodies including human ones that are part of these assemblages, are continuously acting upon each other to bring forth and distribute, as well as to obscure and deny, knowledge. (Fenwick et al 2011: vii)

In the greenhouse, plants have their demands and their needs, pests and diseases as well. The university graduates, farm owner, managers, consultants and other employees deal with these in different ways such as according to their aims, farm rules, code of practice, assigned responsibilities, emotions and prior capabilities.

Empirical findings in my thesis also indicate that some problem solving aspects in practice were only possible when people were physically or bodily involved. This is shown in the bodily movements of scout members when inspecting key pests (spider mites) and their predators in a greenhouse (Chapter 2). These practices were possible when the members interact bodily with tools like hand lens, plants and pest and predators. Likewise, under certain circumstances, consultants or employed graduates often travelled long distances to see specific situations in person, as condition to understand the manifestation of problems or the results of treatments (Chapter 2, 3 and 4).

The above instances have important implications. First, experiences of an individual, such as a university graduate, in one setting may not determine her or his problem solving capabilities in another (Chapter 4). Second, the situated social and material arrangements and the material properties of the emerging problems (see chapter 2, 3, and 4) are also integral parts that dictate how people act and interact. This insight advances our understanding of capabilities that go beyond prior capabilities of an individual and introduces the notion of emergent and embodied capabilities.

As material and social components interact, a diversity of outcomes may be realized: intended practices such as graduates using prior capabilities acquired at school or on the job, to tackle known or unknown problems, or graduates solving emerging and unanticipated problems through improvising and using unanticipated combinations of new and prior capabilities. In the latter case new competence or know-how may emerge which is obviously

difficult to predict in advance. This insight contributes to seeing competence as an embodied and emergent assemblage of past and present situation (Nemirovsky 2011), as a transformation of the past (Larsen-Freeman 2013), as an embodied experience in a new situation (Spackman and Yanchar 2013), or as knowledge in action (Wals et al. 2013). That also implies, in contrast to the prevailing assumption in the code of practice adopted in the Ethiopian floriculture sector, that competence is not reducible to individuals past experiences and is not fully predictable.

Know-how in a setting of distributed cognition

The study further showed the distributed nature of problem solving that transcended the social dimensions and included the material world (Chapter 2, 3 and 4). Findings reveal that problem solving practices were distributed among social and material environments, both within and across the farm boundaries (Chapter 2, 3, 4, and 5). My research extended problem solving capabilities beyond the boundaries of the individual person or farm to the distributed networks of people (Chapter 2), tasks (Chapter 3), farms (Chapter 4), and community (Chapter 5). I interpret my results by drawing upon the perspective of distributed cognition developed by Hutchins (2006, 1995).

The findings indicated that decision making was beyond the formal organizational boundaries of task groups responsible for particular activities, such as pests and disease management teams (Chapter 2 and 3). More specifically, the results showed that solving pest and disease problems in the greenhouses was a collective action. The problem-solving tasks were not restricted to individuals, such as team leaders, farm managers, or supervisors (Chapter 2). Rather, they were distributed in a network that included other actors, such as members of the scout team, peer graduates, and consultants, both within and beyond the farm boundaries (Chapter 2). The study documents how people (graduates) and materials (pest and diseases and growing plants) form a web of interactions that collectively generates know-how (Fenwick et al. 2012). The evidence presented highlights that problem-solving capabilities are distributed within the farm, but also found capabilities in environments outside the individual farm. For instance, in solving pest and disease problems, flower farms located at different places were connected through the interactions between graduates. As indicated in Chapter 4, farms were connected through graduates' everyday interactions: via e-mail, telephone and practical farm visits. This web of interactions was not intended or planned. Likewise, in managing conflict over resources with the local community, elders and local government officials played key roles (Chapter 5).

Theoretical implications

The theoretical insights derived from this study are relevant for (i) the study of situated problem-solving practices, and (ii) the study of learning.

The study of situated problem solving practices

The orientation towards studying situated activities and problem solving capabilities to understand how people develop and use know-how is reflected in the empirical findings presented in this thesis. The study views the ability to use skills and know-how as a property emerging in networks of social and material environments (Jansen and Vellema 2011, Fenwick et al. 2012, Fenwick and Edwards 2013, Gherardi 2013, Gärtner 2013, Semin and Smith 2013). The empirical results in my thesis inform my discussion with perspectives based on the dominant assumptions underpinning the focus on scripted past practices or codes and individually embodied prior capabilities of employed university graduates, specifically in the context of Ethiopian floriculture. Accordingly, I highlight the following three main areas in the field of practice-oriented studies of technology and knowledge to which my thesis can contribute.

First, the results (Chapter 2 and 3) substantiate that the efficacy of codified standard procedures (embedded in IPM) was constrained by emerging problems of pest and disease in the greenhouses. The reported critical incidents in the greenhouses revealed how people, including the experienced university trained graduates, were challenged by the uncertainties and particularities of problems (Chapter 2, 3 and 4). Simultaneously, my research showed features of capabilities that were transpiring during the confrontations with intractable materialities, conceptualized as know-how. Consequently, my research shifts focus from planned practices to know-how. According to Duguid (2005), knowing how in practice is more critical for solving problems, which has been invisible in the discussion of capability building and technology transfer in the context of less developed regions (see also Bell and Figueiredo 2012, Pietrobelli and Rabellotti 2011).

Second, informed by the technographic perspective on performance (Richards 1993, Jansen and Vellema 2011) and socio-material perspectives (Orlikowski 2006, Fenwick 2012, Fenwick 2006a, Orlikowski 2007) I study know-how in practice as a result of the interactions of people with situated social and material arrangements in workplaces. The thesis demonstrates the role of the material dimension of capabilities, which are often overlooked in capability building and related technology/knowledge transfer studies.

Third, as indicated above, the notion of know-how in my thesis goes beyond demonstrating capabilities to use pre-set aspects of problem solving. It regards know-how as an assemblage of pre-set arrangements and newly emerging capabilities in situated problem solving or practice. The notion of assemblage and emergence can complement the contemporary discussions of technology or knowledge transfer that tend to place an exclusive focus on capabilities to choose and use the pre-identified devices such as codified protocols in a new context (Zuo et al. 2013).

This understanding challenges the claim underlying capability building based on codification, which has been viewed as a way by which knowledge can be portable and reusable across space and time. In Chapter 3, for instance, I indicated the limitations of codification. The consideration of know-how as situated and embodied can help to question the overreliance on codified aspects of capabilities and their transfer. As stated by Gorman (2002), capability transfer may not be possible merely through codified documents. By and large, the insights implies reframing the prevailing notion of problem solving capability: it emphasizes the way people enact codified information in activities situated in a web of social and material environments rather than taking it as a mere acquisition of abstract knowledge/concepts.

