



DEVELOPMENT OF A READINESS ASSESSMENT MODEL TO EVALUATE ENGAGEMENT WITH FOOD LOSS MANAGEMENT IN LOGISTICS

Julia Kleineidam ¹, Angelica Coll, Frank Straube ¹

¹: Technische Universität Berlin

Abstract:

Background: The topic of food loss reduction has become an important issue today, not only because of its explicit mention in the SDGs but also because tackling it requires the active involvement and collaboration of all actors in the food value chains. Successfully implementing food loss measures requires an appropriate level of readiness within the organization. However, a suitable model to determine and evaluate this level of readiness does not yet exist. Nevertheless, the main focus of current research is on developing cutting-edge technologies and solutions for industrialized countries. This paper examines the differences in addressing food loss reduction between developing and developed countries, using Ethiopia and Germany as examples.

Methods: The data for this study were collected using an online survey and analysed using Excel and SPSS 27.

Results: The results of this study show that the relevance of the topic is considered equally important in both areas of investigation. However, its consideration in corporate strategies differs significantly. The underlying barriers in Ethiopia are analysed in this paper.

Conclusions: From the analysis, a readiness assessment tool is developed which enables an assessment of the previous engagement of a specific organization with the topic of food loss reduction. This is the first step to apply appropriate methods for food loss reduction.

Keywords: logistics, food loss, comparative analysis, developing countries, readiness assessment

1. INTRODUCTION

With its 17 SDGs, the UN has set itself the goal of making the world a fairer and more sustainable place by 2030. Goal 12 aims for ‘responsible consumption’; more specifically, sub-goal 12.3 states: “By 2030, halving per capita global food waste at retail and consumer level and reducing food losses along the production and supply chain, including post-harvest losses” (United Nations 2015). Since the SDGs were formulated, six years ago, there has been no scientific evidence that the world is decisively closer to achieving this goal. There are promising approaches to food loss (FL) prevention in both practice and science (Nitsche et al. 2018; English 2019); however, for the most part, these have not yet been adopted by the vast majority. If one considers this factor, it is questionable whether a clear understanding of the relevance of this problem already exists across the industry and communities (Garske et al. 2020; Aldaco et al. 2020). Until there is a clear understanding of the problem among companies and consumers, it will be much more difficult to achieve the above-mentioned goal. Furthermore, different logistical measures against food loss require a certain level of knowledge and readiness within the organization (Weidner et al. 2019). However, there is no instrument to assess the readiness level of an organization in order to make a decision on the implementation of food loss management.

When looking at the problems in the current body of research, it is noticeable that most of the latest studies focus on approaches in industrialized countries. Highly technical solutions such as forecast algorithms and intelligent packaging are discussed (Nitsche et al. 2018). However, value chains in developing countries and the link between industrialized and developing countries are not considered very much (Sharma et al. 2021; Närvänen et al. 2021). Many international food supply chains originate in developing countries. Looking at the analysis of Gustafsson et al. (2011), it is evident that developing countries, in particular, have high loss rates in the early stages of the supply chain (Gustafsson et al. 2011). Since the UN target described above explicitly includes post-harvest losses, these parts of the value chain must also be explicitly included in finding solutions. This fact raises the question of whether the results of the previously described studies can be applied to developing countries or whether other approaches need to be developed in this context.

Awareness and readiness are important steps in tackling the problem, which is why it should be examined at this stage how far the problem has already reached the actors in the value chain and how they incorporate this topic into their daily actions. This will also provide an insight into the loss rates of the individual stages. Ideally, these results can be used to directly deduce

measures that contribute to reducing losses and, thereby, to meeting objective 12 of the SDGs (United Nations 2015).

In order to address such a question, it is necessary to compare and contrast the conditions in the two parts of the value chain. Ethiopia, as a representative nation of the developing countries, and Germany, as a representative nation of the industrialized countries, are suitable for this comparison.

Ethiopia holds a special position among the African countries. Besides a change of power unique in African history in 2018, this country is characterized by constant economic growth rates since 2004 according to World Bank data (World Bank 2019). At the same time, it remains one of the countries with the highest food imports in the world due to the humanitarian situation in parts of the country (Blome 2016). Despite periodical food shortages that the country is facing, food losses seems to be a foreign topic with little public attention and no national strategy (Federal Democratic Republic of Ethiopia 2016; The Federal Democratic Republic of Ethiopia 2010). Having such characteristics, Ethiopia can be regarded as an example of a least developed country as well as an emerging economy (UNEP 2018; Minten et al. 2021).

Germany has been a benchmark in the field of logistics for years. The World Bank's Logistics Performance Index has regularly ranked Germany first since 2014 (World Bank 2018). Therefore, Germany can be used as an example of an industrialized nation. However, there are also extensive challenges in food logistics in Germany. Above all, increased customer requirements are driving the German food industry to take new paths. Specifically, mindfulness towards food and how to deal with food loss is not always in focus. In some cases, the urge to fulfil customer wishes leads to the deliberate waste of food. As a result, the German government presented a new 'national strategy to reduce food waste' (German Federal Ministry of Food and Agriculture 2019). This shows that there is still a long way to go to meet the SDG's objectives. The comparison between the countries presented allows us to answer the question of how awareness for food losses differs. In addition, best practices can also be identified by which actors from both countries can learn from each other and optimize their own processes. This results in the following research question:

RQ1: How does addressing the issue of food loss reduction differ between German and Ethiopian companies?

Furthermore, the aim of this research is to develop a systematic awareness assessment tool based on the identified level of awareness in the investigated companies, which answers the second research question:

RQ2: How can companies be supported in determining their own level of readiness regarding the topic of food losses to be able to independently develop solutions for their own context?

2. THEORETICAL BACKGROUND

2.1. Definition of essential terms

This paper follows the understanding of **food logistics** as formulated by Nitsche and Figiel (Nitsche and Figiel 2016). According to this, food logistics includes “the planning, management and control of the value network of food products from the source of raw materials to the end customer. The focus is on the efficient processing of customer orders using information systems, technologies and management concepts, with special emphasis given with regard to high article-specific quality and safety requirements for perishable goods in various temperature ranges.” Straube, Nitsche and Figiel identified the reduction of food losses as one of the most relevant trends in food logistics for the coming years (Nitsche and Figiel 2016).

In the literature, different definitions of the terms ‘food loss’ and ‘food waste’ are used. These definitions differ in terms of the relationship between the two terms, but also in terms of the general understanding of how these terms are used (FAO 2013; Gustavsson et al. 2011; Papargyropoulou et al. 2014; Parfitt et al. 2010). There are even more extensive definitions, which, for example, include all excess consumption that exceeds a person’s basic nutritional requirements as food waste (Smil 2004). In the context of this paper, the term **food loss** is used as defined by the High-Level Panel of Experts on Food Security and Nutrition of the European Union (HLPE). The HLPE defines food loss thus: “Food losses (FL) refers to a decrease, at all stages of the food chain prior to the consumer level, in mass, of food that was originally intended for human consumption, regardless of the cause.” According to this understanding, food waste is the loss of food at the consumer level. Since the focus of this paper is not on end consumers, these losses are not considered (HLPE 2014).

