Managing Biomass Supply Chains: The Importance of Strategic Leadership

Leadership Strategies for Global Supply Chain Management in Emerging Markets

Muerza, V.; Urciuoli, L.; Annevelink, E.; Snels, J.C.M.A.; Dam, J.E.G.

https://doi.org/10.4018/978-1-7998-2867-9.ch001

Leadership Strategies for Global Supply Chain Management in Emerging Markets

Ashish Dwivedi
The University of Hull, UK

Mohammed Saad Alshamrani
King Fahd Naval College, Saudi Arabia

A volume in the Advances in Logistics, Operations, and Management Science (ALOMS) Book Series

IGI Global
PUBLISHER of TIMELY KNOWLEDGE

Chapter 1
Managing Biomass Supply Chains:
The Importance of Strategic Leadership

Victoria Muerza
University of Zaragoza, Spain

Luca Urciuoli
https://orcid.org/0000-0002-9417-9421
Department of Industrial Economics and Management, KTH Royal Institute of Technology, Stockholm, Sweden & MIT International Logistics Program, Zaragoza Logistics Center, Zaragoza, Spain

E. (Bert) Annevelink
Wageningen Food and Biobased Research, The Netherlands

J.C.M.A (Joost) Snels
Wageningen University & Research, The Netherlands

Jan E. G. van Dam
Wageningen Food and Biobased Research, The Netherlands

ABSTRACT

This chapter explores the feasibility and advantages of integrated biomass logistics centres (IBLCs). These are centres aiming to collect residues from farming activities and transform these into new intermediate bio-products. Operations in these IBLCs aim to achieve economies of scale through integration of resources and business lines, while creating technical and environmental advantages for firms and societies. The experience from one agro-industry case study in Spain (fodder production) highlights the importance of leadership roles to manage the newly created supply chains, through the identification of strategic objectives and the coordination of operational activities. Hence, the scope of this chapter is to review the concept of IBLCs under the lens of supply chain management leadership. Thereafter, it will discuss the potential to transfer the IBLC concept to emerging markets, with examples for African agricultural crops.

DOI: 10.4018/978-1-7998-2867-9.ch001

INTRODUCTION

The concern about the environment has boosted the trend towards the circular economy, based on a "recycling society". It has initiated a transformation in different industries and sectors, where residues are used as an input in new processes "closing the cycle" and taking advantage of the existing resources in terms of machinery and knowledge (Geissdoerfer, Savaget, Bocken, & Hultink, 2017). In this context, a new concept has been coined for the agroindustry within the AGROinLOG project: the Integrated Biomass Logistics Centre (IBLC) (Annevelink et al., 2017). IBLCs aim to increase the use of existing facilities of an agroindustry taking advantage of idle periods, allowing a diversification of the business activity.

The feasibility of IBLCs should be studied from a social, environmental and economic standpoint (Muerza, De la Cruz, & Urciuoli, 2019): social viability refers to the creation of employment derived from the diversification of the company's activity. Environmental viability is related to the emissions derived from the collection of the raw material (residues from agribusiness), until the transformation in the IBLC and the distribution in the markets of the new product compared to the reduction of emissions due to the substitution of fossil-based products by biobased products. Economic viability considers the calculation of logistics costs and processing costs, related to the configuration of the supply chain. This strategy is linked to several of the agribusiness leaders' seven top strategic priorities identified in a survey to 200 companies (SpencerStuart, 2015): (i) pursue joint ventures, alliances, acquisitions; (ii) expand presence in international markets; (iii) develop new products; (iv) develop cooperative relationships with farmers, suppliers and customers; (v) develop new sales channels; (vi) build upstream/downstream capabilities to increase vertical integration, and (vii) dramatically reduce costs. Furthermore, the World Council for Sustainable Development system has pointed out the need of deeper collaboration between diverse stakeholders across sectors and the "*use the circular bioeconomy to alleviate resource supply risks, shift from fossil-fuel and non-renewable resources to sustainable, renewable biomass, repurpose agricultural waste and recycle nutrients*" (Morrison, 2019).

Current research is exploring both feasibility and advantages of these IBLCs in three agro-industries in Europe: fodder (Spain), olive oil production (Greece) and cereal processing (Sweden) sectors. The experience from these three demos in Europe highlights the importance of leadership roles in order to manage optimally supply chains, through the identification of strategic objectives and the coordination of operational activities. In this sense, the configuration of the logistics chain must be optimized as it directly impacts on the economic viability of the IBLC (Muerza et al., 2019). The logistic solutions to adopt will depend on the type of final product based on a certain type of residue. The transformation processes will be different both in the IBLC and in terms of supply: raw material size, transport, use of intermediate warehouses, etc.

Leadership in Supply Chain Management (SCM) is of great importance as it affects the optimal integration of people and logistics systems, facing challenges in several stages of the supply chain, e.g. optimal coordination of material and flows in global and uncertain environments (Mentzer et al., 2001). The supply chain leader analyses market trends and selects appropriate information systems, making decisions and promoting innovation to support company growth.

The objective of this chapter is to analyze the concept of Integrated Biomass Logistics Centers under the lens of supply chain management leadership. Main drivers, opportunities and barriers are discussed. In addition, a case study in the fodder sector is presented. Furthermore, the chapter discusses the potential to transfer the IBLC concept from European to emerging markets, including main advantages and disadvantages. Emerging markets are, in principle, appropriate to test the possibilities for the IBLC concept from several perspectives: there is a large access to biomass in developing countries (Faaij & Domac, 2006); for example, Africa owns sustainable forestry products, non-food crops, and food crop residues, including agro-food industry residues, and marine biomass. Crops residues that can be used include sugar crops, carbohydrate crops, oil crops, and bamboo. In addition, production of bioenergy in these countries can benefit local communities and develop further agricultural and forestry sectors (Faaij & Domac, 2006).

The structure of this chapter is the following: it starts by describing the theoretical description of leadership in supply chain management; then it explains the IBLCs concept and the economic implications of integrated biomass centres. Next, by using a case from the feed and fodder sector, it suggests strategic and operational leadership considerations for the implementation of the IBLC concept. Then it describes the potential of biocommodities in emerging markets. Finally, it envisions the implementation of the IBLC concept in emerging markets and discusses leadership implications to manage IBLCs supply chains in emerging countries based on the experience in Europe.

LEADERSHIP IN SUPPLY CHAIN MANAGEMENT

A supply chain consists of a virtual network of organizations that collaborate in order to transform raw materials into finished products to be delivered to final consumers. The network involves value production in form of products and services, involving firms upstream, suppliers, and downstream, distributors (Mentzer et al., 2001). The management of supply chains is a concept that was first identified by Forrester using computer simulation. The model that was developed pointed out the importance to enhance the understanding of interrelationships between company's functions, between companies, markets and national economy. The concepts related to inter-firms relationships, supplier management, integration, partnership, coordination etc. have been transformed into supply chain management theories, applied to current challenges experienced in several stages of the supply chain, e.g. global sourcing, production, transport and distribution in uncertain environments (Mentzer et al., 2001). In essence, companies are stretching their supply chains distances between production and consumption, while coordinating flows of materials optimally. The goal is to manage to deliver the right products to customers in optimal conditions at the right place, in the right quantity and at the right time. Hence, the importance to coordinate flows in complex supply chain networks increases, emphasizing competition not anymore among single entities, but rather among various supply chains. Mentzer et al. (2001) suggest that supply chain management should determine coordination across functions, internally in companies, and externally, across companies. The former implies the understanding of trust commitment and risks, while the latter is about coordination of various third party suppliers, relationships and the feasibility of different supply chain structures (Mentzer et al., 2001).