The study of learning

The perspective developed in this thesis questions the view predominant in standard-setting and related training and selection procedures in Ethiopian floriculture that tends to regard capabilities and competence of hired graduates as a discrete attribute that can be fully pre-figured in training and education with a predictable outcome. As demonstrated by findings in chapter 4, there was a tendency in the Ethiopian floriculture sector to view the pre-fixed attributes of graduates as capabilities of problem solving across contexts. Standard-setting and associated trainings initiated by sector organisations also revealed an exclusive focus on the significance of prior demonstrable experiences. I make and exemplify the case that this approach tends to restrict problem-solving capabilities to knowledge and skill that can be acquired through involvement in pre-defined events such as training regardless of changing contexts. Instead, I emphasize the possibilities of the emergence of know-how at the practice level. The findings illustrate that problem-solving capabilities were situated in and emergent from social and material networks in workplaces (Chapter 4)

The findings presented in this thesis show the relevance of working towards convergence of parallel scholarly traditions, namely anthropological work on learning, skills, apprenticeship and competence to which technography relates closely (Lave and Wenger

1991, Lave 1993, Jaarsma et al. 2011) and work in education and competence research developing a more practice-oriented conceptualisation of competence (Mulder 2014; Lans et al., 2014). The analysis of situated activity links strongly with recent work in education studies, specifically to insights offered by Akkerman and Bakker (2012). They argue that what students are supposed to learn in apprenticeships is largely rendered invisible by the technology-mediated, scripted, and socially distributed nature of work. Their study reflects the seminal work of Hutchins (1995) on distributed cognition central to the technographic approach used in this thesis. The work of Akkerman et al. (2007) on group cognition also fits the descriptive account in the present thesis, and the documented coordination of information and actions. The interactions among humans in the workplace and between human and plants represent processes through which a shared conception of a problem is constructed, which contrasts with the individualistic training approach still dominant in the standard-setting and training practices steering development in the Ethiopian floriculture sector. The thesis confirms the general idea of Lave (1993) that learning takes place anyway, be it intentional or incidental, organised or informal, conscious or unconscious.

The thesis points at the emerging interest in research on boundary crossing by people, objects, and interactions / practices, presented by Akkerman and Bakker (2011) and referring to Starr's (1989) work on boundary objects. Boundary crossing is done by people, in the context literally by consultants who fly in to observe the performance of plants under the specific conditions in the greenhouse but also members of the scouting team interacting with the greenhouse manager. But also objects, i.e. the plants, predators and pests, and scripts, such as the codified observation of what happens in the plants, cross boundaries within the greenhouse setting. Akkerman and Bakker (2011) argue that movements across boundaries shape learning. The thesis shows that this is the case in the problematic field of pest management: graduates learn from experiences and mistakes of peer working in other farms, scouting team members and farm managers interact frequently in interactions giving meaning to observations made on plant health, and international consultants need to be on the spot to diagnose the observed problems with local experts.

Chapter 5 elaborates this perspective to an interest in investigating how boundaries are crossed between the company and the surrounding community in the context of Corporate Social Responsibility (CSR). The issue of accessing lake water, presented in Chapter 5, indicates that the construction of a trough for watering livestock shaped temporary interactions between the company and elders in the local communities as a boundary object. However, this chapter also brings into question whether the CSR policy adopted by the company translated into competence to organise, as is argued by Akkerman and Bakker

(2011), a due process incorporating cultural and institutional ingredients from different corporate and community contexts. Although an object crossed the boundary, it remains to be seen whether the movements of people and practices are flexible enough to avoid that differences between company and community lead to discontinuity in the interactions (ibid.). This brings forward a research agenda for a new terrain for competence research in the domain of CSR and global value chains (see for example the preliminary findings in Osagie et al. 2012).

Overall, the thesis tries to avoid the pitfall in competence management and development, mentioned by Mulder (2014), namely to start with modelling professional competence, as an act of normative decision backed by the use of standards in selection and assessment procedures. Mulder (2014) observes that the concept of competence may lack clarity but has been widely used in training and education. Therefore, the thesis endeavours to use an empirically grounded description of performance for conceptualising competence and to provide an alternative to the predominant focus in Ethiopian floriculture on a pre-defined set of skills, knowledge and attitudes visible in university training and the training designed for ensuring compliance with a sector-based standard. Here the research interest in situated activity developed by Lave and Wenger (1991) converges with the research interest in situated professionalism proposed by Mulder (2014). Learning and team work take place in the specific conditions of the situation. Although manuals, trainings and standards may suggest otherwise, addressing pest problems, or shared problems about water resources, occurs also in the context of mundane practices, which are improvisational and create future recipes (Lave 1993) via reflection, observation and experimentation, as is demonstrated in the study of how Dutch horticulturists learn by looking at examples (Mulder et al., 2007). The link to learning in Dutch horticulture, in practice and in literature, opens opportunities to further investigate what makes transfer of competence possible, perhaps in other ways than through prescribed standards and manuals.

My study complements a research, policy and training/education approach and firm strategies that focus on transfer of pre-defined practices and plans to the not fully-known present and unpredictable future of agricultural in less developed regions. In other words, it may provide opportunities to see beyond the past possibilities (Dall'Alba 2009) and works towards future-creating activities (Lave 1993) situated in everyday encounters (Gherardi 2013, Fenwick et al. 2012). Likewise, it may inform education programmes how to include practices that enrich and transform plans and prior capabilities.

Conclusion

This thesis emphasizes situated problem solving practices as contexts for emerging know-how to handle unanticipated or composite problems within the everyday socio-materiality within the Ethiopian flower farms and their boundaries. It described and explained why and how people and organizations know how to solve practical problems within and across boundaries of export-oriented flower farms in Ethiopia. It investigated how people use skills, tools, techniques, and know-how, how they interact among themselves, as well as with plants and materials, and how they organize to manage pest problems in the workplace. The thesis explored the functioning of university graduates in a setting wherein improvisation, repair, and adjustment are essential to discover workable solutions. By expanding its scope, the study showed how a cluster of corporate farms interacts with the surrounding communities to manage use of a common pool resource: water. It then concludes that: (1) problem-solving capabilities are a joint action, not limited to an individual person, task and organization, (2) material environments constitute peoples' situated everyday activities and interactions and shape their know-how to make use of their prior experiences and codes/standards/protocols available to them to solve practical problems, (3) some features of problem solving in practice are only possible when people are physically present and bodily involved, and (4) know-how of people and organizations generated in situated problem solving practices is an assemblage of prior and new capabilities emerging in practice. Subsequently, the thesis draws attention away from an exclusive focus on codes of practice and prior capabilities of individual person, prevailing in the context of the Ethiopian floriculture sector, to focus on know-how distributed and situated in the world of practice. Understanding know-how as assemblages of the past and situated problem solving distributed in networks of the social and material environments both within and across boundaries of a firm/farm/organization can advance understanding capability building in the context of technology transfer in less developed regions.

Implications of the findings

From the integrative analysis of the use of scripted past practices (codes) and prior capabilities of individuals (such as experiences and educational backgrounds) in situated practices, the following becomes clear:

- understanding problem solving capabilities as transformation of past experiences and generation of know-how is not just limited to the past practices or plans/intentions;

General discussion and conclusions

- focus not just on plans and predictable outcomes, but on the actual process of problem solving to capture knowledge that makes learning possible and therefore facilitates the processes of improvement/innovation, which in turn can help to re-design and enrich the pre-defined practices;
- regard scripted past practices such as codes and prior capabilities as guiding devices while understanding their limitations.

Based on the above insights, my study has important implications for firms/farms and training/education.

Implications for farm and firm management practices

From the empirical evidences of my thesis, I draw two major implications that may support the performance of the Ethiopian flower farms, beyond the pre-set intensions both within and across boundaries.