2.2. Food Loss in logistics networks

Food losses occur at all levels in logistics networks and are multi-faceted and different not only depending on their occurrence in the network in terms of their causes, but also differ in terms of the level of development of the country in which this function is performed. In relation to

the operational functions in a food logistics network and the level of development of the country, the following figure shows examples of causes of food losses.

Table 1 - Causes of losses in food value chains (Nitsche et al. 2018)

Value Chain Stage	Developing Countries	Developed Countries
Harvesting and post-harvesting	<ul style="list-style-type: none"> • weather-related loss • suboptimal harvest period • damage of crops • inadequate infrastructure • low level of automation • defective harvesting equipment • lack of qualified personnel 	<ul style="list-style-type: none"> • weather-related loss • over-production • damage of crops
Food processing industry	<ul style="list-style-type: none"> • transformational processes • contamination 	<ul style="list-style-type: none"> • transformational processes • production failures • technical issues
Warehousing	<ul style="list-style-type: none"> • low storage capacity • inappropriate storage conditions and cooling systems • long distances to warehouses • warehouse usage not aligned to customer demand 	<ul style="list-style-type: none"> • technical malfunction of cooling systems • manual errors in cooling regulation • inappropriate storage conditions
Transportation	<ul style="list-style-type: none"> • inadequate infrastructure • inappropriately equipped transport vehicles • low transportation safety for perishable goods • unreliable transport packaging • inappropriate load securing 	<ul style="list-style-type: none"> • long throughput times • long transport distances • delivery delays • overloading of terminals • inadequate temperature measurements • unreliable transport packaging
Retail	<ul style="list-style-type: none"> • lack of cooling systems • inappropriately equipped storage and sales areas • unhygienic conditions 	<ul style="list-style-type: none"> • inaccurate sales forecasts • uncertainty regarding date indications • inappropriately equipped sales areas • inefficient optimization efforts • promotions and discounts
Packaging	<ul style="list-style-type: none"> • lack of packaging knowledge • inappropriate packaging for transportation and storage 	<ul style="list-style-type: none"> • large packaging units • defective packaging • inefficient packaging design
Processes	<ul style="list-style-type: none"> • lack of holistic view of value adding • processes in food value chains due to profit optimization • lack of communication between food value chain actors • inefficient processing processes 	<ul style="list-style-type: none"> • high complexity of value-adding processes • lack of holistic view of value-adding processes in food value chains • lack of communication • lack of transparency along the food value chain

Various studies have looked at how food losses can be reduced through logistics measures. In their meta-analysis, Nitsche et al. (2018) created a systematization of the approaches, which can be found in Figure 1.

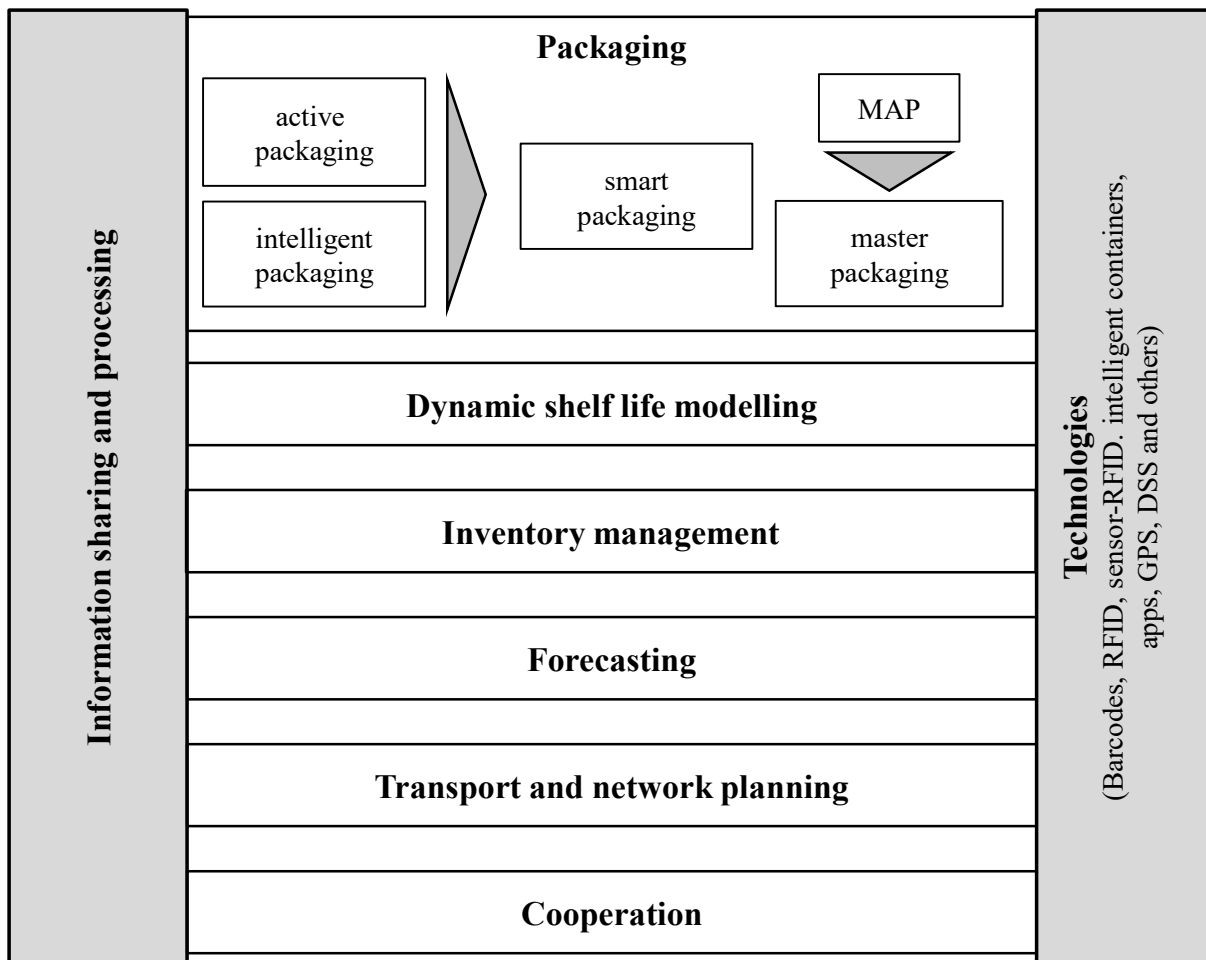


Figure 1 - Food loss management framework (Nitsche et al. 2018)

From this overview, it can be determined that most of the measures have a technical reference and assumed a relatively high level of technological development of the implementing organization (Wang et al. 2012; Xiao et al. 2017; Brewster et al. 2017). The objective of most of the measures found in the literature therefore address the causes of food losses in industrialized countries listed in Table 1 and are discussed for those conditions (Azuara et al. 2012; Vanderroost et al. 2017; Strotmann et al. 2017; Mercier et al. 2018). Little attention is paid to the transfer or application of these measures in developing countries, as well as only limited scope in the literature discussing measures that directly address the causes listed above in Table 1 for developing countries (Martens et al. 2012).

In the following, an introduction to the relevant basics for trend analysis in food logistics is presented, which form the basis for further considerations regarding the handling of the topic of food loss management within the scope of this article.