Leadership is an important characteristic of leaders in order to optimally and effectively navigate teams of people in an uncertain environment. Schoemaker, Krupp, and Howland (2013) state that important traits of leaders include "*the abilities to anticipate, challenge, interpret, decide, align, and learn*". *Anticipate* concern the ability to detect or simply recognize threats or opportunities in advance and steer corporations accordingly. *Challenge* requires a careful analysis of the current status of things or problems and thereby take decisive actions. Leaders could develop solutions to problems in an isolated manner leading to predictable and rarely innovative changes. It is important to discover root causes of problems and dare to embrace basic industry assumptions. *Interpret* is the ability to elaborate complex and conflicting information. Hence, gathering the available information, recognize patterns, remove ambiguity and seek new insights is essential to clean the information and uncover implicit or hidden problems or implications. *Decide*, at some point leaders will have to make decisions and implement them, sometimes with incomplete information and high level of uncertainty. *Align* is the ability to find common ground in different ideas and achieving buy-in from stakeholders with different agendas. *Learn* from failures in a constructive manner and promote a culture to identify lessons learned both from success and failures (Schoemaker et al., 2013).

A sound and effective management leadership is necessary to translate the corporate vision of SCM into strategic plans, short, medium and long-term decision making, processes and operations (Ou, Liu, Hung, & Yen, 2010). A leadership structure is typically determined in a supply chain, defining power, or simply coordination, especially in the downstream market channels (Ellram & Cooper, 1990; Stock &

Lambert, 2001). Leadership is sometimes associated with the size, economic power or the initiation of the inter-firm relationships. When applying the leadership strategic ability to the management of supply chains, it is possible to frame the six abilities defined by Schoemaker et al. (2013): anticipate, challenge, interpret, decide, align and learn (Table 1).

THE IBLC CONCEPT

Introduction

Many European agro-industries are characterized by the fact that capital goods and facilities in these industries cannot be used year-round due to the seasonal availability of the primary feedstocks. The EU project SUCELLOG formed the starting point for the idea to use available agro-industrial capacities as a resource for the processing of biomass for renewable energy (Sucellog, 2017). In AGROinLOG, the project that followed, this idea was defined as Integrated Biomass Logistics Centre (IBLC) concept (Annevelink et al., 2017). The goal of an IBLC is to establish an increased utilization of the facilities of an agro-industry. Alternative non-food feedstocks (e.g. crop residues or non-food crops) could fill the idle periods of, for example, the pre-treatment equipment (e.g. compact, dry, etc.) or of the storage capacity at the facility. Hence, in this situation the underutilization of processing and storage capacity in the middle of the value chain is the main driver for the potential development of an IBLC. However, the drivers of an IBLC could also be considered from two other perspectives, being (i) upstream in the beginning of the value chain: the residues that are not being utilized at the moment and (ii) downstream at the end of the value chain: new biobased products that need clearly defined feedstocks or biocommodities of a specific quality.

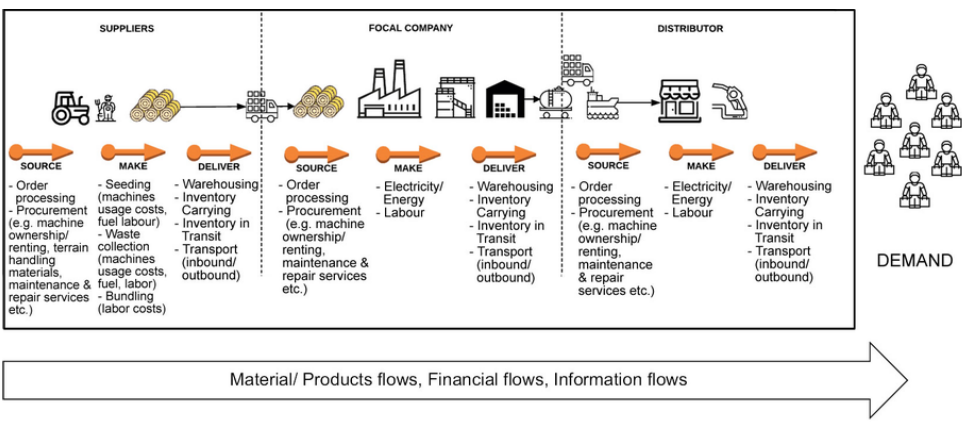
Table 1. Leadership strategic ability to manage supply chains (Schoemaker et al., 2013)

Anticipate	Challenge
• Establish a closer relationship with both customers and suppliers. Arm's length relationships may not work since 1) suppliers may be reluctant to share internal challenges or likewise 2) buyers/customers could not have resources and managerial setups to engage into better understanding of challenges. Therefore, collaboration/cooperation are to be preferred. • Use market research and simulations to determine competitors' position on the market and detect potential disruptive offerings that could ultimately affect sales. In this aspect, scenario-planning tools could be of great help. • Perform benchmarking of competitors that have been fast growing. • Analyse reasons for customers leaving for competitors. Determine whether changes in the distribution and delivery channels can improve sales and regain loyalty. • Attend conferences and events to determine on-going trends and internalize in upcoming supply chain strategies.	• Focus on root causes of problems in supply chains, e.g. using the five whys of Sakichi. • Discover the long-standing assumptions of a business and its supply chain and question whether they should still hold true. • Encourage open dialogue in meetings, not being afraid of conflicts and welcoming criticism. • Include in meetings people with opposite views, in order to identify and address challenges.
Interpret	**Decide**
• Collect and analyse data to deduct possible explanations for patterns observed. • Search for any missing information, to reject / confirm any hypotheses formulated. • Force and strive to develop the big picture, rather than look at details.	• Frame, weighs and evaluate the options at disposal. • Big decisions related to the whole supply chain, could be broken down into pieces, in order to understand sub-decisions and their implications on the supply chain system. • Diversify short, medium and long-term decisions.
Align (both internally, but also externally with other supply chain companies)	**Learn**
• Improve communication in order to avoid uncertainty and lack of knowledge. • Enhance understanding about on-going coalitions and hidden agendas growing. • Engage in conversations to reduce misunderstanding or resistance to change. Especially reach to resistors to understand their concerns and address them accordingly. • Monitor stakeholders internally and externally during the rollout of any supply chain initiative/ strategy. • Recognize and reward high performing colleagues / supply chain partners.	• Encourage gathering of documentation to review and report lessons learned after major decisions or achieved milestones. Eventually supply chain risk management tools could be exploited. • Examine root causes of failures. Eventually supply chain risk management tools could be exploited. • Establish reward to managers engaging in difficult tasks and failing. In this aspect, the organization should create a culture accepting failures and viewing those as a growing opportunity form lessons learned.

Economic Considerations for an Integrated Biomass System

Previous research has highlighted the importance of integrated biomass systems and their economic significance (Ebadian, Sowlati, Sokhansanj, Stumborg, & Townley-Smith, 2011; Mahmoudi, Sowlati, & Sokhansanj, 2009; Sokhansanj, Kumar, Turhollow, & Bioenergy, 2006). Recent research has emphasized the importance to map processes, activities, and machines in a supply chain and thereby compute and costs-revenues. Urciuoli and Muerza (2018) advance a framework for evaluating costs of IBLCs' supply chains. For each of the actors (i.e. suppliers, focal company (IBLC), distributors), based on the SCOR approach developed by the Supply Chain Council (SCC, 1999), the following activities are distinguished: Source, Make and Deliver. Thereafter, main costs involved in the different parts of the framework are elaborated. Figure 1 shows a summary of the identified costs. The cost to deliver herbaceous biomass varies by feedstock type, location and technologies used for packaging the biomass (An & Searcy, 2012).