- My investigation that highlights emerging know-how in practice can help to reframe the dominant approach that focuses on pre-defined arrangements and outcomes. As shown in my study the use of standard protocols in implementing IPM as a code was not a straightforward process that could accommodate uncertainties and emergent issues in the process of solving practical problems in greenhouses (Chapter 2 and 3). Likewise, as noted in Chapter 5, implementing codes as CSR in a compliance centred approach did not fully address issues related to floriculture business-community relations. Rather, the practice and nature of emerging problems induced new structures and concerns that were invisible in the formal organizational structures or codes (Chapter 2, 3, 4 and 5). These results can suggest that solutions to problems in practice are open and co-produced by ongoing interactions of people and material components both within and across the boundaries of workplaces. Accordingly, a strong focus on standards as evidenced in the code (Chapter 2 and 5) may limit space for re-examining know-how to solve situated problems at the level of practice. Kogut and Zander (1993) conclude that firms compete on the basis of their superiority of know-how. Consequently, I suggest shifting focus to problem solving in practice, which I conceptualize as know-how.
- The approach that focuses on codes puts emphasis on training of individuals (Chapter 2 and 3). The focus on training entails the notion of manuals and pre-determined structures with limited possibilities and selective methods. This perspective can be limited as, with its focus on rules and procedures or past agreed up on practices, it may ignore situated problems and new encounters. In short, they pay less attention to what people do, and how

they do things in time and space that may limit our understanding of dynamic capabilities of local actors (Orlikowski 2002). In general, overreliance on training of past practices can oversee learning by doing for situated problem solving capabilities and performance. The perspective of distributed cognition (Hutchins 2006), demonstrated by empirical findings in my thesis (Chapter 2, 3, 4), can indicate the limitation of the explicit focuses on standardized procedures and subsequent training of individuals. Instead, problem solving involves a group of people not just using codified standards but also learning by doing and experimenting with situated material practice in workplaces. I further propose the transformation of the existing capacity building approach in the Ethiopia floriculture sector that tended to restrict capabilities to transfer of best practices by limiting emphasis to compliance and prior capabilities.

Implications for training and education

My research has also implications for education. The insights can help to complement farm level training and vocational and university education in Ethiopia that puts strong focus on designing curriculum and training manuals with the objective of achieving competence as an outcome that constitutes pre-defined skill and knowledge and that can and must be acquired by graduates through pre-set courses and practices. I advocate that this approach needs reconsideration. I further propose to revisit the way we evaluate the competence of employees, in particular of university trained graduates (Chapter 4).

As demonstrated in my study (Chapter 4), social and material environments in workplaces may constrain opportunities/possibilities for some, while opening them to others. Particularly, drawing on my understanding of embodied capabilities that emerge in a situated problem solving in social and material practice, I see learned experiences in universities as past experiences/cognition.

Nevertheless, while “[...] providing possibilities, the past may not determine the present or future, or even it may limit our capabilities of looking for other possibilities, if we take it for granted” (Dall’Alba 2009: 38). As noted by Larsen-Freeman (2013: 110), this line of thinking “... assumes learning within a certain context and asks about its impact beyond that context”. These concerns and issues are also recent discussion topics in education (see also Hager and Hodkinson 2009, Hager and Johnsson 2012, Fenwick and Edwards 2013, Wals et al. 2013). Accordingly, in contrast to the existing dominant views of competence that emphasize the pre-defined attributes (see also Chapter 4); I suggest, following Spackman and Yanchar (2013), to adopt a new conceptualization of know-how in situated problem solving. Based on my empirical findings, I also suggest a reconceptualization of competence, as being not

limited to pre-set attributes and outcomes, but always performed through social and material interactions in workplaces and across their boundaries. Put differently, competence can be viewed as emergent and embodied know-how of people engaged in social and material practices in a particular situation. This includes, but is essentially not reducible to pre-set attributes (Orlikowski 2007, Fenwick et al. 2012). The thesis contributes to a more complete conceptualization of competence, which is needed to direct the focus of education policy away from universal or standardized pre-defined competence with assumed predictable outcomes to competence-in-use following guidelines set by what works.

Finally, drawing on the insights from my empirical study, I tried to design learning in context as an intervention by taking on board past cognition, but emphasising the relevance of diagnostic skills and composite problem solving strategies in real life, where unanticipated problems figure. Below I present a summary of a project I initiated to develop and implement on location masters training in Ethiopian horticulture, which is a practical consequence of the insights presented in this thesis.

Connecting competence to real world practice: a practical example

Policy makers and employers emphasize development of local capabilities particularly through university training in order to produce quality products for export (Chapter 4). The competences/capabilities required were mainly associated with the nature of the export horticulture characterized by higher quality requirements associated with certification schemes. Put differently, the anticipated capabilities were related to the nature of the sector that is considered as knowledge intensive (for instance see Mulder 2012). The proposed approach (On location masters training) is in line with the situated learning model proposed by Jean Lave and Etienne Wenger (1991), which emphasises learning that occurs in a context in which it is used.

Indeed, as shown in my research (Chapter 4), competences of young employed graduates are among the key concerns in the sector. In my investigation, I identified two key issues related to capabilities of university graduates raised by employers in the horticulture business (Chapter 4). First, graduates in their early period of employment could not demonstrate the knowledge and skill required for effective professional work. Second, the university learning approach needs critical re-examination to address the emerging and continuously changing requirements by the sector. Consequently, employers were seeking ways of developing capabilities that can accommodate the changing situations of the sector.

Drawing upon the socio-material approach to learning (Fenwick 2006b, Fenwick et al. 2012) and the competence based approach (Mulder 2012) and reflecting the insights from my

empirical study (Chapter 4), I propose to experiment with constructing new contexts of learning that are stronger embedded in real world situations. This shifts attention to (1) the interactions among graduates and material environments in the workplaces, and (2) integration of past cognition/experiences, including standardized curriculum and courses, and contingencies and situated problems that the graduates encounter in everyday practice.

Accordingly, I identified two key areas of intervention: (1) encourage employed graduates to participate in learning in work contexts; and (2) support universities to design curricula that integrate past cognitions and real world practices. In this task, I was informed by accounts of Hager and Hodkinson (2009), who state that capabilities or competences in agriculture/horticulture are irreducibly contextual.

From this fresh perspective, I initiated on location masters training in 2011 with strong support from my own university (Jimma University) and financial support from the embassy of the Kingdom of The Netherlands in Addis Ababa. The programme was established in partnership with the flower growers association (EHPEA), Ethiopian Horticulture Development Agency (EHDA), and Jimma University. Three learning sites were established by taking into account the distribution of export oriented horticulture farms in the country (Addis Abba, Adama, and Ziway). Since 2011, three batches of 160 graduates working for EHPEA, EHDA, private horticulture farms, farmers' cooperatives, small holders and agricultural offices attended the masters training.

The programme involved various actors outside the university in the tasks of teaching/learning and research. It attempted to integrate experiences of graduates, employers/practitioners, consultants, policy makers and to include everyday realities in the workplaces and across boundaries of the farms in the process of teaching/learning. It regarded learning outside the university campus as an integral part of the process to educate graduates and to generate know-how that can address complicated issues and mutual concerns in the horticulture sector. Generally, the approach aims to support ongoing efforts of the Ethiopian government to transform the education system.