2.3. Dimensions of logistics to classify logistics trends

Since food loss management is considered a trend in food logistics, the question arises as to how trends in food logistics can be classified. In their trend analysis on logistics, Handfield et al. (2013) define five dimensions that are relevant when considering trends in logistics: Employees, Processes, Technology, Network and Strategy (Handfield et al. 2013). Straube, Figiel and Nitsche specify these dimensions regarding food logistics. The five dimensions are defined in the context of this study and linked to the topic of food loss management.

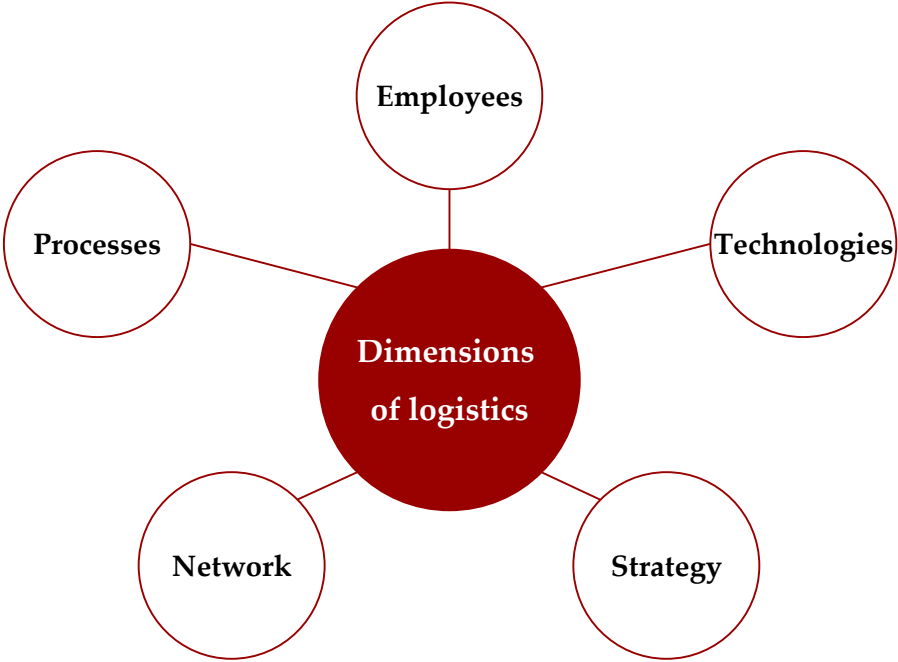


Figure 2 - Dimensions of logistics

2.3.1. Employees

Organizations must be able to adapt quickly and make adjustments to respond to unforeseen changes in a challenging environment. A responsive culture is based on highly professional and well-trained employees. Particularly with regard to food, high demands are placed on the knowledge and behaviour of employees. In particular, wrong behaviour in handling food by employees is a reason for losses. They are at the core of any business, and leading companies take talent management very seriously. The goal of this is to enable employees to respond appropriately to difficult and unstructured situations. For many of those companies who are not business leaders, the shortage of qualified employees is the overall biggest challenge for the future. Leading companies are concerned about their employees responsible for the supply chain, and the HR department is working out common strategies for talent management, clearly

specifying this shortage and implementing measures to counter it. One of the strategies is research collaboration with universities to have a presence on campus and build a source of talent. Another approach is to educate potential employees about careers in logistics and to present logistics as an exciting, growing career field to junior managers and students. Furthermore, these companies advise and develop their employees for work in logistics and recruit qualified employees from other areas of the company. They also invest in training and education for high-potential employees to ensure their further development and retention in the company, as well as promoting employees into specific roles that will help them advance (Handfield et al. 2013; Nitsche and Figiel 2016).

2.3.2. Processes

The more a company grows, the more its success depends on clearly defined policies, procedures, structures and a supportive corporate culture. However, core processes must provide sufficient leeway to adapt to the changing situation or culture. Employees who grasp the corporate culture are challenged through mentoring, guidance, and training and development opportunities. This not only leads to greater employee loyalty, but also builds their skills, paving the way for innovation and new ways of working in a global network. To build a global process that can be adapted to diverse local regulatory, cultural and network conditions, a suitable decision maker is needed who is familiar with the process environment. Due to the specific demands that different foods place on logistics, coordinated processes are important to ensure that all requirements are always considered. Faulty processes are, in many cases, the reason for food losses. Process-oriented companies operate with independent logistics organizations. This independence makes logistics an important global process with its own services but adapted to business requirements. Thus, structured decisions regarding the fulfilment of the customer order process can be centrally planned, executed and controlled. Similarly, leading companies need to make outsourcing or insourcing activities and decisions regarding their processes. These decisions, in turn, have an impact on internal and external logistics processes. Depending on the company's objective, planning and fulfilment processes are involved here, for example in the distribution of foodstuffs or in procurement and production preparation (Handfield et al. 2013; Nitsche and Figiel 2016).

2.3.3. Technologies

Leading companies have recognized that to successfully meet logistics trends, they must leverage technologies that generate new insights, provide transparency and demand an action-oriented corporate culture. Investments in technologies promise the greatest success in implementation when they have a direct link to user requirements, responsiveness to customer requests and value creation. The use of technology facilitates the handling of food on many levels. Nevertheless, incorrect handling or the incorrect use of technology in general can lead to food losses. Leading companies are investing in a solid foundation of robust logistics and supply chain data, ensuring that their data systems can track events and transactions and provide a strong, data-driven analytics foundation. These technologies are the foundation for network optimization, visibility into global material flows and end-to-end integration. By requiring multiple players in the extended global supply chain to have access to the same data, all members of the supply chain are able to contribute to its bottom line. Technologies help integrate planning processes, ensure coordinated responses to global events and provide the foundation for analytics that will become increasingly important for competitive decision-making in the near future. In addition, technologies enable the tracking of events at upstream suppliers and provide real-time updated key figures for the optimization of logistics networks (Handfield et al. 2013; Nitsche and Figiel 2016).

2.3.4. Network

Due to interdependencies between supply chains, often globally connected, disruptions in one node can compromise the entire network. Over 70% of all respondents in the study by Handfield et al. consider close collaboration with key suppliers as a measure against disruptions. A key component to creating a resilient logistics network, in addition to understanding the various players, is gaining insight into their capabilities, limitations and connections within the network. Especially due to the many actors involved in food logistics processes, it is highly relevant for food loss management to pay attention to good relationships within the network and, thus, also work together to reduce food losses. Leading companies have moved to disclose even confidential data if it provides a more complete understanding of requirements among key partners, particularly data related to research and development. Another prominent feature is that they are sharing information with more and more members of their supply chains, including upstream suppliers and logistics service providers. The results also show that leading companies are also using cost-to-serve analytics to inform their logistics decisions, for example for future outsourcing processes (Handfield et al. 2013; Nitsche and Figiel 2016).

2.3.5. Strategy

When dealing with trends in food logistics, a long-term alignment of the corporate strategy to these trends is essential. These include, for example, the development of new markets, innovative business models, corporations or customer segments. These, in turn, have a significant influence on the company's logistics. As customers become more open to these issues, proactive companies are aligning their strategies with new measures, such as monitoring and measuring their environmental footprint, optimized transportation networks, packaging and end-of-life strategies for their products. Companies, thus, can also engage with the environment and society to respond to trends. Joint development of standards with network partners, organizations or government agencies can also be part of the company's strategic direction. In the future, companies will need to partner vertically and horizontally with other organizations in industry initiatives or partner with government agencies, for example, to ensure greater social equity and further reduce CO₂ emissions over time. The study findings of Handfield et al. suggest that leading companies are more likely than others to implement green logistics strategies and to see corporate social responsibility as an important component of their logistics strategies. The human factor has become a central issue, so that companies require their suppliers to comply with globally uniform standards for labour and human rights (Handfield et al. 2013; Nitsche and Figiel 2016).