Figure 1. Framework for integrated modelling in the agro-food waste and recycle business
Source: Urciuoli & Muerza, 2018



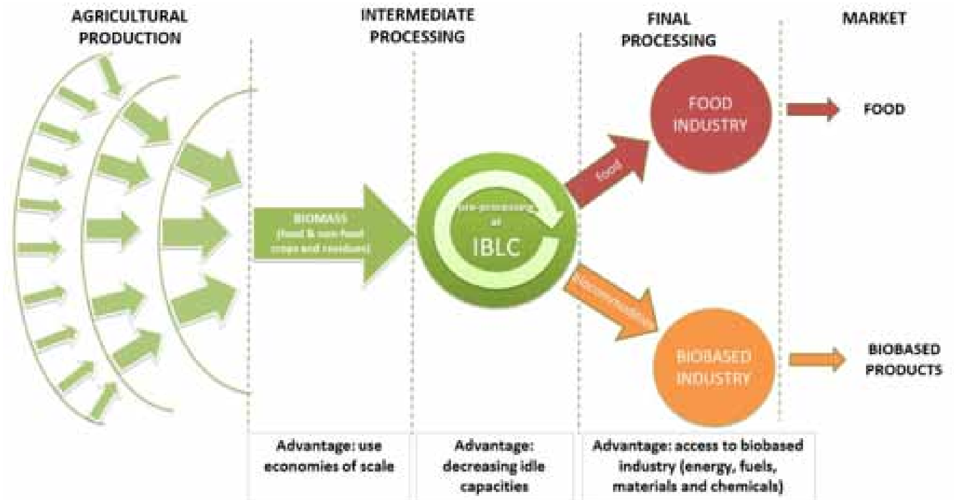
Given the level of uncertainty within biomass supply chains, many authors have been developing simulation tools or mathematical models to evaluate the performance of biomass supply operations (Ho, Hashim, & Lim, 2014; How, Tan, & Lam, 2016; Mitchell et al., 1995). An Integrated Biomass Supply Analysis and Logistics (IBSAL) model was developed that has been applied for different types of feedstocks, e.g. corn grains, wood, wheat etc. (An & Searcy, 2012; Mahmoudi et al., 2009; Sokhansanj et al., 2006). Ebadian et al. (2011) propose a logistics model and its application to supply a mixture of agricultural feedstocks to a cellulosic ethanol plant. Mitchell et al. (1995) develop a spreadsheet-based decision support system to evaluate integrated biomass systems, focusing on the transformation of biomass into to ethanol schemes. Ho et al. (2014) use mixed integer linear programming (MILP) to compute the cost-effectiveness of an integrated biomass and solar town, where palm kernel, palm oil, food waste, solar radiation and empty fruit bunches are transformed into energy.

These models emphasize the importance of balancing costs and performance / efficiency. An and Searcy (2012) suggest the biomass logistics cost to range between 19.65 \$ Mg^{-1} and 41.26 \$ Mg^{-1} with varying yield levels and transport distances. provide cost components of the logistic system in the Prince Albert region in Canada according to the following logistics operations: square baling, in-field transporting, on-field storage, loading into truck, road transporting, loading into grinder/stacking into at-plant storage, at-plant storage, grinding. How et al. (2016) present a mathematical model to solve the multi-echelon biomass supply chain synthesis problem. The economic performance of the supply chain is based on three components, i.e. annual gross profit, annualized hub investment cost, and annual transportation cost. Mitchell et al. (1995) evaluate the costs of the different technologies to convert raw materials into biomass. Economies of scale are measured as an output on electricity costs when capacity changes (measured in MWe), plantation area (hectares), and cost of delivered fuel (Mitchell et al., 1995). Efficiency is measured as the conversion factor of different technologies, pyrolysis, gas engine, Integrated Gasification Combined Cycle (IGCC) and combustion. Among those IGCC shows the highest overall efficiency of 37.9% (Mitchell et al., 1995). Sokhansanj et al. (2006) measure efficiency in terms of time during which work is done over total time spent in the field.

Integrated Biomass Logistics Centre (IBLC) Concept

An Integrated Biomass Logistics Centre (IBLC) is defined as a business strategy for agro-industries to take advantage of unexploited synergies in terms of facilities, equipment and staff capacities. The strategy aims to diversify regular activity both on the input (food, feed and biomass feedstock) and output side (food, feed, biocommodities & intermediate biobased feedstocks); thereby, enhancing the strength of agro-industries and increasing the added value delivered by those companies. The IBLC concept can be further specified into four separate elements:

Figure 2. Schematic position of an IBLC in value chain



- **Integrated:** Refers to the integration of value adding activities towards food, feed and biobased markets;
- **Biomass:** Refers to biomass that is available in the surrounding region of the agro-industry, that is underutilized or unexploited currently and that has the potential as resource with an added value;
- **Logistics:** Refers to the role of an agro-industry using its available logistics, storage operations and pre-treatment facilities to (i) collect and transport biomass residues, (ii) to pre-treat and transform these residues into food, feed, biocommodities & intermediate biobased products, (iii) to store them and finally (iv) to distribute the biocommodities and intermediate products to industrial processing sites elsewhere;
- **Centre:** Refers to exploiting the central position of the agro-industry in a specific region.

The schematic position of an IBLC within the value chain is presented in Figure 2. Important parts of the value chain are (i) the agricultural production with the suppliers of biomass feedstocks for food and non-food, (ii) intermediate food & biomass pre-treatment / pre-processing industry (IBLC), (iii) final processing by the food and bio-based industry and finally (iv) the markets for food and bio-based products. The advantages of having an integral view on both food and bio-based (non-food) value chains are:

- **Economies of Scale:** Because more biomass feedstocks need to be transported and processed;
- **Decrease idle Capacities:** Because the facilities at an IBLC can be fully used for processing multiple biomass feedstocks for either food, feed or bio-based products;
- **Access to Bio-Based Industry:** Because the IBLC produces not only food or feed but also bio-commodities that can be processed into bioenergy, biofuels, bio-based materials and bio-chemicals for industries further on in the value chain.

The four aspects of an Integrated Biomass Logistics Centre will be further explained below:

An integrated value approach towards food and biobased markets means that both market segments are addressed at the same time by the IBLC. The existing system for supplying food products is combined with supplying bio-based (intermediate) products such as bioenergy (electricity and heat), biofuels, biomaterials and bio-chemicals to new markets. Of course, the availability of profitable new markets for these biobased products is essential for the success of the IBLC concept. A potential biobased market should be analyzed regarding several aspects like size, value, developments, expectations/prognosis, radius for supply, etc. Furthermore, a distinction must be made between three-market types viz. the final consumer market (direct purchasing of final products by households), the business-to-business market (purchasing of intermediate products and bio-commodities by industry) and the public market (direct purchasing by governments). Predominantly the IBLC concept is directed at the business-to-business market. However, the other two markets can also be served if a specific opportunity arises e.g. the case of selling biomass pellets directly from the IBLC to households or municipalities for heating in biomass stoves or boilers.

Regional Availability of Biomass: Nearby locations of agricultural production sites offer easier access to biomass resources (mainly residues) for an IBLC due to the short transportation distances. The technical ability to harvest biomass residues with minimal added costs and without influencing the quality of the primary crop is very important to increase the availability of biomass.

The seasonality of harvesting agricultural crops restricts the availability of biomass residues to a specific period. The time of the season determines the actual ability to harvest a crop residue (e.g. harvesting of maize stalks in November is not always possible because of wet soil).

Easy-to-access biomass residues from the agro-industry's own food or feed production process that do not have a market, could also be an important source for producing biocommodities and intermediate biobased feedstocks. Furthermore, residues from other agro-industries could also be a source of biomass and should be explored when setting up an IBLC.

Logistics, Storage Operations and Pre-Treatment: The availability of existing transport facilities for the collection of biomass residues from the surrounding fields, and the connection with an existing logistic chain are factors that form a stimulating incentive for developing an IBLC. The logistics from harvesting, handling and collection of biomass residues, as well as the transport to the IBLC influence the quality of the end-product and vice versa. In some cases, new transport facilities will be needed to guarantee enough supply of a specified quality. After all, the quality of the end-product will be determined by the type, composition and quality of the biomass that is available, and that will enter the processing stage at the IBLC. The quality and composition specifications of the IBLC's end-product will have to fit with the required technical specs for the processes of the user of the IBLC end-product (e.g. the quality requirements and specifications of agro-pellets for specific biomass stoves or boilers).

Quality requirements of the end-product and microbiological / physiological characteristics of the biomass also affect the storability of biomass residues. Storage facilities for the collected biomass will have to comply with safeguarding enough biomass quality to meet the end-product requirements. Quality and food-safety requirements (originating from the side of the food production) may place limitations to the combination of food and non-food production in the same agro-processing facility.