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Appendixes

Appendix A. Checklist for problem identification used in group discussions in Ethiopian flower farms at three major clusters: Sebata, Debre Zeit and Ziway
(Chapter 2, 3 and 4)

Issues in Ethiopian floriculture (Chapter 2, 3 and 4)	Major sources of information to solve the problems?		Major means of communication among the key actors	Individual farm/company context
	People and organizations	Material environments		
Pest and diseases management	<ul style="list-style-type: none"> • Government agencies • Private companies • Universities and research NGOs • Suppliers of inputs • Service providers • Buyers • Consultancy firms • Consultants • Regulatory bodies • Local communities • Government owned enterprises • Growers associations • Auditors • Private standards and code of practice • Others 	<ul style="list-style-type: none"> • Weather condition • Soil characteristics • Physical location • Plant characteristics • Websites • Books • Manuals • Labels and code of practice • Others 	<ul style="list-style-type: none"> • Face to face • Meetings • e-mail • Reports • Telephone • Training and conferences • Others 	<ul style="list-style-type: none"> • Year of establishment • Products /varieties grown for export • Market out lets (direct/auction) • Local, foreign or joint venture , • Intensity of experimentation and trails • Human resource • Education and experiences • No. of BSc holders and experiences • No. of MSc holders and experiences • No. of PhD holders and experiences • R& D department? • Investment in research • No. of ongoing research • Collaborating institutions • No. of experimentation and trails • Organizational structure of the company • Others
Postharvest handling				
Soil and nutrient related				
Fertigation / Irrigation and nutrient management				
Water management				
Energy management				
Labor or human resource management				
Environmental and waste management				
Agro -chemicals				
Greenhouses				
Variety selection				
Logistics and transportation				
Postharvest and cool chain management				
Financial management				
Safety				
Market				
Promotion				
Others				

Appendix B. Analysis of tasks/activities demonstrating pests and diseases management head and other key actors interaction in the study farm
(Chapter 2 and 3)

Activities/tasks	Action stimulus	Action	Feedback
Compare the newly received data with the pervious scout data	Look for changes or differences	Read the pervious data in line with beds, bays, lines and varieties	Noticed changes and was not happy with the data submitted by the supervisors and planned for joint farm visit
Joint farm visit	Intent to confirm the data	Walking and driving through the greenhouse following beds, bays and varieties	Confirmed some of the data and took remarks on others for further rechecking (the head he was not happy with the data filled by one of the scout members in bay 3 of line 26)
Refer weather data	To understand the reason for some changes(e.g. number of spots and hot spots for spider mites increased in all bays of line 26)	Using the computer networks of the farm, the head referred temperature and relative humidity and related them to the population of spider mites indicated in the scout format	He related higher population of spider mites to the increasing temperature, but population for BCA, particularly in one of the bays of line 26 was decreasing, despite increasing population of spider mites. This was in contrast to the other bays in line 26, where the population of BCA agents was increasing.

Sources: author's data

Appendix B. (Continued)

Activities/tasks	Action stimulus	Action	Feedback
Refer grading reports	Intent to confirm reliability of the data	Refer a written report related to number of rejects due to pests and diseases for each variety and remarks made at the end of the report	Noticed remarks on some varieties and number of rejects indicated for each variety
Refer unpack /buyers reports	Remarks made by buyers	Read e-mail sent by buyers and refer remarks made on each variety	Remarks due to pests and diseases were noticed
Receive comments from production line managers	Intent to get more information	communicate with line production managers	Get more information of the status of pests and new developments
Refer spray history	Population of BCAs were decreasing in one of the bays	Refer last three years spray history	The head decided to further investigate the matter
Receive comments from farm managers and deputy farm manager	Pests and diseases infestation increased	Unplanned meeting with head, farm manager	The head and farm manager agreed to further consult consultants and sent e-mail
Discuss with scout supervisors	Pests and diseases infestation increased and BCA decreased	Unplanned meeting	Found that there were some mistakes while recording the data and still they couldn't agree on the case of BCA

Sources: author's data

Appendix B. (Continued)

Tasks/activities	Action stimulus	Action	Feedback
Discuss with spray supervisors	Pests and diseases infestation increased and biological agents decreased	unplanned meeting	Confirmed that the recommended chemicals were sprayed, but suspicious about the doses, particularly on bays where the population of BCA decreased
Consult suppliers of BCA	Pests and diseases infestation increased and BCAs decreased	send an e-mail	Get some documents and locate some web-sites to refer and also promised to send an expert
Ask for advises from farm owners	Pests and diseases infestation increased and BCAs decreased	send e-mail to the farm owner	Agreed to invite experts from the supplier of biological agents
Refer books	Pests and diseases infestation increased and BCAs decreased	Read topics related to spider mite and BCAs	Need further investigation
Refer web sites	Pests and diseases infestation increased and BCAs decreased	Explore topics related to spider mites and their predators	Could not get satisfactory answers, particularly for BCAs
Refer labels of chemicals used	Pests and diseases infestation increased and BCAs decreased	Refer to the doses	Confirmed that the recommendation was correct, but the head was suspicious whether it was sprayed by the spray members accordingly.
Ask information from friends in neighbouring farms	Pests and diseases infestation increased and BCAs decreased	Call friends and discuss on the issues	The neighbouring farm were observing that population for spider mite was increasing, but they were able to control by using BCAs, they did not face the same problem. The BCAs were doing well in their case.
Meeting with experts of BCAs	Pests and diseases infestation increased and BCAs decreased	Face to face communication, joint farm visit and referring reports	They did not agree on the exact reason for the problem but agreed to reapply the BCAs.
Wright a report and attached the analysed scout data	Required by farm manager, owner and suppliers of BCAs	Compile and send written report to the farm manager and send an e-mail to farm manager, owner and supplier company of BCAs	Report received by farm manager, farm owner the supplier company.

Appendix C. Actors involved, materials used and protocols followed to execute the task to identify pest, biological agents (predators) and diseases in a greenhouse in the case study farm
(Chapter 2 and 3)

No.	Subtasks	Actors	Materials used
1	Discuss about the plan and scout activities in the office	Head pest and disease management and scout supervisors	-
2	Get out materials and tools from the store	Scout members and scout supervisors	Record keeping format and pen, 10X power hand lens, Iron flag, pieces of white papers and uniform
3	Check scout members in their respective lines, bays and beds in the greenhouse	Scout supervisors and scout members	Record keeping format and pen, 10X power hand lens, Iron flag, pieces of white papers and uniform
4	Inspect plants in the greenhouse	Scout members and scout supervisors	Plant leaves and stems
5	Identify pests, diseases and predators in plants in the greenhouse	Scout members and scout supervisors	10 X hand lens and plant leaves
6	Record the identified pests, diseases and predators on the scout report format in the greenhouse	Scout members and scout supervisors	Scout report format, clip board and pen
7	Determine levels of the pests, diseases and predators in for beds, bays, varieties and lines(greenhouses)	Scout members and scout supervisors	Cut plant leaves, number of spider mites, biological control agents, number of lesions for diseases and chart on the scout report
8	Record levels of pests, diseases and predators in plants on the scout record format in the greenhouse	Scout members and scout supervisors	Scout report , pen, clip board

Source: author's data

Appendix C. (Continued)

No.	Subtasks	Actors	Materials used
9	Identify 'hot spots' in for spider mites and diseases in the for	Scout members and scout supervisors	10 X hand lens, plant leaves and plants in beds
10	Determine levels for 'hot spot' for spider mites, diseases and label for beds in the greenhouse	Scout members and scout supervisors	Charts scout report format, number of spider mites per observations in beds, bays and lines pieces of white papers, and white iron flag, plants stems
11	Monitor activities of scout members in the greenhouse	Scout supervisors	Scout report format, hand lens, plants
12	Submit scout report(data) in the greenhouse	Scout members and scout supervisors	Scout report format and memos
13	Collect scout data and memos in the greenhouse	Scout supervisors	Scout report and memos
15	Compile scout data and memos and submit in office	Scout supervisors	Scout data and memos
16	Receive and analyze scout data in office	Head pest and disease management, scout supervisors, spray supervisors, line production managers, irrigation manager, farm manager, deputy farm predator sup suppliers, suppliers of predators('biologicals'), consultants,	Scout data (old and new), scout memos, plants in the greenhouse, grading reports, weather data, unpack reports, spray history data, refer web sites, books, memos, spray memos, cut plant leaves, rejected plants in the greenhouse, e-mail message from consultants and suppliers