3. METHODOLOGY

For the purpose of gaining an overview of the extent to which food losses are already being addressed in the research environments of Ethiopia and Germany, an online survey was conducted among food producing and processing as well as transporting companies in both countries. In addition to the main focus of food losses, the survey also covered the future issues of sustainability, transparency and the increasing influence of e-commerce in the B2B and B2C sectors, which are not covered in detail in this paper.

3.1. Selection of the data collection method

An online survey using the Unipark survey platform was chosen as the data collection method for the study. The design of the survey was based on the methodology of the study by Nitsche

and Figiel (Nitsche and Figiel 2016). The advantages of this method are, in particular, that a large number of people from the desired target group, located in two different countries, can be reached within a short period of time and without significant financial expenditure, and that the collected data are subsequently available directly in digital form. Due largely to the circumstances of the COVID-19 pandemic, no direct interviews could be conducted in either country, which further strengthened the advantages of an online survey.

3.2. Structural development of the questionnaire

Regarding the structural development of the questions, mainly closed as well as semi-open questions were formulated. Closed or semi-open questions ensure greater objectivity of the results. In addition, they offer a better possibility to conduct a replication study at a later point in time, if this becomes appropriate (Reinders et al. 2011).

Closed questions are particularly useful for online surveys, as they often result in a higher response rate. In addition, the evaluation of the data is easier with closed questions since the answers given do not have to be coded or clustered. In contrast, in the case of semi-open questions, which allow more creative response behaviour, the answers given must also be coded in order to ensure comparability of the answers.

For this online survey, nominal, ordinal and cardinal scale levels were used according to the respective questions. For the majority of questions, responses were based on ordinally scaled Likert scales. These response options mostly represent the range between complete agreement and complete disagreement. In addition, numerical values from one to five were assigned to the answer options to facilitate the subsequent evaluation. Generally, when developing the questions for the online survey, great care was taken to ensure that they were used in a targeted manner to answer the research questions. Furthermore, the necessary principle of neutrality was always observed in the process of formulating the questionnaire. The questionnaire was divided into general questions about the respective company and trend-specific questions. The trend-specific questions regarding the food loss trend concerned the application of action items which had been concluded in this analysis by Kleineidam (Kleineidam 2020). Since the current COVID-19 pandemic will have lasting consequences for companies within the food industry and their involvement with issues outside their regular day-to-day business, the trend-specific questions were followed by an optional open-ended question to query individual insights regarding the impact of the pandemic on the food industry. Overall, it took an average of 19.7 minutes to complete the questionnaire.

The analysis was carried out using Microsoft Excel and SPSS version 27. The first descriptive analyses as well as the graphical presentation were conducted in Excel. For further statistical analyses, for example correlation analyses, regression analyses and statistical tests, SPSS version 27 was used.

3.3. Sample Demographics

A total of 84 participants completed the survey. There were 30 participants from Ethiopia and 54 participants from Germany. In addition to country affiliation, participants were asked about the position of their companies within their value chain. The allocation of the companies to the position of the value chain can be seen in Figure 3.

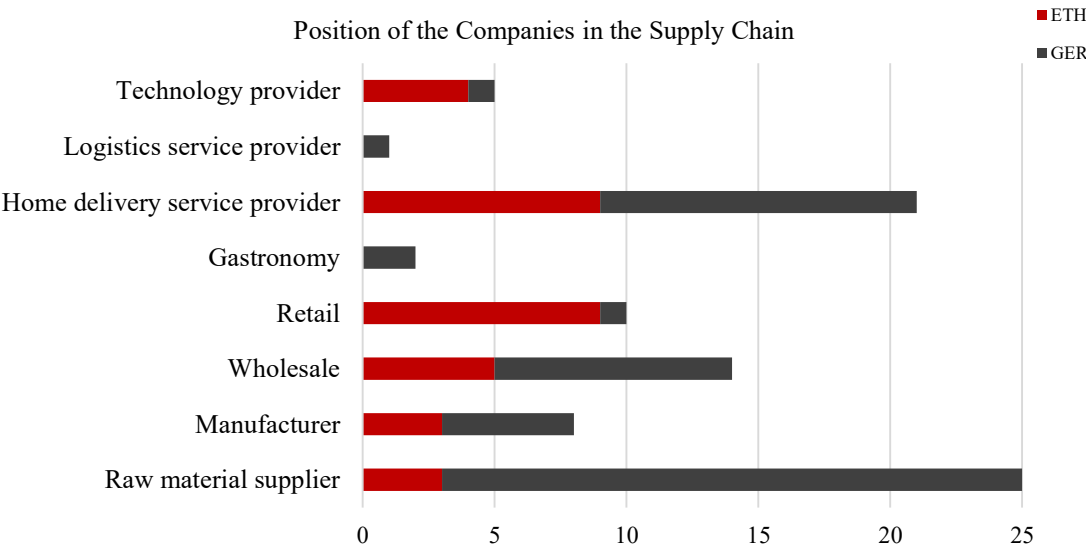


Figure 3 - Position of the Companies in the Supply Chain

Four participants did not assign themselves to any of the stakeholder groups surveyed. The most frequently mentioned category among the German participants was manufacturers, with 45.3% of the responses. The most frequently mentioned actor groups among the Ethiopian participants were gastronomy and logistics service providers, with 33.3% of the mentions. The logistics service provider group shows the greatest similarity in terms of frequency with 33.3% and 26.4%, respectively, between the two groups. No Ethiopian participants assigned themselves to the categories home delivery service provider or technology provider. For this reason, these groups of actors are not explicitly considered further in the following sections.

4. RESULTS AND DISCUSSION

4.1. Descriptive analysis of survey results

As an introduction, the participants were asked how they assess the relevance of food loss management (FLM) for the food industry in general today and in five years. On average, Ethiopian participants rated the relevance today with a scale value of 3.47. German participants rated the relevance today with a scale value of 3.09.