The input specifications and handling characteristics of collected biomass are the linking pin with available processing capacities in the IBLC. As mentioned, the availability of idle pre-treatment capacity in a certain period is one of the drivers for the IBLC. Therefore, it is important to know the length of the idle period of the facilities, the capacity of these facilities and the way available pre-treatment and storage capacity can be optimally used for biomass processing. In addition, it is very important to assess the technical feasibility of the available capacity, to determine if the capacity is appropriate for processing biomass residues. Furthermore, the available capacity needs to be matched with the volume and timing of the biomass residue availability.

An IBLC can **exploit the benefits of the central geographical position** of the agro-industry in relation to the existing regional biomass sourcing area. The central position of the IBLC reduces the transportation distances and costs in the value chain both from the agricultural production areas to the IBLC and from the IBLC to the industrial processing locations. But also the location of the IBLC relative to the location of the industrial processing facilities that will take product from the IBLC and will supply the market (local, regional, global) with the end-product is something to consider in the design of operations and logistics within an IBLC

(Lamers et al., 2015). The availability of a regional market with enough demand is an advantage for both the IBLC and the industrial processing companies that are in the centre of such a market. However, when the regional biomass is transformed to biocommodities at the IBLC even the national and global markets come within reach.

Main Drivers for Implementing the IBLC Concept

Biomass is an appealing source of energy in the current climate and energy context. Biomass residues will also form an important feedstock in the future to produce biobased products other than solid biofuels. For existing agro-industries there are three important drivers to develop an IBLC:

- Diversification of inputs;
- Optimization of available and new capacity;
- Diversification of outputs.

An existing company could expand its operational activities for value creation in various ways:

- By using extra feedstock types (not only food or feed but also non-food biomass residues) on the input side,
- By optimizing its existing processing capacity that already has fixed (capital) costs or by expanding its processing capacity with extra (pre-treatment) capacity with low additional investment costs,
- By obtaining extra revenues from delivering new output types (e.g. not only food or feed but also biocommodities for the biobased economy).

Opportunities and Barriers for the IBLC Concept

An IBLC can play an important role as a unit for increasing economic, environmental and social sustainability of agricultural production and processing in the region. In addition, the IBLC concept is affected by the governance of the agricultural sector (incl. laws and regulations) as well as by specific policies regarding biomass, waste and valorisation of residues from agriculture into new products. In Table 2, the main opportunities and perceived barriers are listed, categorized by the impact categories (economic, environmental, social, governance and technical).

Table 2. The main opportunities and perceived barriers for the IBLC concept

	Opportunities	Barriers
Economic	● Diversification in feedstocks and end-products: use cheap biomass residues as a resource for bioenergy and biobased intermediate products. ● Fixed costs reduction through optimal use of existing agro-industrial facilities (increased return on investment of invested capital). ● Diversification of product portfolio to biobased markets.	● Some feedstocks might be too expensive at the gate of the IBLC (including logistical costs) ● Lack of experience and knowledge regarding the market potential of bioenergy / biobased products. ● Low pricing of fossil product counterparts (oil and gas). ● Lack of appropriate technologies for biomass transformation on the market;
Environmental	● GHG reduction (through reduction of the consumption of fossil fuels). ● Supply of renewable energy (bio-energy).	● Impact on nutrient cycle. ● Impact on soil depletion;
Social	● More employment through increased business activity. ● Strengthens the role and function of the agricultural sector and rural areas in the bio-economy.	● Social acceptance / perception of product quality. ● Reluctance to change the business as usual in agriculture sector.
Governance, laws & regulations	● Positive contribution to the EU / national goals with reference to the use of biomass for energy and for biobased production. ● Current promotion of circular economy needs to be translated into new regulations (in short-term).	● Uncertainty / different interpretation of national legislations what biomass can be used and if it is waste or not. ● Limited availability of and access to funding resources. ● Unfavourable taxation regimes for raw material, product and fuel.
Technical	● IBLC concepts are suitable to energy integration and hence, energy efficiency optimization within existing facilities. ● The equipment is already well known (e.g. dryers, pelletizers, storage facilities, etc.).	● Lack of knowledge on processing (new) types of feedstock (incl. how to deal with variable quality of raw material). ● Increased wear and tear of equipment; ● Extra cleaning needed between processing of food and non-food feedstocks. ● Difficult to meet biomass end-product compatibility / quality requirements.

STRATEGIC AND OPERATIONAL LEADERSHIP CONSIDERATIONS FOR AN IBLC IN THE FODDER SECTOR

The IBLC concept is being applied in a European research project, specifically in three demos in different sectors, feed and fodder in Spain, cereals in Sweden, and olives in Greece (AGROINLOG, 2020). This section presents strategic and operational leadership considerations using data and observations collected in the Spanish demo related to the feed and fodder sector. Focus is on an agroindustry located in Spain whose main activity is the production of dehydrated alfalfa, in the form of bales or pellets (compact granule), intended for direct animal feed or as a raw material for the manufacture of compound feed. Animal feed industries final products are homogeneous mixes of several raw materials (grains, cereals, vegetable and animal by-products) and components (oil and fats, molasses, vitamins and minerals) from which a balanced and nutritious food is achieved, providing a better conversion performance in the animal feeding. Fodder industries process herbaceous matter for better preservation of the nutritious elements contained on it through three different industrial processes: silage, haymaking and dehydration.

The objective is to become and IBLC by optimally designing a new business line taking advantage of the idle period of the equipment in the plant taking place from December to March. During this time, new pellets for two different purposes will be produced: energy use and bio-composite materials. Furthermore, two additional markets will be tackled with these new products: bioenergy and bio-composites. The raw material used to produce the pellets will be cereal straw, maize stalks and Sudan grass to be purchased from the farmers located in the surrounding area. In order to upgrade the quality of the pellet when the goal is to satisfy the energy demands, wood chips will be also acquired.

Leadership strategic ability to design and manage the new supply chain can be discussed in view of the six abilities defined by Schoemaker et al. (2013) as shown in Table 3.

Figure 3. Some logistics solutions to be chosen in the design of the supply chain of an IBLC based on cereal straw

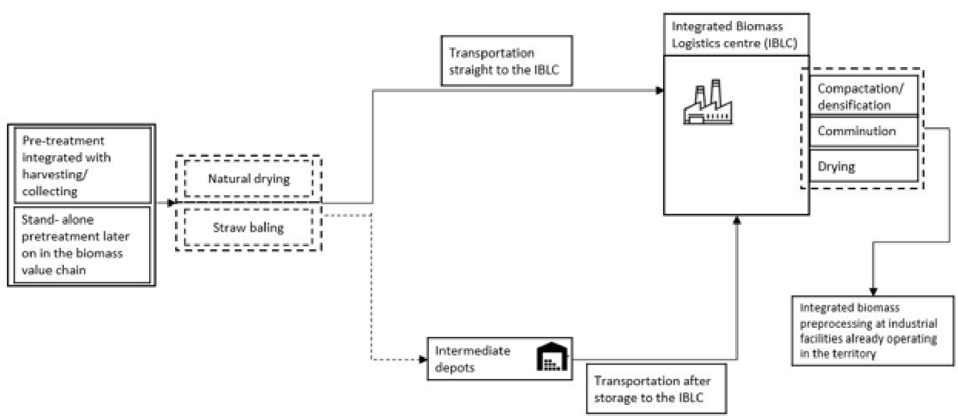
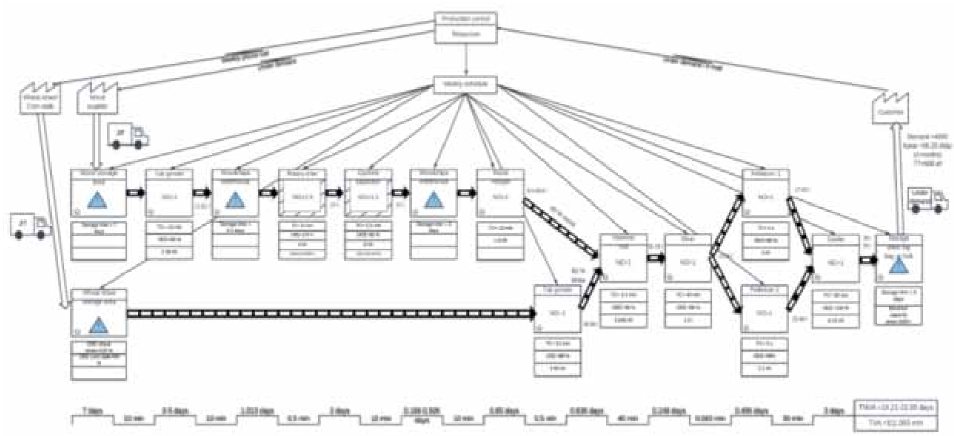