Source: author's data

Appendix D. Summary of task analysis

(Chapter 2 and 3)

Information required (knowledge and skills required to do the task of scouting)	Sources	Means of communication
<ul style="list-style-type: none"> • knowledge of scouting tools to monitor pests and diseases of roses in the greenhouse and skills to use pest counting methods and visual observations and 10X hand lens, sampling techniques in the greenhouse following a specific pattern, skills to read scout record format and read farm maps(beds, bays, and lines) from the format • knowledge of the biology of the rose plants, pest, diseases , biological control agents(predators) and the farm environment • knowledge of the physical and biological factors that affect the number d distribution of pests, diseases and beneficial(biological agents) • knowledge of the life cycle and conditions that trigger pests and diseases of roses in the greenhouse (if a specific temperature and humidity is conducive for spider mites, then the head and scout supervisors should plan frequent monitoring) • Skill to manage human power • knowledge of scouting tools and locate hand lenses, scout data format, flags and farm map, bed, bays, and lines • knowledge of the scout members and their competencies/capabilities • knowledge and skill to identify pests, diseases and biological agents and skills to identify the symptoms of the common diseases in the greenhouse. • knowledge of the greenhouse history • skills of sampling tools to be used and capability to consider what other information should be monitored and recorded, such as bugs, rodents, birds and other that may affect roses 	<p>Head pest and diseases management, scout supervisors, line production managers, suppliers of predators, previous scout data, grade reports, weather data, farm report, farm visits, unpack/buyers report, web sites, manuals, friends in the other farm and deputy farm manager, meetings, consultants</p>	<p>Face-to-face, memos, mobile telephone, e-mail, computer-network, written reports</p>

Appendix D. (Continued)

Information required (knowledge and skills required to do the task of scouting)	Sources	Means of communication
<ul style="list-style-type: none"> • skill to collect scout data, how to use lens , how to record on the pre-designed format is need, understand farm maps in line with the format – columns, rows that represent beds, bays, lines , - identification of varieties, identify of normal growth from abnormal, identify normal leaf color , damages due to spider mites or diseases, differentiate disease and pest damage symptoms from that of water deficiency , differentiate visually varieties of roses in the greenhouse • knowledge of life cycle of spider mites and diseases, relationship between pests, diseases and predators and weather conditions, relationships between pests and predators, • understand growth stages of roses, • understanding the farm maps in line with the format –columns, rows that represent beds, bays, lines and varieties • skills of record keeping (scout members should be able to keep records of location and time pests and diseases, as well as predators) • translate the number of pests, diseases and beneficial into ‘codes’ in line with the scout format 	<p>Head pests and diseases management, scout supervisors, trainings, meetings, scout members, farm visits, line production managers, harvesters, flower transporters, scout format, plant condition in the farm, friends in neighboring farm, spray supervisors, plant conditions, farm visit, population of pests and beneficial, level of disease infestation., consultants</p>	<p>Face-to-face, memos, mobile, telephone Face-to face, memos</p>

Source: author’s data

Appendix E. Employer Survey

(Chapter 4)

The aim of the research is to analyze the role of university graduates in the process of capability development in Ethiopian Export horticulture sector. We would like to know what you think of the capability (skills, understandings and personal attributes) of Ethiopian university graduates currently working in your organization/company/farm. We are particularly interested in:

- understanding how university courses/degrees focus on the capabilities that really count in the early years (1- 5 years) of a graduate's career
- identifying the changes organizations/companies like yours expect to face during the coming years which university courses must take into account to remain relevant

How to complete the survey

The survey consists mainly of a set of statements for you to rate. It also gives space for you to comment on your ratings and other issues, including important things we may have overlooked. You will be asked to rate an item for importance, in other cases you will be asked to rate the performance of graduates in addressing that item.

Important

- Your response will be used to report research results.
- All responses to this survey are totally confidential and will not be referred to by organization/company, farm, etc.

Part I

1. Name of your organization/company/farm
2. Your position in the organization/company/farm
3. What, approximately, is the total number of employees in your organization/company/farm?
4. On average, how many graduates does your organization/company/farm employ per year?
5. Approximately how many Ethiopian university graduates has your organization employed in the last 5 years?
6. From which of the following Universities have graduates been employed by your company?
7. From which of the following field of studies have Ethiopian university graduates been employed by your company? Select more than one area if necessary.
(Plant Sciences, Horticulture, Horticulture and Plant Sciences, Agribusiness, Agricultural Engineering, Agricultural economics, Business and Economics, Accounting and Management or others (please specify))

1. Your images of Ethiopian university/universities from which graduates have been employed by your organization/company/farm? (Please mark on the circle which best describes your image):

To what extent does each of the following phrase/word describe your image of the universities	Not at all	Somewhat	Quite well	Very well	Not sure
Work focused	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flexible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practical	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Theoretical	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Relevant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Additional ways in which you would describe the Universities:

Part II

This part seeks your views on importance of graduate capability indicators for successful performance of recent graduates in your organization. Then you are asked to rate the extent to which you believe recent graduates demonstrate these capabilities. It consists mainly of a set of statements for you to rate. It also gives space for you to comment on your ratings and other issues, including important things we may have overlooked. For each item (capability indicator), please mark in the circle which best describes your rating of its importance to you and your experience of current performance.

1. Personal attributes

Your views on importance for early career success in your organization	Graduate capability indicators			Your views on current performance of graduates in workplace
	Low	Medium	High	
Being willing to face and learn from errors and listen openly to feedback	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Understanding personal strengths & limitations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being confident to take calculated risks and take on new assignments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being able to remain calm under pressure or when things go wrong	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wanting to produce as good a job as possible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being willing to take responsibility for assignments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A commitment to ethical practice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being flexible and adaptable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What other personal qualities do you consider to be the most useful for new graduates? Other comments

2. Interpersonal attributes

Your views on importance for early career success in your organization	Graduate capability indicators			Your views on current performance of graduates in workplace		
Low	Medium	High	Low	Medium	High	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	The ability to work productively with people from a wide range of backgrounds / can work effectively in settings of social and cultural diversity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	A willingness to listen to different points of view before coming to a decision	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Being able to develop and use networks of colleagues to help solve key workplace problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	The ability to function effectively as an individual and in a group	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Being able to work with senior staff without being intimidated	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Being able to give constructive feedback to work colleagues and others without engaging personal blame	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Being able to motivate others to achieve great things	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Being able to develop and contribute positively to team-based tasks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What other interpersonal attributes do you consider to be the most useful for new graduates?
Other comments

3. Other important attributes

Your views on importance for early career success in your organization	Graduate capability indicators			Your views on current performance of graduates in workplace
Low Medium High	Low	Medium	High	Low Medium High
The ability to undertake problem identification, apply problem solving , formulation and solutions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being able to identify from a mass of detail the core issue in any situation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The ability to use previous experience to figure out what is going on when a current situation takes an unexpected turn	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being able to readjust a plan of action in the light of what happens as it is implemented	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being able to see how apparently unconnected activities are linked and make up an overall picture	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being able to set and justify priorities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
An ability to recognize patterns in a complex situation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The ability to undertake problem identification, apply problem solving , formulation and solutions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
What other important attributes do you consider to be the most useful for new graduates?				
Other comments				