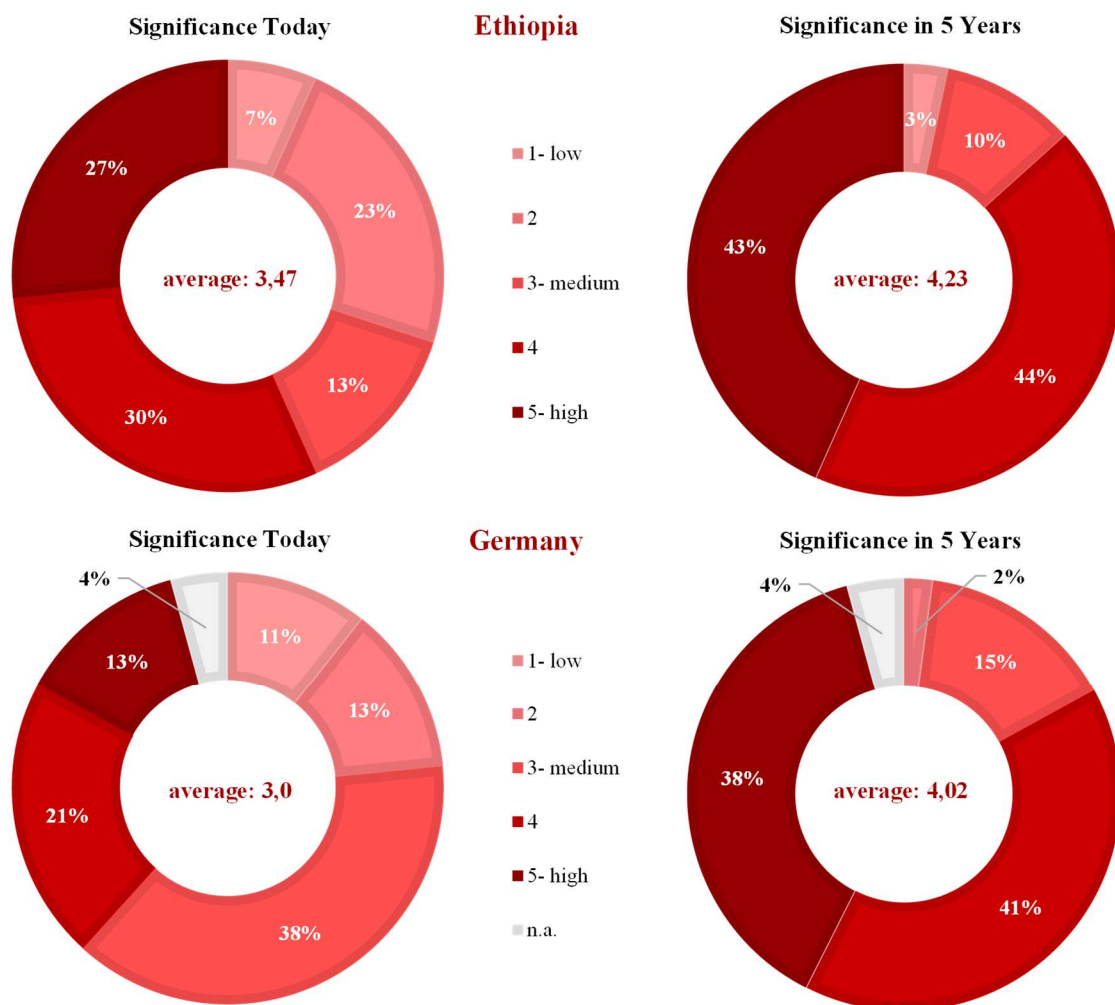


Figure 4 - Relevance of the Food Loss Management Trend in Ethiopia and Germany

These values are not significant after consideration of the test statistics (p value at 0.202 for the current view or 0.504 for a reference value of 0.05). Thus, it can be assumed that the relevance of food loss management today is assessed by both groups of respondents as being at the same, medium level. If this assessment is compared with the known figures on the extent of the problem of food loss, it can be seen that the companies do not yet attribute the necessary relevance to the problem. In both groups, the five-year outlook shows an increase in relevance

to 4.23 from the Ethiopian experts and 4.13 from the German experts. Again, the test statistics show that the difference is not significant. Thus, it can be stated for the five-year view that both expert groups see an increase to a high relevance equally.

In addition, the participants were asked about the importance of food loss management in their company. Here, the assessments differed significantly. Figure 5 shows the percentage distribution of both expert groups.

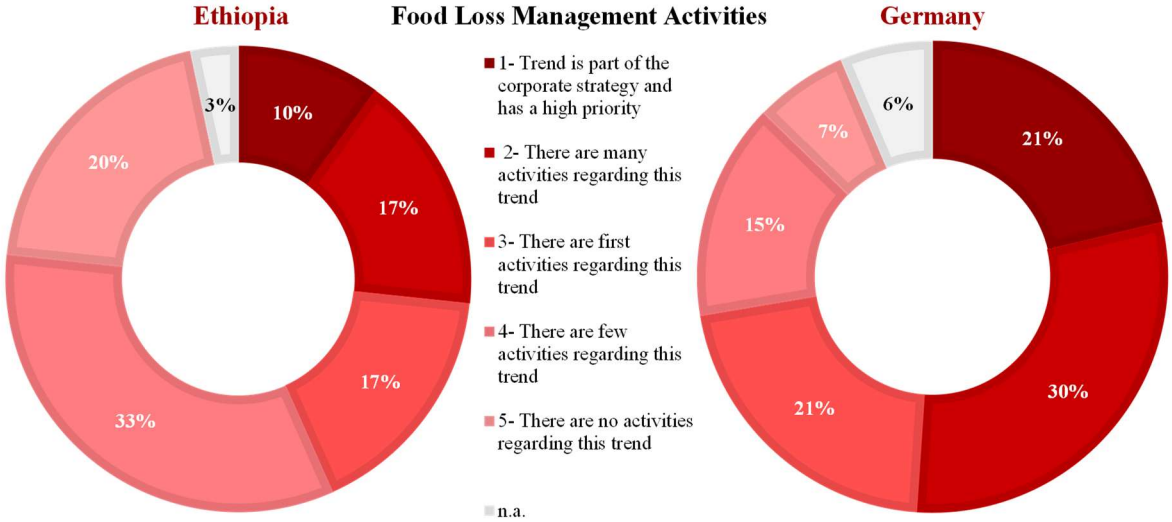


Figure 5 - Food Loss Management Activities

Only 10% of Ethiopian experts stated that they have implemented food loss management as part of their corporate strategy and give the issue a high priority. Twice as many Ethiopian experts (20%) indicated that the company does not undertake any activities regarding this trend. Among the German experts, 21% gave the trend a high priority and only 7% stated that the company does not undertake any activities regarding this trend.

This picture is strengthened when the answers to the following question in the questionnaire are considered. The question asked what opportunities are seen for the companies through the reduction of food losses. The challenges identified from the literature and the experts' assessment are shown in the Figure 6. In addition, the experts were given the opportunity to name further opportunities that they see in the reduction of food losses. No further opportunities were named by the experts, which indicates that the opportunities derived from theory are also regarded as the most relevant in practice.

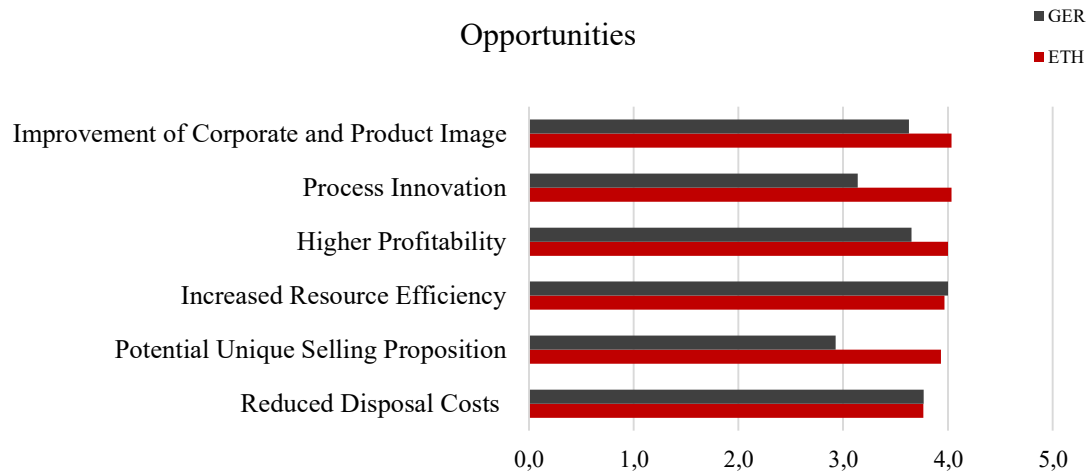


Figure 6 - Opportunities of food loss management

When looking at the figure and the six opportunities, we see that four of the six opportunities are rated as more important by the Ethiopian experts than by the German experts. These differences are significant for the three opportunities ‘Potential unique selling proposition’, ‘Increase in economic efficiency’ and ‘Opportunity for process innovation’.