Table 3. Leader strategic abilities for the IBLC in the fodder sector

Anticipate	Challenge
• *Supply chain design.* The configuration of the new business line includes the design of the supply chain. Different logistics solutions and configuration of the supply chain can be adopted depending on the type of final product to be produced from the residue. The transformation processes will be different both in the IBLC and at supply level, e.g. raw material size, transportation mode, use of intermediate warehouses, residues collection technology (see a generic configuration in Figure 3) and directly impact on the feasibility of the IBLC. • *Management of material.* Straw (residue material) storage may be temporarily depending on the sources and period of supply, in the medium-long term in the IBLC itself, in a distribution warehouse, or at the retailer's premises. • *Adapt transport modes*. The mode of transport will depend on the shape of the residue, the quality of the raw material and the distance of transport. Eventually identify existing flows to integrate. • *Relationship management.* A closer relationship with both customers and suppliers must be established. In this sense, the strategy of the company consists of ensuring the supply of small farmers around the company for the main product (alfalfa); acquiring also the straw, they provide (around 20%) to gain loyalty. Agreements with medium and big suppliers are being studied. • *Adapt production lines.* The company has analysed the existing equipment to identify idle time and to include new lines in the production process. In addition, they have studied the possibility to adapt the machinery, and the need for buying new equipment. Feed industries own compatible equipment with the processing of biomass such as pelletizers, silos for storage, screening and chipping machinery, besides of a high degree of staff professionalization and many other valuable assets useful for the biomass processing activities (workforce, means of transport, etc.). Similar to the feed industries, fodder dehydrator industries own pelletizers, silos for storage, screening and chipping machinery compatible with the biomass handling. Besides, the fodder dehydration process requires horizontal rotary dryers to reduce the water content of the fodder, completely suitable for biomass drying in an IBLC. • *Adapt production to electricity tariffs.* An analysis of electricity tariffs from January to December has been carried out. Six electricity tariffs (€/kWhe) have been identified as a function of the month and the hour of the day at which the electricity is consumed. The cheapest tariff is applied from 00:00 to 8:00 a.m. during the whole year. The operation of the new line in the IBLC will consider the operation during the cheapest period time from December to March. • *Identify competitors.* A market analysis before the investment and implementation of a new activity in the IBLC is needed. Main competitors for the new activity are fossil fuel sources, higher quality standard biomass pellets, and similar agro-residues materials. The company has attended to meetings with companies of the sector to explore the possibility to create synergies. • *Assess social impacts.* Surveys are going to be launched to study the social impact of the IBLC in the area. Understanding social impacts can help firms in collaborating with local governments and thereby benefit subsidizes or facilitated procedures. • *Establish relationship with R&D centres.* Technological and research centres in the area are supporting the analysis process in terms of both logistics, design of the installation, and tests and design of the new product, before the launching in the market.	• *Suppliers selection.* Define a strategy of selection of suppliers for the current activity (bales and pellets for the feed industry), mainly based on price and loyalty of small suppliers, and the new activity (pellets for energy market). The strategy should include all stakeholders' standpoint. • *Simulations* to determine quantities of raw (residues) material, and distance-price ratios. Current suppliers are located in a distance of approximately 100 km from the IBLC. • *The equipment* that determine the production timing of the main activity are the dryer and the mill-pelletizer. The challenge is to optimize its use taking into consideration the hours with the cheapest electricity tariffs. Both equipment is needed in the new activity. • *Weather conditions* determine the load of the dryer. Moisture content determine collection and processing. Material can be stocked a maximum of 36 hours (when not baled) due to affections in the quality. Amount to be stored in this format in the IBLC is determined by the space and capacity (around 400 t).
Interpret	**Decide**
• Tests regarding the *size* and *quality* of the new product (in terms of energy) need to be performed. • *Planning tools* are being used. For instance, Value Stream Mapping (VSM) allows an analysis of the material and information flows to optimize the processes (Rother, 1999). Material moved from phase to phase, intermediate inventories, and customer demand are represented. Added value and non-value-added times are calculated. The tool allows the identification of "waste" in the process in terms of material, information and time loses. The interpretation of the VSM is needed to define actuation plans and optimization of resources, stablishing priorities in the activities of continuous improvement and for the integration of the new production line in the company. Figure 4 shows the Value Stream Mapping carried out for the implementation of the new production line considering a pellet with a mix of 60% straw and 40% wood. The non-value-added time is mainly due to the storage times of the material in intermediate points of the manufacturing process.	• The production process is highly influenced by *customer demand*. Decide about the possibility to develop a tool to foresight demand to optimize the integration of the new line. • Value Stream Mapping definition has considered production during the cheapest electricity tariffs. Specifically, from December to February a production of 8 hours/ day, and in March 14 h/ day, and a medium production of 9.5 h/ day (for the 4 months). • Decide about the possibility to operate the new line from October to November as the dryer generally works at 40% of the maximum capacity due to the lower alfalfa yield. • Decide on the quality of pellet for the energy market to be manufactured. Quality is mainly related to the type of biomass used, and the procurement and pre-treatment activities. • *Set the price* for the new product.
Align (both internally, but also externally with other supply chain companies)	**Learn**
• *Set contracts* with suppliers to ensure the supply of the material in the quantity needed. • *Align the actors* of the supply chain: suppliers, IBLC and distributor (Urciuoli & Muerza, 2018). • *Align the strategy of distribution* with the customer demand minimizing transportation costs and environmental emissions. • *Align customer demand and sales channels.* Different strategies may be needed according to the customer typology. • *Develop a good customer service*, including training activities regarding the best use of the product during the first weeks of operation. • *Develop demonstration activities* with potential customers to prove the good operation of a boiler with the pellet developed.	• *Establish reports of* the production activity. • *Encourage feedback* from all stakeholders in the process: design and research, simulation, manufacturing, launching to the market and after sales. • *Examine root causes of failures*, both in the conception of the product (blends and qualities) and the process. • *Learn from key partners in dissemination activities*. Involve agricultural associations, journals in the sector, stakeholders and Administration.

Figure 4. Value stream mapping for the new activity of the companyThe potential of biocommodities in emerging markets



THE POTENTIAL OF BIOCOMMODITIES IN EMERGING MARKETS

One of the few options to combat climate change is to avoid carbon emissions by petrochemical fossil resources and the use of carbon neutral biobased, renewable and circular materials. The resources that potentially can be made available to supply the biobased economy comprise sustainable forestry products, non-food crops, and food crop residues, including agro-food industry residues, besides marine biomass.

Many well-known commodity crops originate from Africa. The indigenous crops that were domesticated in Africa are often drought-resistant crops originating in the savannahs, such as sorghum and (pearl) millet, yams, African rice, baobab, and tamarind. Other crops originating from the forest margins are for example oil palm, cowpea, hyacinth bean, and Bambara groundnut. Kola nut, coffee and malaguete are African forest derived crops. Other crops have been introduced from Eur-Asia or the Americas (Maize, Cassava) in the African agricultural production system.