4. Specific skills and knowledge

Your views on importance for early career success in your organization	Graduate capability indicators			Your views on current performance of graduates in workplace		
Low Medium High	Low	Medium	High	Low	Medium	High
			Having a high level of current technical expertise relevant to current work requirements-having ability to use the techniques, and skills required by the workplace/ in-depth technical competence in her/his specific field of study			
			Understanding the role of risk management and mitigation in current professional work			
			Being able to use IT effectively to communicate & perform key work functions			
			Competency in theoretical and practical research			
			Communicates effectively as a professional/ the ability to present ideas with confidence through oral and written modes, not only with professionals but also with the community at large			
			An ability to help others learn in the workplace			
			Having a high level of current technical expertise relevant to current work requirements/having ability to use the techniques, and skills required by the workplace/ in-depth technical competence in their specific field of study			

What other skills and knowledge do you consider to be the most useful for new graduates? Other comments

Part III

Please outline the key trends and changes that are facing your company over the next 3 - 5 years and which universities should be addressing in order to keep their graduates/ curriculum/education relevant and up-to-date.

What, in your opinion, will be the most important attributes, abilities, skills and knowledge needed by graduates in a professional area/industry like yours over the next three to five years?

Thank you very much for completing the survey.

Appendix F. Interview questions with graduates working in the flower farms
(Chapter 4)

1. Background

- Name, age
- Address: mobile and e-mail address
- Field of study (horticulture/agricultural economics/plant sciences/others)
- Graduated from which University?
- Year of graduation?
- Name of your current organization/company/farm?
- Experiences (years) (including your work experiences in other companies/farms/ organizations you worked for)

2. What is your current position in the organization/company/farm?

2.1 What are your major duties and responsibilities in the company/farm/organization?

2.2 How long did you serve the company/farm/organization? Year(s) or less than One year?

3. Did you receive local training(s) since you joined the company/farm/organization/? Yes/ No. If yes, please mention the type or areas of training(s).

3.1 Places (locations) of the training(s)?

3.2 How long did each training take: days/weeks/months/ or year(s)?

3.3 Who did organize the training(s)?

4. Did you visit other companies/farms/ organizations in the country since you joined the company/farm/organization/? Yes/ No. If yes, what was the purpose of your visit?

4.1 Who organized the visit? The company/farm/organization or it was your own initiatives or other third party?

4.2 Which companies/farms/ organizations did you visit?

5. Did you travel abroad for visit or training since you joined the company/farm/organization? Yes/No? If yes, what were the areas of training or visit?

5.1 Please mention name(s) of the companies/institutions/farms/organizations you visited

5.2 Which country(s)?

5.3 How long did you stay there?

5.4 Who did organize/sponsor the visit/training?

6. Did you work for other company/farm/organization before you were employed by the current one? Yes/No? If yes, please indicate all the names of companies/farms/organizations you worked for (before you joined the present one)?

7. Please answer the following for each of the company/farm/organization you mentioned above (which you were working for before you joined the current one): 1st, 2nd, 3rd etc..

Company/farm/organization you worked for:

- What was your position in the company/farm/organization?
- What were your major duties and responsibilities in the company/farm/organization?
- How long did you serve the company/farm/organization? Year(s) or months.
- Did you receive local training(s) since you joined the company/farm/organization/?
- Yes/ No? If yes, please mention the type or areas of training(s), places (locations) and how long did each training take: days/weeks/months/ or year(s)?
- Who organized the training(s)? The company/farm/organization or it was your own initiatives or other third party?

Appendixes

- Did you visit other companies/farms/ organizations in the country while you were working for the company/farm/organization/? Yes/ No. If yes, what was the purpose of your visit
- Who organized the visit? The company/farm/organization or was it your own initiatives or other third party?
- Did you travel abroad for visit or training while you were working in the company/farm/organization? Yes/No? If yes, what were the areas of training or visit?
- Please mention name(s) of the companies/farms/ Organizations you visited? In which Country? And how long did you stay there? Days/months/years?

8. Other remarks

Appendix G. Graduate Survey

(Chapter 4)

Based on Wells, P., Gerbic, P., Kranenburg, I., Bygrave, J. (2009) and Hodges, D., Burchell, N. (2003).

The aim of the research is to analyze the role of university graduates in the process of capability development in Ethiopian Export horticulture sector. We would like to know your perceptions about importance of graduate capabilities (skills, understandings and personal attributes) and your views on to what extent each capability helped you to achieve success in your current employment. Your response will be used to report research results and you will not be identified in any way.

How to complete the survey

The survey consists mainly of a set of statements for you to rate. It also gives space for you to comment on your ratings and other issues, including important things we may have overlooked. For each item (capability indicator), please fill in the circle which best describes your rating of its importance to you and your current performance. Rank how important you think each graduate capability indicator is on the five point importance scale, and then rank your level of agreement on the five points current performance scale. At the end of each section of the survey there is room to indicate other important Graduate Capability Indicators and areas that most need improvement.

Part I

General information

1. Name of the company/organization/farm you are currently working for
2. Gender Male Female
3. Age
4. Field of study
5. University from which you graduated and department
6. Years of graduation?
7. Were you enrolled to study on campus or through distance education or summer program?
8. Is your current employment specifically linked to your degree? Yes / No, if yes how?
9. Is your job experience in areas related to your degree/field of study?

10. Your images of university from which you graduated? (Please mark on the circle which best describes your image):

To what extent does each of the following phrase/word describe your image of the university	Not at all	Somewhat	Quite well	Very well	Not sure
Work focused	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flexible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practical	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Theoretical	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Relevant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Additional ways in which you would describe the university:

Part II

This part seeks your views on importance of graduate capability indicators for your successful performance in work place. Then you are asked to rate the extent to which you believe you demonstrate these capabilities. It consists mainly of a set of statements for you to rate. It also gives space for you to comment on your ratings and other issues, including important things we may have overlooked. For each item (capability indicator), please mark in the circle which best describes your rating of its importance to you and your current performance.

5. Personal attributes

Your views on importance for your early career success in work place	Your views on your current performance in workplace		
	Low	Medium	High
Graduate capability indicators			
Being willing to face and learn from errors and listen openly to feedback	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Understanding personal strengths & limitations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being confident to take calculated risks and take on new assignments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being able to remain calm under pressure or when things go wrong	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wanting to produce as good a job as possible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being willing to take responsibility for assignments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A commitment to ethical practice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being flexible and adaptable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What other personal qualities do you consider to be the most useful for new graduates? Other comments

6. Interpersonal attributes

Your views on importance for your early career success in workplace	Your views on your current performance in workplace		
	Low	Medium	High
Graduate capability indicators			
The ability to work productively with people from a wide range of backgrounds / can work effectively in settings of social and cultural diversity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A willingness to listen to different points of view before coming to a decision	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being able to develop and use networks of colleagues to help solve key workplace problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The ability to function effectively as an individual and in a group	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being able to work with senior staff without being intimidated	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being able to give constructive feedback to work colleagues and others without engaging personal blame	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being able to motivate others to achieve great things	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being able to develop and contribute positively to team-based tasks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What other interpersonal attributes do you consider to be the most useful for new graduates?
Other comments