Despite an equivalent assessment of the relevance of the trend, the discussion of food loss management is very different between the two reference groups. The results of the opportunity assessment pointed in the same direction. These results suggest that in Ethiopia there are greater obstacles to the actual consideration of the topic in entrepreneurial activity, despite an equally high assessment of relevance and a partially even higher assessment of opportunities.

The participants were also asked about these barriers. Analogous to the opportunities in the literature, seven barriers were derived, and the experts were asked to assess their relevance. The experts were also given the opportunity to name further barriers. Four additional barriers were named. It should be noted that only the German experts named further barriers. These were: best before date as a waste-maker, consumer appreciation not monetizable, high degree of automation and acceptance readiness/capacities of social services. The consideration of the additionally mentioned barriers suggests that these result strongly from the basic conditions in Germany. It can be deduced from this that barriers that are considered general can be derived from theory, analogously to the challenges, as also valid for practice.

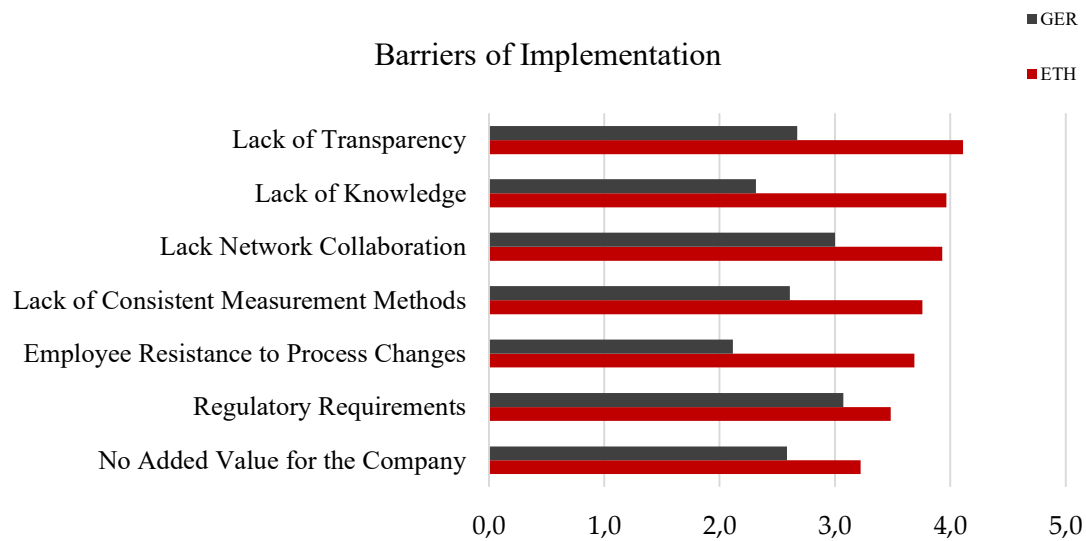


Figure 7 - Barriers of implementation of food loss management

When considering the seven barriers in question, it is noticeable that the Ethiopian experts rated the influence of all seven barriers as stronger than the German experts. This difference is statistically significant for five of the seven barriers. For the two barriers ‘No added value for the company is seen from the decision-making level’ and ‘Regulatory requirements generate losses’, an equally strong assessment is assumed. It should be emphasized here that with an overarching mean scale value of 2.55, that is, a mean relevance assessment, the barrier ‘No added value for the company is seen from the decision-making level’ has the lowest relevance of the barriers in question. This underlines the previous findings that companies in both countries are generally open to the positive opportunities of reducing food loss.

The results presented so far strongly indicate that the difference in the implementation of food loss management in the respective companies and the difference in the assessment of the barriers show a correlation. Since the general assessment of the trend is the same, it follows logically that the different strength of the barriers has an influence on the implementation. The barriers in question are, therefore, examined in more detail below.

The greatest difference in the assessment is shown by the barrier ‘Lack of knowledge among employees for the implementation of improvement measures’. The formation of company-relevant skills and knowledge is a core task of the company to promote engagement with current trends. Accordingly, this barrier represents the ‘Employees’ dimension of logistics described above. Thus, this barrier shows that the Ethiopian companies surveyed see difficulties in addressing this dimension of logistics with regard to the food loss management trend. However, the appropriate further qualification of employees and the targeted recruitment of qualified personnel are prerequisites for the successful consideration of this logistics dimension.

The barrier 'Lack of willingness of network partners to cooperate' shows the second largest difference in the assessment. The relevance of cooperation with network partners to meet trends in food logistics is reflected in the logistics dimension 'Network'. This is particularly important for food loss management. Without designing cross-actor processes with low losses, losses are merely shifted to another actor with selective optimization measures.

The third largest difference in the experts' assessment is the barrier 'Lack of technology to create transparency about losses in own network'. The lack of use of technology, whether due to a lack of resources for the technology or a lack of competencies for its use, reflects the fact that the logistics dimension 'Technology' is not sufficiently taken into account when dealing with FLM.

The barrier 'Lack of uniform measurement methods for food losses' also shows a significant difference between the observed groups. Uniform measures, standards and guidelines fall under the logistics dimension 'Strategy'. Companies should be actively involved in standardization processes in order to create cross-company synergies. In relation to FLM, this is above all the question of uniform measurement methods addressed here, in order to bring the different network partners onto the same basis for discussion.

The last barrier with significant differences is the barrier 'Employee resistance to process changes'. As described in the introduction, it is an elementary task of the logistics dimension 'Process' to establish structured processes in the company and to involve the employees in them. If employees actively oppose changes in these processes, this is evidence of a failure on the part of the company to give this logistics dimension sufficient relevance and to implement suitable measures to successfully incorporate this logistics dimension within the company.

The explanations given here have shown that, despite the same assessment of relevance, Ethiopian companies face greater challenges that prevent the implementation of FLM. These barriers can be directly linked to the five logistics dimensions.

4.2. Derive a readiness assessment model to assess engagement with food loss management

Following this deduction, the question arises as to how organizations must position themselves in the logistics dimensions discussed in order to deal with the barriers described in an appropriate manner, and, thus, respond more effectively to the trend of food loss management. For this purpose, a framework is proposed which shows important aspects of the respective

dimensions and offers the possibility to check the readiness level of an organization with regard to the described logistics dimensions.

Figure 8 summarizes the proposed readiness level assessment model.