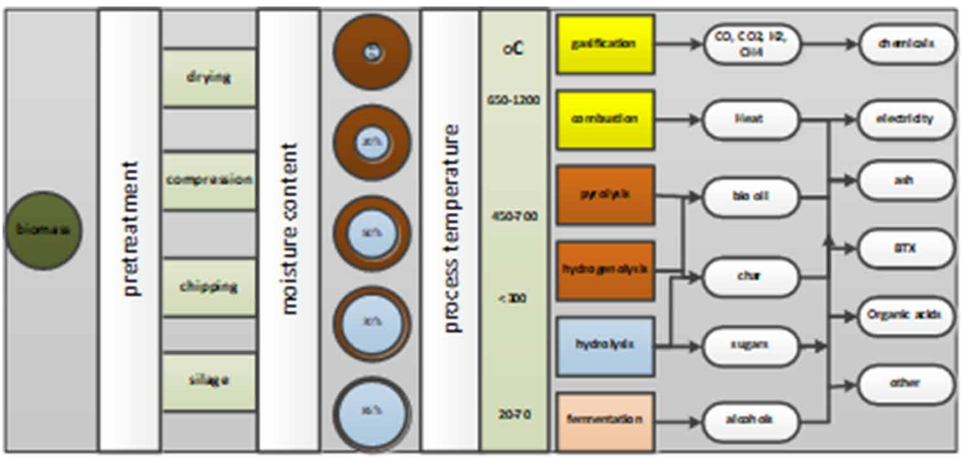
Bio-Commodities in Africa

The global production volumes and land demands of the major bio-commodity crops are available at the Food and Agriculture Organization of the United Nations (FAO, 2017). The most important nutritious crops that are produced to feed the human population are rich in carbohydrates (sugar, starch) or high yielding oil seeds.

Africa has a significant share in the world sorghum, millet and cassava production. In soybean production, Africa (0.8%) is insignificant on global scale, other Leguminosae such as groundnuts, dry beans, vetches, and Bambara prevail.

From most food crops the foliage and lignocellulose residues are left in the field after harvest, but may find economic value as renewable energy source when collected and properly processed (Jingura & Matengaifa, 2008). Part of the residual biomass is left in the field to compost and considered necessary for maintaining soil carbon and soil fertility. Other part is used as animal fodder. Biomass conversion can be performed by various biorefinery technologies depending on the composition (moisture, energy content) and available supply of biomass volumes for economic plant operation (Figure 5).

Figure 5. Suitability of biomass for biorefinery processing related to the dry-matter content



Abundant biomass resources of a wide range of forms (agricultural, municipal and industrial waste, wastewater) can be used in digesters to produce biogas (CH_4). Selection of the optimal biomass feedstock for efficient anaerobic conversion by the various technologies (e.g. floating drum, plug flow, fixed dome, batch and semi-batch) is important for the economics of the process. The variability of feedstock supply can be better controlled when pre-processing and storage capacities can be installed (e.g. IBLC).

Crop Residues Utilization

In the production of food crops significant amounts of biomass residues are produced (Table 4) and left in the field after harvest (primary residues) or liberated at the mill (secondary residues). The degree of utilization differs per crop and per region.

Table 4. Some types of common primary and secondary crop residues

Crops	Example	Primary residues/ by-products	Secondary residues/ by-products
Sugar cane	--	Leaves and tops	Bagasse, molasses filter cake, vinasse
Sugar beet	--	Leaves and tops	Pulp, molasse
Grains	Wheat, corn, rice, barley, millet	Straw (stover), chaff (hulls, husks)	Bran, cobs
Tubers and roots	Potato, cassava, yams	Foliage, tops	Peels, pulp
Oil seeds	Sunflower	Hulls, flower heads	Press cake
	Olive	Wood, pruning	Stones, pomace
	Cocos	Husks, fronts	Shells
	Oil palm	Fronts, stems	EFB, fibre, shells, POME
	Soy, rape, peanut	Foliage	seed coat, shells
Vegetables	--	Leaves, stems, roots	Peelings, skin
Fruits and nuts	--	Seeds, stems, shells	Fruit pulp, peelings
Fibres	Cotton, flax, hemp, sisal	Seeds, stems	Shives, hurts, tow

Sugar Crops

The potential of Africa sugar production is not fully developed due to global protectionism. Sugar beet is found only in North Africa (Egypt/ Morocco). Sugar cane is found widely distributed over Africa, but highest production is found in East Africa. Despite the competitive production of sugar cane (e.g. South Africa, Zambia, Swaziland, Malawi) just 5% of the world sugar cane production is produced in Africa. The African yields stay behind the global average of productivity. The utilization of bagasse, the biomass residue of sugar cane processing, has received much attention as it accumulates at the sugar mills and its use has been demonstrated to produce energy pellets, pyrolysis oil, 2^{nd} generation bioethanol (Leal et al., 2013), and composites (particle boards, fibre boards, fibre cement, etc.) (Verma, Gope, Maheshwari, & Sharma, 2012).

Carbohydrate Crops

Carbohydrate crops in Africa show large regional differences. Wheat production in Africa is only 4.8% of the global production area, with average yields of 75% of the global productivity. Most is produced in the Northern countries (Egypt, Ethiopia, Tunisia, Algeria and Morocco). Rice and millet are mostly produced in West Africa. In some special grains, crops are grown that are only known in Africa such as teff (Eragrostis abyssinica) and fonio (Digitaria exilis). Maize is the largest starch crop and can be found in all regions of Africa. Maize or Corn is primarily produced for its cobs, but also for animal feed in the form of silage and corn. In Africa most biomass residues are used to feed livestock (cattle) (Powell, Pearson, & Hiernaux, 2004).

Maize production is on 20% of the global crop area with strongly varying average yields. In Northern and Southern area, the yields are above average, but in Western, Middle and Eastern Africa the total yields are only 1/3rd of the global average.

The starch from cereal grains are the largest source of carbohydrates for human food production. In the primary production, at the farm, the cereal crops yield as a residue straw and the seed hulls, husks or chaff. The primary crop residues – the biomass left in the field at harvest - from cereals are produced in vast quantities and the worldwide straw production has been estimated for wheat and rice respectively at around 350 and 730 10^6 tons per annum.

Rice and wheat straw burning is a common practice in Africa and give rise to significant air pollution and smog (Mkoma, Kawamura, & Fu, 2013). Attempts to ban these open crop-burning practices are failing and alternative ways of disposal are of interest. Concern about the loss of nutrients and soil carbon when straw is removed from the field should be carefully considered and balanced. The uses of straws include energy and materials. R&D for alternative uses as bioenergy or paper pulp, building materials, particle boards, and 2nd generation bioethanol can be found in the literature (e.g. Batidzirai et al. (2016)).

Electricity and heat can be produced by different technologies such as direct combustion, digestion to biogas, gasification and pyrolysis. Biofuel production from straw, e.g. 2nd generation bioethanol production is still economically hard to achieve if no added value is created for the non-converted residues (unfermented carbohydrates, lignin, and silica).

Oil Crops

Sesame (*Sesamum indicum*) is native to Africa and Tanzania and Sudan are the largest producers. Sesame can grow under harsh conditions and there is a global market for the seeds and oil. The sesame straw that is left after trashing does not find much use as it has low nutritional value.

Karite or shea (*Vittalaria paradoxa* or *Butyrospermum parkii*) is typical from West Africa and yields the much appreciated shea butter, which is in high demand in health food products and cosmetics (NRC, 2006). Smallholder processing of the fruits may be improved to give higher yields and valorisation of the by-products.

Olive trees (*Olea europea*) are found in the Mediterranean countries of North Africa exclusively and the olives are processed similarly to the practice of Southern European producers. The utilisation of residues liberated from olive oil production (pruning, pomace, press cake) as studied in the AGROinLOG project as demonstration for the IBLC concept of can also be implemented in North African olive mills.

Palm oil (*Elaeis guineensis*) originates from West Africa and has evolved from wild harvested oilseeds in the mid-19th century in Ghana to an industrial crop in other continents, for example Malaysia, Indonesia and Colombia. Productivity in Africa of palm oil contributes only 6% to global production on more than 20% of land area covered by Oil Palms. Despite large opportunities of palm oil production in West Africa, conditions of local infrastructure are poorly organized and need improvements. Besides improving institutional conditions for small-scale processors to provide access to international and industrial markets the organization of farmers is important to negotiate better deals (Adjei-Nsiah, Owurak, & Kuyper, 2012).