7. Other important attributes

Your views on importance for your early career success in workplace	Graduate capability indicators			Your views on your current performance in workplace						
Low <input type="radio"/>	Medium <input type="radio"/>	High <input type="radio"/>				Low <input type="radio"/>	Medium <input type="radio"/>	High <input type="radio"/>		
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	The ability to undertake problem identification, apply problem solving, formulation and solutions Being able to identify from a mass of detail the core issue in any situation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		The ability to use previous experience to figure out what is going on when a current situation takes an unexpected turn Being able to readjust a plan of action in the light of what happens as it is implemented	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			Being able to see how apparently unconnected activities are linked and make up an overall picture Being able to set and justify priorities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	An ability to recognize patterns in a complex situation	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		The ability to undertake problem identification, apply problem solving, formulation and solutions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What other intellectual attributes do you consider to be the most useful for new graduates?
Other comments

8. Specific skills and knowledge

Your views on importance for your early career success in workplace	Graduate capability indicators			Your views on your current performance in workplace		
Low	Medium	High	Low	Medium	High	
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Having a high level of current technical expertise relevant to current work requirements-having ability to use the techniques, and skills required by the workplace/ in-depth technical competence in her/his specific field of study	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Understanding the role of risk management and mitigation in current professional work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Being able to use IT effectively to communicate & perform key work functions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Competency in theoretical and practical research	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Communicates effectively as a professional/ the ability to present ideas with confidence through oral and written modes, not only with professionals but also with the community at large	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	An ability to help others learn in the workplace	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Having a high level of current technical expertise relevant to current work requirements/having ability to use the techniques, and skills required by the workplace/ in-depth technical competence in their specific field of study	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What other skills and knowledge do you consider to be the most useful for new graduates?
Other comments

Part III

Please outline the key trends and changes that are facing the company/farm you are working in over the next 3 - 5 years and which universities should be addressing in order to keep their graduates/ curriculum/education relevant and up-to-date.

What, in your opinion, will be the most important attributes, abilities, skills and knowledge needed by graduates in a professional area like yours over the next three to five years?

Thank very much for completing the survey.

Appendix H. Guiding questions for group discussion on use of common pool resources: water

(Chapter 5)

1. Village
2. In what way do you use the resource/water?
4. How would you describe the condition of the resource? What is the ecological state of the area? How “healthy” is the resource?
5. How do you gain knowledge about the state of the resource system (methods for measurements, systematic observations, or “just knowing” and own experiences)? Who provides this information? Do you have access to reliable information concerning the resource (quantities, health, etc.)?
6. Who has access to information regarding the state of the resource? Do all users have this information? How is the information distributed among users?
7. What conflicts are observed?
 - causes of conflict
 - dimensions, level, and intensity of conflict
 - the interventions

Summary

Ethiopia has become the second largest flower producer and exporter in Africa, next to Kenya. EU markets are the country's major export destinations, which are demanding in terms of product quality, sustainability of production, and corporate social responsibility. The Ethiopian Horticulture Producers Exporters Association (EHPEA) introduced a code of practice to facilitate compliance with international standards such as Global GAP. Exporters and flower farms, and public policy in Ethiopia supporting the code of practice try to find ways to involve (foreign) experts and university graduates, and to import hardware, such as equipment and crop varieties, in order to be able to perform in the global market. In a newly emerging sector, requirements in international markets and new forms of governance impact on the way problems are solved and production is managed in the greenhouses.

The research is motivated by the observation that floriculture in Ethiopia resembles a knowledge-intensive industry and is confronted with increasing demands in the international market to comply with standards for environmentally benign production and corporate social responsibility. Yet, the thesis is critical about the default mechanism to revert to training of individuals. It aims to develop a grounded understanding of how capabilities are formed or emerge in the daily practices and interactions of people and teams within firms operating in the context of less developed regions.

The thesis seeks to explore how the practices stipulated in the code of practice are enacted in the everyday realities of workers, technicians, and managers in the floriculture sector. The research investigates these practices by focusing on: (1) a complicated agronomic problem, namely pest and disease management (Chapter 2 and 3), (2) the functioning of university graduates employed by flower farms (Chapter 4), and (3) the relationship between flower farms and the surrounding community relations in the context of shared use of a common pool resource, namely water from the lake (Chapter 5).

To explore problem solving capabilities, the study builds on the scholarly work of practice based and socio-material approaches to agriculture, science and technology studies, organizational studies, and workplace learning. It primarily draws upon two methodological approaches: (1) technography and socio-materiality. These two approaches have an interesting synergy as both: (1) focus on situated action, (2) reject an exclusive focus on either social or material and take an integrative perspective on socio-material interactions, and (3) emphasize technology in use rather than design. Typically, both approaches take seriously the role of material environments by showing how problem solving is relational and distributed among

people, activities, standard procedures and biophysical environments. Further, they regard capabilities as situated; hence, know-how emerges in a particular practice. Through in-depth analysis of problem solving, the study examined how technicians, farm managers, and workers in a case study export flower farm in Ethiopia use standards and expert knowledge with the general objective of producing quality flowers for international markets. More specifically, the study sought to understand the inextricable relationships between plans, practice, and know-how.

The investigation of pest and disease management practices within the case study farm (Chapters 2 and 3) explores how people use a code of practice for good agricultural activities. Specifically, these chapters study how people use an integrated pest management (IPM), as preferred by the code. Chapter 2 examines technical details of pest and disease management problems and looks at the way teams coordinated actions, responded to the technical and managerial challenges, and took corrective measures. Chapter 3 explores how members of a team using IPM translated practices into codified information and work protocols and used these codified practices in solving practical problems. It demonstrates in what ways the process of codification involved skills, techniques, and knowledge of people performing various tasks, and illustrates how people abstract actual practices to codes by referring to elements in the material environments such as tools, growing plants, pests, predators and the prevailing weather data. Chapter 4 examines the extent to which graduates make use of knowledge and practices transferred to them during their formal university training and discusses the emergence of know-how in workplaces as blending of pre-defined attributes of individual graduates and skills developed during pest and disease management.

The scope of the investigation was extended to another part of the code of practice, i.e. the articles referring to corporate social responsibility (CSR), which defines guidelines on how commercial farms are supposed to deal with surrounding communities (Chapter 5). The research studied how a cluster of farms, including the case study farm, interacted with a select group of farmer / community representatives and public officials in finding ways to arrange access to and use of water as a common pool resource. The findings suggests that companies tend to opt for hardware, such as building a hospital, and technical solutions, such as constructing new water points, and are less skilful in including multiple interests and values expressed by community leaders in solutions outside its direct span of influence and.

The general discussion (Chapter 6) analyses problem solving capabilities as know-how beyond the pre-defined features such as codes and attributes of individual graduates and translates the main findings into implications for policy, practice, and education.

Samenvatting

Ethiopië is uitgegroeid tot de tweede bloemen producent en exporteur in Afrika, naast Kenia. Europese markten zijn de belangrijke exportbestemmingen. Deze markten stellen strikte eisen op het gebied van productkwaliteit, duurzaamheid van de productie, en maatschappelijk verantwoord ondernemen. Als antwoord heeft de Ethiopian Horticulture Producers Exporters Association (EHPEA) een gedragscode geïntroduceerd, bedoeld om de naleving van internationale normen zoals Global GAP te vergemakkelijken. Exporteurs en bloemenproducenten, en de Ethiopische overheid ondersteunen de gedragscode. Om aan de strikte eisen te voldoen en te kunnen presteren in de internationale markten, met nieuwe vormen van regelgeving, trekken bedrijven in de bloemensector (buitenlandse) experts en academici aan, en importeren zij hardware, zoals apparatuur en gewasvariëteiten. In een nieuw opkomende sector, zijn de eisen van en sturing in de internationale markten van invloed op de manier waarop problemen worden opgelost en productie wordt gemanaged in de kassen.