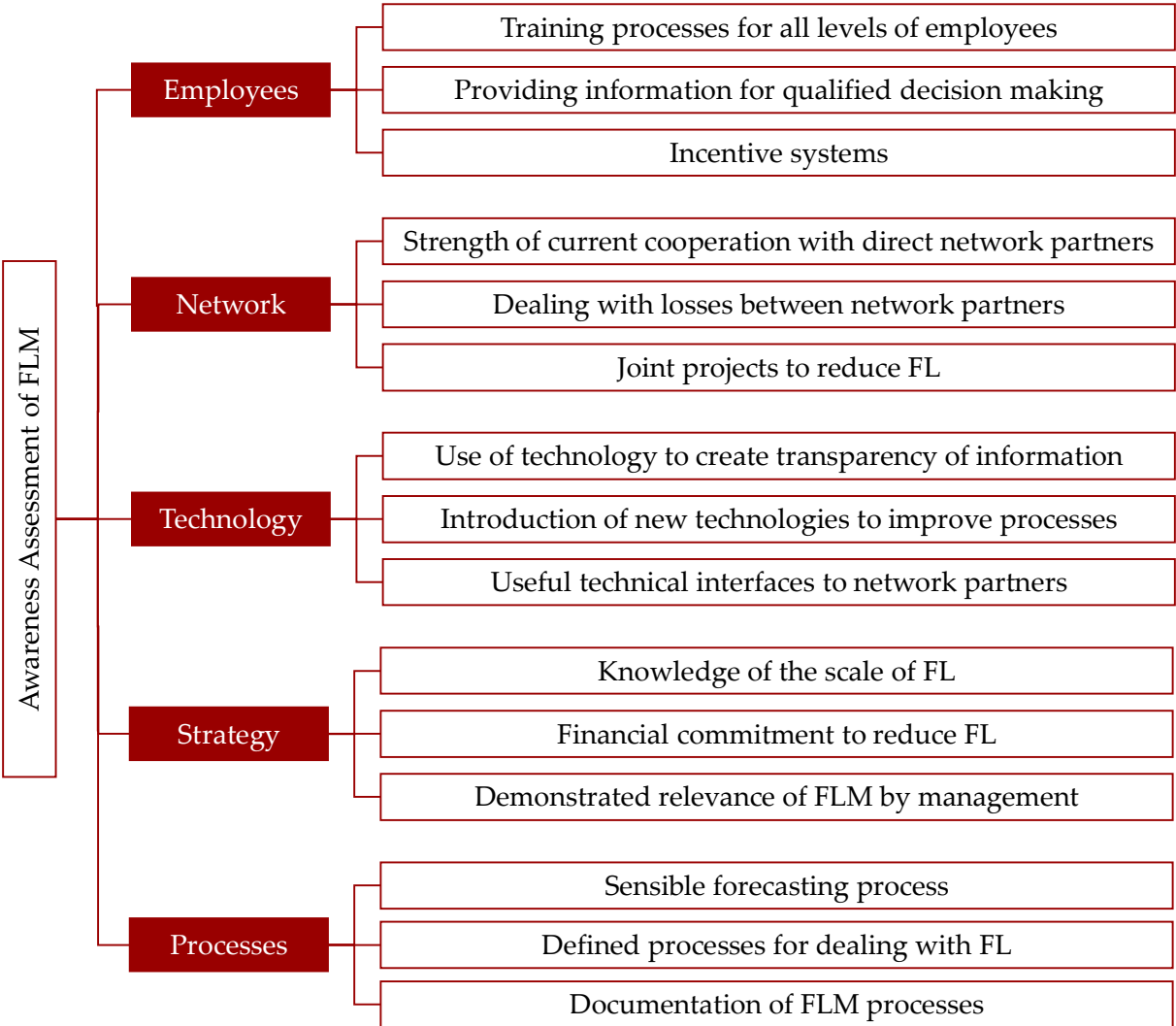


Figure 8 - Readiness assessment of food loss management

In order to increase the involvement of employees and their willingness to contribute to food loss management in a target-oriented manner, an intensive examination of the skills and potential of employees is essential. It is also extremely important to show employees that their potential is recognized and promoted within the company. This applies to employees at all levels. Thus, it can be concluded that established training processes for employees at all levels are a building block for successful familiarization of the employee dimension with food loss management.

Well-educated and trained employees can only react and respond to new challenges in a reasonable way if they are provided with the necessary information to make appropriate decisions based on it. Accordingly, it is indispensable for the company to provide employees

with as much process information as possible at all times to support decision-making. However, a company must do this in a structured process so that the information can also be usefully absorbed and taken into account by the employees. It is, therefore, not only a question of providing sufficient information but also a necessity to pre-process the information in a way that is customized to the employee's level of knowledge and workplace, and to process and present it in a suitable manner.

The third important pillar for the meaningful involvement of employees is the long-term motivation of the employees to commit themselves to the company with regard to food loss management and to participate in the further development of solution approaches. Besides a generally open and positive corporate climate, incentive systems are necessary for increased commitment. These not only increase the motivation of the employees to think about an issue and to get involved in a change process; they also reward additional commitment in retrospect. The knowledge that other employees have already benefited from an incentive system can also motivate others to get involved. The design of an incentive system must be aligned with the processes and structures in the company. This can include financial incentives, internal company awards such as 'Employee of the Month' or other improvements such as additional vacation days.

In summary, the following pillars are proposed to rank the readiness level of a company with respect to the logistics dimension 'Employees':

- Training for all levels of employees
- Providing information for qualified decision making
- Incentive systems

In order to involve one's own network in tackling the challenges posed by food loss management, it goes without saying that, in addition to one's own commitment, the willingness and cooperation of the network partners is also necessary. However, a company can create the best conditions at the time to tackle the challenges in a collaborative manner. The strength of the current cooperation with the network partners can be seen as a benchmark and a pillar for this. Companies that do not make an effort to establish strong cooperation in their day-to-day business will not have the opportunity to initiate further projects regarding an improvement of food loss management together with their partners. In particular, long-term relationships

strengthen the trust between network partners and make it possible to work together on challenging problems.

Another pillar to consider should be the handling of losses between network partners. Without established processes on how to react to losses in deliveries between partners, a substantial component in the establishment of food loss management is missing. What is needed above all is a common understanding that losses should not be shifted from the own system boundaries to the partners, but that sources of loss at the interfaces should be understood as a joint task and responsibility and that joint approaches to solutions should be sought.

A further statement about the readiness level of a company with regard to the logistics dimension 'Network' should be made on the basis of pre-existing or successfully completed joint projects concerning food losses. A company that has already established intensive relationships with network partners and has reacted to noticeable problems and causes of loss through joint projects to overcome these shows itself capable of working successfully with network partners on the one hand and implementing the objectives of this logistics dimension on the other.

Concluding, it is suggested to use the following pillars to classify the readiness level of a company with respect to the logistics dimension 'Network':

- Strength of current cooperation with direct network partners
- Dealing with losses between network partners
- Joint projects to reduce food losses

A company that has successfully positioned itself with regard to the logistics dimension 'Technology' should be able to use suitable technologies to generate information transparency within its own processes. If this is done, it enables fact-based decision-making and a timely response to problems. The use of suitable technologies is, therefore, of essential importance, as information can be provided more quickly and effectively than through manual processing of the information. In addition, the use of artificial intelligence, for example, enables not only the provision of information but also the provision of proposals for action that decision-makers can incorporate into their own considerations.