Coconut (*Cocos nucifera*) is found in tropical coastal areas of both West Africa (Ghana, Nigeria, Ivory Coast) and East Africa (Tanzania, Kenya and Mozambique). African countries account for 10% of the total land area covered by coconut and are producing more than 2 million tons (3.5%) of nuts (FAO, 2017). Many small holder farmers depend on the nuts for their sustenance. Currently the use of the residues (shells, husks, fronts) is limited. Currently in Africa only in Ghana and Ivory Coast, some production of coconut coir is reported. Based on an estimated husk yield of 15% dry matter per coconut the potential production volumes can be estimated per country. The husks commonly are left in the field when the nuts are harvested and transported to the coconut oil mills. Collection and supply of the bulky husk to a pre-processing plant will be essential for implementation of a manufacturing plant, where the dried husks can be converted to building panels or compression moulded forms.

Bamboo

Woody bamboo species are found naturally in many places in sub-Saharan Africa (Bystriakova, Kapos, & Lysenko, 2004) and their hollow stems have traditionally been used for building and construction, fuel, feed and fodder, and to manufacture tools and handicrafts, furniture and many other products (van Dam, Elbersen, & Daza Montaño, 2018). Natural bamboo forests are important for the protection of many endangered species of animals and proper management of the human exploitation of this biomass resource is critical. Bamboo is harvested to produce charcoal or building materials, most often is derived from natural stands.

In the Dutch-Sino East Africa Bamboo Development Programme (INBAR) the options for development of industrial bamboo uses are explored (Mulatu & Kindu, 2010). In Ethiopia, Kenya and Tanzania the industrial production of bamboo show potential for applications such as flooring and furniture, plywood, polymer composites and building materials. Besides the traditional uses of bamboo as charcoal and the tapping of juice to produce bamboo alcohol and vinegar, there is no tradition to harvest edible bamboo shoots. Currently, the industrial production of toothpicks and incense sticks is yielding significant volumes of sawdust, which may be suitable fibres in composite production. The options for bamboo-based pulp and paper industry have been explored in East Africa and is gaining increasing attention in India and China. Because of its rapid growth, bamboo is considered an ideal crop for rural development. The harvest and collection require skilled labour and transportation to pre-processing plants, where the bulky hollow culms can be converted to strips or fibres.

HOW TO APPLY IBLC TO ESTABLISH SCM LEADERSHIP ROLES IN EMERGING COUNTRIES

A leadership function, aiming to setup and run such a supply chain in emerging countries should still build upon on the abilities proposed by Schoemaker et al. (2013): anticipate, challenge, interpret, decide, align and learn. However, the changed contextual factors of two different scenarios, where the IBLC concept is implemented in Europe versus emerging markets, will have to be considered. It can be hypothesized that the following divergences will dawn:

- There is a variety of crop residues that could be utilized in emerging countries like e.g. Africa (see previous section). However, the collection of these residues is still not organized. Therefore, completely new supply chains will need to be designed that cannot build on previous experiences.
- Distances to be covered in the supply chain are often much larger in emerging countries than in the European situation, both from the IBLC to the processing industry and from there to the final market. This will increase transport costs of the raw feedstock. However, it also offers more opportunities for producing high-density intermediates at an IBLC that can be transported at lower costs to a final processing industry at large distance. Hence, supply chain design is crucial for lowering transport costs.

- Less capital might be available in emerging countries to buy extra equipment; hence, more emphasis will be put on utilising the idle time of the equipment that is already available. Therefore, in emerging countries there will be even more need for the IBLC concept than in European countries.
- Optimizing electricity tariffs will only be useful when the really vary. This might not be the case in emerging countries. Security of electricity supply might be a topic that is more relevant in emerging countries, both for the original production and for the new biobased production.
- Storage conditions of raw biomass might be different in emerging countries, e.g. due to climate conditions.
- Competitor analysis will probably be more difficult in emerging countries, nevertheless still very important.
- Social aspects in emerging countries will greatly differ between those countries and from the European situation.
- In emerging countries less relevant knowledge and expertise might have been developed since the concept has not yet been studied locally yet. However, large parts of the European knowledge could serve as a starting point to adopt to the regional situation. In that sense the knowledge base of the AGROinLOG project can be very valuable (http://agroinlog-h2020.eu/en/home/).
- Non-technical issues like rules and regulations will be different in emerging countries. However, this also offers an opportunity to introduce suited new legislation to stimulate the establishment of IBLCs.
- The selection of local suppliers is still very important. However, the type of contact/ business relation between the IBLC and the farmers might be different from the European situation.
- A market analysis will always be needed for each specific country. This will probably lead to different types of products compared to the European situation.

CONCLUSIONS AND DISCUSSIONS

In the agroindustry, the use of residues as an input of new processes has out the basis for the creation of a new concept: The Integrated Biomass Logistics Centre (IBLC). The concept is being tested in three agro-industries in Europe, within the framework of the AGROinLOG project, in terms of both feasibility and advantages: fodder (Spain), olive oil production (Greece) and cereal processing (Sweden). The project aims to align with the growing amount of research and development in the circular economy area, a new sustainability paradigm aiming to conserve our earth's national resources (Geissdoerfer et al., 2017).

While technical innovation has demonstrated pros and cons from the implementation of circular economy principles, it remains unexplored how the related supply chains should be managed and led. This chapter analyse the concept of IBLCs under the lens of supply chain management leadership. By means of a framework proposed by Schoemaker et al. (2013) (anticipate, challenge, interpret, decide, align and learn), leadership abilities to be considered when developing a supply chain management function in these IBLCs are proposed. Thereafter, the potential for applying the IBLCs in emerging market and implications for leadership are discussed.

The following knowledge can be extracted from the analysis:

- A leader should consider that the configuration of the supply chain must be optimized as it directly influences the economic viability of the IBLC. Different storage options should be studied and adapted to climate conditions. In this sense, weather conditions influence moisture content and determine collection and processing.
- The selection of suppliers is fundamental but presents challenges to undertake. Local suppliers should be secured to decrease transport costs and ensure supply. In this aspect, contracting and related legislative frameworks may need to be developed and applied.
- A supply chain manager needs to investigate and use idle time of equipment as an opportunity to activate production of biocommodities. Hence, the idle time of the equipment that is already available should be clearly defined maximizing the use of the existing resources in terms of equipment and resources.
- Perform a competitor and market analysis before making the decision to invest in the new activity in the IBLC. Decide the price for the new product. In particular, the supply chain leader should be able to trade off the costs of production with the potential revenues from sales.
- Production costs and especially utilities costs need to be carefully reviewed. Optimizing electricity tariffs can be challenging in emerging countries where access in rural areas is still limited. This can force the supply chain to move production facilities far away from collection points. Consequences are increased distances and transport costs.
- Rules and regulations will be different in emerging countries. Introducing suited new legislation can be an opportunity to stimulate the establishment of IBLCs.
- Tests are needed to develop the new product in terms of quality and size.
- Develop sales channels. Perform different strategies to introduce the product in the market adapted to the customs and culture.

- Encourage feedback from all stakeholders in the process to learn and align all the needs. Examine cause of failure and apply corrections.
- Involve the community in dissemination activities promoting acceptance.

The main contribution of this research study consists of performing a preliminary analysis to shift the IBLC concept to emerging countries, with a focus on the supply chain management function and its leadership abilities. From a scientific viewpoint, many studies can be found, describing main principles and concepts related to biocommodities supply chains. Nevertheless, there is still very little research defining leadership functions and their main challenges in both developed and developing countries. From a practical viewpoint, supply chain management is a discipline that has not permeated the biocommodities sectors yet. In principle, based on the experience from Europe, it has been discovered that main actors are not able to implement and apply business strategies in the management of their supply chains. Hence, it is of outmost importance to understand how this can be performed to create competitive biocommodities products. At the same, the lessons learned should be moved to developing countries, where the need of sustainable energy supplies is still a problem in many parts of the countries, despite plenty of underutilised resources are available.