Het onderzoek is ingegeven door de constatering dat de bloemensector in Ethiopië een kennisintensieve industrie is die wordt geconfronteerd met toenemende eisen in de internationale markt om te voldoen aan de normen voor milieuvriendelijke productie en maatschappelijk verantwoord ondernemen. Echter, de thesis staat kritisch tegenover het standaard mechanisme om terug te vallen op training van individuen. De empirische studie verlegt de aandacht naar het ontstaan van probleemoplossende vermogens in de dagelijkse praktijken en interacties van mensen en teams in bedrijven in minder ontwikkelde regio's.

De thesis onderzoekt hoe de door de gedragscode voorgeschreven praktijken een vertaalslag krijgen in de dagelijkse realiteit van de werknemers, technici en managers in de sierteeltsector. Het onderzoekt deze praktijken door zich te richten op: (1) een ingewikkeld agronomische probleem, namelijk de bestrijding van plagen en ziekten (hoofdstuk 2 en 3), (2) het functioneren universitair afgestudeerden in dienst van bloemenbedrijven (hoofdstuk 4), en (3) de verhouding tussen bloemenbedrijven en de omringende gemeenschap in het organiseren van het gedeeld gebruik van een gemeenschappelijke hulpbron, namelijk water uit het meer (hoofdstuk 5).

Om probleemoplossend vermogen te doorgronden bouwt de studie voort op praktijk georiënteerde wetenschappelijke benaderingen die oog hebben voor zowel sociale als materiele dimensies. Het onderzoek combineert twee methodologische benaderingen: (1)

technography en socio-materiality. Deze twee benaderingen hebben een interessante synergie. Bij beiden ligt de nadruk op actie, en zij wijzen een exclusieve focus op ofwel het sociale of het materiele af en nemen een integrerend perspectief op sociaal-materiaal interacties. En, de benaderingen benadrukken technologie in gebruik in plaats van het ontwerp. Beide benaderingen hebben oog voor de rol van de materiële omstandigheden in menselijk handelen en zij laten zien het relationele en gedistribueerde karakter van het oplossen van problemen zien: onder de mensen, activiteiten, standaardprocedures en biofysische omgevingen. De beschrijving van probleemoplossend vermogens situeert kennis van zaken (knowhow) in de dagelijkse praktijk. De case studie van een op export gerichte productiebedrijf onderzoekt hoe technici, bedrijfsleiders en werknemers, standaarden en vakkennis gebruiken om rozen te produceren die voldoen aan de kwaliteitseisen in de internationale markten. De studie gaat in op de onlosmakelijke relatie tussen de plannen, praktijk, en knowhow.

Het onderzoek naar het beheersen van ziekten en in het case studie y bedrijf (hoofdstukken 2 en 3) laat zien hoe mensen gebruik maken van een gedragscode. In het bijzonder bestuderen deze hoofdstukken hoe mensen gebruik maken van geïntegreerde gewasbescherming (IPM), dat de voorkeur heeft van de code. Hoofdstuk 2 gaat in op de technische details van de bestrijding en management van ziekten en kijkt naar de manier waarop teams acties coördineren, hoe zij reageren op de technische en bestuurlijke uitdagingen, en hoe zij corrigerende maatregelen nemen. Hoofdstuk 3 onderzoekt hoe leden van een team werkend met IPM hun eigen praktijken vertalen in gecodificeerd informatie en werken met protocollen in het oplossen van praktische problemen. Het toont aan op welke manier het proces van codificatie geënt is op vaardigheden, technieken en kennis die mensen ontwikkelen tijdens het uitvoeren van diverse taken, en illustreert hoe mensen bij het abstraheren van concrete feitelijke in codes verwijzen naar elementen in de materiële omstandigheden, zoals gereedschappen, het kweken van planten, het gedrag van insecten en hun natuurlijke vijanden, en de weersomstandigheden. Hoofdstuk 4 gaat in op de mate waarin afgestudeerden gebruik maken van de kennis opgedaan tijdens hun formele universitaire opleiding en beschouwt het ontstaan van knowhow in de werkplaatsen als het resultaat van de vermenging van vooraf gedefinieerde kwalificaties van de individuele afgestudeerden en vaardigheden ontwikkeld tijdens de concrete praktijk van het beheersen van ziekten en plagen.

Het onderzoek verbreed zicht naar een ander deel van de gedragscode, namelijk de artikelen die gaan over maatschappelijk verantwoord ondernemen (MVO). Hierin staan richtlijnen over hoe commerciële landbouwbedrijven worden verondersteld om te gaan met

omliggende gemeenschappen. Het onderzoek (hoofdstuk 5) beschrijft hoe een cluster van bedrijven, inclusief het case studie bedrijf, samenwerkt met een selecte groep van vertegenwoordigers van boeren / gemeenschappen en met ambtenaren in het vinden van manieren om de toegang tot en het gebruik van water te regelen. De bevindingen suggereren dat bedrijven de neiging hebben om te kiezen voor investeren in hardware, zoals de bouw van een ziekenhuis, en technische oplossingen, zoals de aanleg van nieuwe waterpunten, en dat zij minder vaardig zijn in het opnemen van de verschillende belangen en waarden, zoals geuit door lokale leiders, in het ontwikkelen van oplossingen die buiten hun directe invloedssfeer liggen.

De algemene discussie (hoofdstuk 6) analyseert probleemoplossend vermogen als knowhow dat verder gaat vooraf gedefinieerde functies, zoals codes, en attributen van individuele afgestudeerden en vertaalt de belangrijkste bevindingen richting beleid, de praktijk en onderwijs.

About the author

Duguma Adugna Debele was born in Arsi, Ethiopia, on November 10, 1971. He obtained his bachelor degree in Plant Sciences (1992) and his master degree at Horticulture at Alemaya (Haromya) University (2003). He worked for the Oromia Bureau of Agriculture (1993 to 2002). From 2002-2004 he served as focal person for agriculture and horticulture in Oromia Integrated Development Project- UNDP. In 2005 he has been employed by Jimma University, College of Agriculture and Veterinary Medicine (JUCAVM) as lecturer in horticulture. From 2006-2008, he served as a Dean of JUCAVM. Since 2011, he has been a coordinator for Industry Oriented MSc Training Program in Horticulture ('On-location masters' training) at Jimma University, Ethiopia.



Completed Training and Supervision Plan

Name of the learning activity	Department/Institute	Year	ECTS*
A) Project related competences			
Workplace MSc thesis Research Supervision in the Horticultural Sciences	WUR	2012 2013	6
Supervisor of (4) MSc students, and co-supervisor of 5 MSc students	Jimma University	2013	2
Design and management of project Master on Location (at three locations in Ethiopia) and supported by Jimma University, the embassy of the Kingdom of The Netherlands in Addis Ababa, EHPEA, and EHDA	Jimma University	2012-2013	3
B) General research related competences			
Introduction course	WASS		
Technography, researching technology and development TAD- 30806	WUR	2009	6
Research Design and Research Methods YRM-20806	WUR	2009	6
Information Literacy, including, Introduction to Endnotes	WGS	2009	0.6
TAD Research Seminars (bi-weekly)	TAD group	2009	4
Research proposal writing	TAD group	2009	3
Total			30.6

*One credit according to ECTS is on average equivalent to 28 hours of study load

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