Additionally, a company's ability to introduce new technologies in a targeted manner should be considered when assessing its readiness levels. The non-introduction of any new technologies shows that companies do not deal with current technology developments and,

therefore, do not integrate the potential of new developments into their processes. Nevertheless, the introduction of a technology must be targeted. A technology introduction that has only been made as a result of the current hype around a technology is generally not effective but binds manpower to it and potentially leads to an unnecessary introduction of additional processes. This, then, possibly leads to increased complexity of processes and makes them more error-prone. A company with a high level of readiness with regard to this logistics dimension is, therefore, able to evaluate a technology in terms of its potential for the company and its positive contribution to food loss management in this context, and then introduce it in a targeted manner. In addition to the targeted use of technologies within the company, it is also essential for a company with a high readiness level to have suitable IT interfaces with its network partners. Electronic information transfer is more efficient and less likely to cause errors than manual information transfer. In addition, information with suitable interfaces can be fed into the company's own systems more quickly and can, thus, contribute more efficiently to the company's own decision-making. In contrast, breaks in service due to manual processing are very likely to result in errors.

Putting it all together, in order to evaluate the readiness level of a company with respect to the logistics dimension 'Technology', the following pillars are proposed:

- Use of technology to create transparency of information
- Introduction of new, adequate technologies to improve processes
- Useful technical interfaces to network partners

A company that strives to establish food loss management and to tackle this trend must also position itself strongly with regard to the logistics dimension 'Strategy'. An important field of action is the general knowledge about the extent of losses in the company. If a company does not make any effort to build up thorough knowledge in this area, it has a particularly low level of readiness with regard to this logistics dimension. In contrast, companies that are fully aware of the extent of losses and their causes are leaders in this area.

Companies that are aware of the strategic importance of food loss management and actively strive for improvement in this area allocate a budget for food loss management. However, these financial resources should be applied in a targeted manner. Thus, a high level of readiness in this pillar is demonstrated not only by the fact that a company provides budget for food loss management but that it combines this with strategic consideration and goal setting.

As a further pillar, a leading company should promote food loss management and a positive culture in this context as a characteristic of its own company. This requires, above all, that the management levels set a good example here and take an active role both through their actions and through their decisions. In addition, the relevance of the topic for the management level should be regularly communicated to the employees as well as to network partners and customers, and this strategic orientation of the company should be made clear.

In order to rank the readiness level of a company with respect to the logistics dimension 'Strategy', the following pillars are proposed:

- Knowledge of the scale of food losses
- Financial commitment to reduce food loss
- Demonstrated relevance of food loss management by management

In order to take the logistics dimension 'Process' into account, it is essential to define processes for dealing with food loss in the company and how these losses can be avoided through certain actions. If employees are not given clear processes on how to deal with losses, they will have to find new ways each time or possibly establish their own approaches to solutions that do not necessarily correspond to the company's objectives. Leading companies in this field should, for example, define processes for dealing with food losses based on the avoidance pyramid (Papargyropoulou et al. 2014). Companies that do not make these specifications lose possible advantages that can be achieved by a certain utilization strategy.

In addition to the necessary definition of processes, these would also have to be documented in a meaningful way. This step, which seems very logical in general, will also lead to undesired processes with losses or even generate them if it is not implemented properly. It is of vital importance that all documentation is user-oriented. If the documentation cannot be quickly understood and followed by the users, for example due to language or complexity, this documentation will not fulfil its purpose of establishing the defined processes.

As the third pillar of the logistics dimension 'Processes', it is proposed to assess companies in terms of their forecasting processes. Companies should be aware of their sales, especially when dealing with food and its perishability. Thus, non-existent or inadequate forecasting processes promote uncertainty, and can also act directly as a cause of loss. A successful company controls its products via structured forecasts, enabling planning reliability.

As a conclusion, in order to assess the readiness level of a company regarding the logistics dimension 'Process', the following pillars are proposed:

- Define processes for dealing with food loss
- Document food loss management processes
- Establish a suitable forecasting process

The framework provides the opportunity for an organization that wants to strengthen its logistics concerning food loss management to orientate itself in a manner in which a high readiness level already exists in the five dimensions, and in which dimensions the fundamental barriers have not yet been addressed. In this way, transparency is created with the help of this framework so that the company can decide on suitable measures based on it, which reduce the weaknesses of the company.

5. IMPLICATIONS

The presented model provides a definitional framework for the analysis of the readiness level of organizations regarding the reduction of food losses in logistics. On the one hand, the model can be applied directly in practice by actors within the food value chain for self-assessment. In addition, it can also be used by administrative and governmental bodies for decision-making. Furthermore, it also contributes to scientific research and, thereby, expands the knowledge base in this research area. Below, the effects for each of the described groups of actors is discussed in more detail.

Actors in the food value chain should look at the presented areas in their own analysis to get a first self-assessment. This helps above all to get started with the topic and to develop a feeling for one's own status. As described above, many actors within the food value chain, especially in developing countries, hardly know what their own status is regarding the degree of addressing the issue of food losses within their own organization. Consequently, this model can provide an introduction to the fundamental discussion of the topic. Only with a corresponding transparency about one's own status, problems and potentials can food losses be effectively reduced.

Administrative and governmental actors can use the model to check the current situation within an organization to be supported for planned support and funding programs. The model was

derived on the basis of company data, but because it is linked to the dimensions of logistics it can also be applied in general to organizations that organize food logistics structures. Particularly in developing countries, this also includes larger aid organizations of the UN or other NGOs.

The research community is dealing with the topic of food loss management in many dimensions. The present work provides a contribution to closing the research gap with regard to the question of how to get started with an active prevention of food losses in logistics by actors of the food value chain.

6. FINAL REMARKS

This paper deals with the question of the extent to which the approach to the reduction of food losses differs in developing countries, exemplified by Ethiopia, and industrialized countries, exemplified by Germany. It was found that German and Ethiopian companies consider the relevance of the issue of food loss to be equally important. In contrast, there is a difference in the implementation of measures against food losses. The analysis showed that Ethiopian companies have established only a small number of activities against food losses in their own structures. Based on this, a model was derived and proposed that allows organizations to assess their own readiness level with regard to addressing food loss reduction.

The postulated model not only provides companies with the possibility to assess their own readiness level; governmental organizations or NGOs can use the proposed model to analyse the structures for projects and to define project priorities.

By enrolling the model in case studies as examples, benchmarks can be derived for the individual pillars of the model and, thus, concrete control variables can be established for assessing the readiness level.

The model is naturally subject to some limitations. The proposed model was derived from the statements of Ethiopian and German experts and their statements about the markets. The participants represent a relatively small sample of stakeholders from the two countries and are not a representative sample. However, the model can be applied globally, as the barriers prevailing in Ethiopia correspond directly to the logistics dimensions presented here, which generally apply to addressing trends in logistics. Nevertheless, the application should take into account that the characteristics of the relevant barriers might differ in other application markets. Based on the derivation, however, it is assumed that the application can be used for developing

countries with a similar level of development. The proposed model is also limited by the fact that it only provides a theoretical framework. A concrete design of a question-based application tool that enables a concrete recommendation for action from the assessment of a company's readiness level is a subsequent step that must follow on from the work presented here in order to fully achieve the goal formulated at the outset.

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