The study performed is based on the analysis of data and observations performed in cases respectively in Europe and emerging countries in Africa. The IBLC concept has been developed in the framework of a three years project in Europe. In addition, the senior members of the research team have decade of experience in the topic of biomass supply chains globally. Nevertheless, we acknowledge that the differences highlighted are merely explorative propositions based on the team's expertise. Therefore, further research needs to be developed to ground our preliminary hypotheses in theory and further validate them in a sound confirmatory study.

ACKNOWLEDGMENT

This research has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 727961.

REFERENCES

Adjei-Nsiah, S., Owurak, S. D., & Kuyper, T. W. (2012). Exploring opportunities for enhancing innovation in agriculture: The case of oil palm production in Ghana. *The Journal of Agricultural Science*, *4*(10), 212–223.

AGROINLOG. (2020). *AGROINLOG, Integrated Biomass Logistics Centres for the agro industry*. Retrieved from http://agroinlog-h2020.eu/en/home/

An, H. J., & Searcy, S. W. (2012). Economic and energy evaluation of a logistics system based on biomass modules. *Biomass and Bioenergy*, *46*, 190–202. doi:10.1016/j.biombioe.2012.09.002

Annevelink, E., van Gogh, B., Nogués, F. S., Espatolero, S., De la Cruz, T., Luzzini, D., . . . Olsson, J. (2017). *Conceptual description of an Integrated Biomass Logistics Centre (IBLC).* Paper presented at the European Biomass Conference & Exhibition 2017, Stockholm, Sweden.

Batidzirai, B., Valk, M., Wicke, B., Junginger, M., Daioglou, V., Euler, W., & Faaij, A. P. C. (2016). Current and future technical, economic and environmental feasibility of maize and wheat residues supply for biomass energy application: Illustrated for South Africa. *Biomass and Bioenergy*, *92*, 106–129.

Bystriakova, N., Kapos, V., & Lysenko, I. (2004). *Bamboo Biodiversity*. UNEP-WCMC/INBAR.

Ebadian, M., Sowlati, T., Sokhansanj, S., Stumborg, M., & Townley-Smith, L. (2011). A new simulation model for multi-agricultural biomass logistics system in bioenergy production. *Biosystems Engineering*, *110*(3), 280–290. doi:10.1016/j.biosystemseng.2011.08.008

Ellram, L. M., & Cooper, M. C. (1990). Supply chain management, partnership, and the shipper-third party relationship. *International Journal of Logistics Management*, *1*(2), 1–10.

Faaij, A. P., & Domac, J. (2006). Emerging international bio-energy markets and opportunities for socio-economic development. *Energy for Sustainable Development*, *10*(1), 7–19.

FAO. (2017). *Faostat Crops*. Retrieved from http://www.fao.org/faostat/en/#data/QC/visualize

Geissdoerfer, M., Savaget, P., Bocken, N. M., & Hultink, E. J. (2017). The Circular Economy–A new sustainability paradigm? *Journal of Cleaner Production*, *143*, 757–768.

Ho, W., Hashim, H., & Lim, J. (2014). Integrated biomass and solar town concept for a smart eco-village in Iskandar Malaysia (IM). *Renewable Energy*, *69*, 190–201.

How, B. S., Tan, K. Y., & Lam, H. L. (2016). Transportation decision tool for optimisation of integrated biomass flow with vehicle capacity constraints. *Journal of Cleaner Production*, *136*, 197–223.

Jingura, R. M., & Matengaifa, R. (2008). The potential for energy production from crop residues in Zimbabwe. *Biomass and Bioenergy*, *32*(12), 1287–1292.

Lamers, P., Tan, E. C. D., Searcy, E. M., Scarlata, C. J., Cafferty, K. G., & Jacobson, J. J. (2015). Strategic supply system design–a holistic evaluation of operational and production cost for a biorefinery supply chain. *Biofuels, Bioproducts and Biorefining, 9*(6), 648-660.

Leal, M. R. L. V., Galdos, M. V., Scarpare, F. V., Seabra, J. E. A., Walter, A., & Oliveira, C. O. F. (2013). Sugarcane straw availability, quality, recovery and energy use: A literature review. *Biomass and Bioenergy*, *53*, 11–19.

Mahmoudi, M., Sowlati, T., & Sokhansanj, S. (2009). Logistics of supplying biomass from a mountain pine beetle-infested forest to a power plant in British Columbia. *Scandinavian Journal of Forest Research*, *24*(1), 76–86.

Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain management. *Journal of Business Logistics*, *22*(2), 1–25.

Mitchell, C., Bridgwater, A., Stevens, D., Toft, A. J., & Watters, M., & Bioenergy. (1995). Technoeconomic assessment of biomass to energy. *Biomass*, *9*(1-5), 205–226.

Mkoma, S. L., Kawamura, K., & Fu, P. Q. (2013). Contributions of biomass/biofuel burning to organic aerosols and particulate matter in Tanzania, East Africa, based on analyses of ionic species, organic and elemental carbon, levoglucosan and mannosan. *Atmospheric Chemistry and Physics*, *13*(20), 10325–10338.

Morrison, O. (2019). *Seven ways business leaders can transform the food system*. Retrieved from https://www.foodnavigator.com/Article/2019/10/16/7-ways-business-leaders-can-transform-the-food-system

Muerza, V., De la Cruz, M. T., & Urciuoli, L. (2019). La logística como factor de éxito en los centros logísticos integrados de biomasa. *Revista de Economía Aragonesa*, *67*, 107–120.

Mulatu, Y., & Kindu, M. (2010). Status of bamboo resource development, utilisation and research in Ethiopia: A review. *Ethiopian Journal of Natural Resources*, *1*, 79–98.

NRC. (2006). Shea. In Lost Crops of Africa (Vol. 2). Washington, DC: The National Academies Press.

Ou, C. S., Liu, F. C., Hung, Y. C., & Yen, D. C. (2010). A structural model of supply chain management on firm performance. *International Journal of Operations & Production Management*, *30*(5), 526–545.

Powell, J. M., Pearson, R. A., & Hiernaux, P. H. (2004). Crop–livestock interactions in the West African drylands. *Agronomy Journal*, *96*(2), 469–483.

Rother, M. (1999). *Learning to See: Value Stream Mapping to Create Value and Eliminate Muda*. The Lean Enterprise Institute.

SCC. (1999). *Supply-Chain Operations Reference-Model: Overview of SCOR Version 3.0*. Pittsburgh, PA: Supply-Chain Council Inc.

Schoemaker, P. J., Krupp, S., & Howland, S. (2013). Strategic leadership: The essential skills. *Harvard Business Review*, *91*(1), 131–134. PMID:23390746

Sokhansanj, S., Kumar, A., & Turhollow, A. F., & Bioenergy. (2006). Development and implementation of integrated biomass supply analysis and logistics model (IBSAL). *Biomass*, *30*(10), 838–847.

SpencerStuart. (2015). *Agribusiness leadership of the future. A Snapshot of Strategic Priorities and Talent Needs in Asia Pacific*. Retrieved from https://www.spencerstuart.com/-/media/pdf-files/research-and-insight-pdfs/agribusiness-leadership-of-the-future_080216.pdf

Stock, J. R., & Lambert, D. M. (2001). *Strategic logistics management* (Vol. 4). McGraw-Hill.

Sucellog. (2017). *Project deliverables*. Retrieved from www.sucellog.eu/en/publications-reports.html

Urciuoli, L., & Muerza, V. (2018). *An integrated Framework for Evaluating Costs of IBLCs' supply chains*. Paper presented at the International Conference on Information Systems, Logistics and Supply Chain, Lyon, France.

van Dam, J. E. G., Elbersen, H. W., & Daza Montaño, C. M. (2018). Bamboo production for industrial utilisation. In E. Alexoupoulo (Ed.), *Perennial grasses for bioenergy and bioproducts* (pp. 175–216). Academic Press.

Verma, D., Gope, P. C., Maheshwari, M. K., & Sharma, R. K. (2012). Bagasse fiber composites-A review. *J. Mater. Environ. Sci*, *3*(6), 1079–1092.