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BROWNBOARD

- A TOOL TO FACILITATE IMPROVED SUPPLY CHAIN TRACEABILITY

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ABSTRACT

Purpose of this paper This paper aims to describe the brownboard tool and to elaborate on its characteristics. Brownboard can be seen as a tool within process mapping and it is focused on supply chain traceability. The process map is created in a dynamical group process where supply chain actors with different competence level meet and interact.

Design/methodology/approach The brownboard tool is used in a case study based on a Swedish supply chain for frozen food; ice cream. The data collection includes on-site interviews, observations, and review of internal documents. Empirical results from the case are used to exemplify the use of the tool.

Findings This study indicates that the brownboard tool enables identification of potential traceability related improvements by its visualization of the flow throughout the supply chain and through highlighting potential risks connected to traceability for the supply chain actors.

Research limitations/implications The evidence has so far been collected through a single case study, and is thereby limited. Although there are limitations in how far one can generalize, the evidence should be regarded as a first step toward future research on this tool in a wider supply chain context.

Practical implications The Swedish food industry has worked intensively with internal traceability, while supply chain traceability is identified as important but not yet fully implemented. In addition, due to increased consumer awareness about food safety, new regulations, and standards, traceability has become a focus area for the food industry in Sweden. Brownboard is one possible tool that can be used in order to facilitate the process towards fully implemented supply chain traceability.

What is original/value of paper This paper describes and illustrates the use of a novel tool within process mapping for gaining improved supply chain traceability.

Keywords: Food safety, food supply chain, food traceability, process mapping, small and medium-sized enterprises (SME)

1. INTRODUCTION

The food sector has radically changed during recent decades (Stadig et al., 2002). 60 or 70 years ago food was sold by local dairies, butchers, bakers, and farmers and very few food products were ever packed and transported between different actors of a supply chain (Thorén & Vinberg, 2000). Today, we expect to be able to buy food from all over the world and food-products are distributed more quickly and over greater distances than before. This led to advantages in terms of availability but also disadvantages in terms of more complex supply chains (Stadig et al., 2002).

Since a defect-free product, or safe foodstuff, delivered on time is no longer considered a competitive advantage for a company but a basic requirement, collaboration and coordination of the supply chain are needed (Mentzer et al., 2001). Bowersox et al. (2002) state that the importance of collaboration has increased and the supply chain has thus become the primary unit of competition. Lambert and Cooper (2000) agree and claim that companies no longer compete as solely autonomous entities, for example store vs. store, but rather as supply chain vs. supply chain. They also state that in this new setting:

“the ultimate success of the single business will depend on management’s ability to integrate the company’s intricate network of business relationships.” (Lambert & Cooper, 2000)

The supply chain perspective can lead food companies, from being effective companies, to being parts of effective food supply chains, where the entire supply chain competes with other supply chains (Kim, 2006).

In the modern food production industry there are several critical points along the food supply chain, especially in interfaces between different actors (Olsson, 2004; Stadig et al., 2002). Different information systems occur in the supply chains. Shortcomings in the capability of the systems to communicate with one another have led to manual transfer of a great deal of information between the actors. This manual transfer can cause manipulation or loss of information, intentionally or unintentionally (Eken & Karlsson, 2006). Information, and particularly identity, are key components which traceability is dependent on (Stadig et al., 2002). It is thereby important to avoid losing this information in the interfaces between supply chain actors in order to ensure supply chain traceability (Eken & Karlsson, 2006; Stadig et al., 2002). There is therefore a need for methods/tools to facilitate the attainment of a good overview of the entire supply chain.

Supply chains can be seen as a process constituted by several interlinked subprocesses. Process mapping can thereby be a suitable method to gain an overview of the supply chain; it is a well-known method to depict processes (Pojasek, 2005; Keller & Jacka, 1999; Matsumoto et al., 2005; Anjard, 1996). Process mapping focuses on *what* is done and not *where* it is done, that is why it can be considered suitable to use in mapping processes which transcend organizational as well as functional boundaries (Ljungberg & Larsson, 2001). Brownboard as described in this paper can be seen as a traceability-focused tool within process mapping where the process map is created in a dynamical group process where supply chain actors with different competence levels meet and interact.

This paper aims to describe the brownboard tool in a food traceability context and to elaborate on the characteristics of the tool. The use of the brownboard tool is exemplified by a case study in a Swedish supply chain for ice cream.

The outline of this paper is structured as follows: After a presentation of the research method used in the study, the area of traceability within the food industry is presented briefly, since it is the attempt to achieve supply chain traceability which has initiated the need for an overview of the entire supply chain. Process mapping is then presented in general, and the brownboard tool is positioned as a tool within process mapping. Thereafter, the brownboard tool and its characteristics are presented. The use of the tool is exemplified with the case study. The described tool is then discussed and the paper is finalized with a presentation of the conclusions.

2. METHOD

This paper is an explorative study based on a single case study in a food supply chain comprising interviews, observations, and internal document studies. Additional interviews on process mapping in general and the brownboard tool in particular, have been carried out. The case study was carried out on a Swedish supply chain for ice cream. Ice cream is an interesting product from a traceability point of view since it is sensitive to variations in temperature. In addition, the ingredients are sensitive from a microbiological point of view and from an allergenic point of view. The case study is chosen as a strategy in line with Eisenhardt (1989): *“building theory from case study research is most appropriate in the early stages of research on a topic”*

The case study as strategy may involve either single or multiple cases (Eisenhardt, 1989) both have advantages as well as disadvantages. This paper, however, is based on a single case, since it offers the possibility to achieve a greater depth of input from the system studied than with multiple cases (Voss et al., 2002). Efforts are nevertheless made in order to counterbalance the limitations of generalizability in a single case study. These efforts are made through complementary interviews. Through these interviews other experiences and business examples were integrated to provide a broader perspective, and to serve as a basis for comparing and contrasting the results from the case study.

The study is conducted within the food industry since supply chain traceability is now a focused topic within this industry due to recent food scares and ever harder demands and legislation. In future studies parallels can connect this study to other production areas than food.

2.1. Case description

The focal company, Pipers glace, was chosen as it is a special case, due to interesting characteristics. It is a very small company, with no production of its own, but with very high standards when it comes to food safety, with organic products, and a very large prestigious customer in its customer base. Therefore, traceability issues have become high on the company agenda due to customer demands and the internal strategy of food safety and quality control. Easy access to internal documents was also a benefit in this case study.

In this case two supply chain actors are studied in depth: Pipers glace (the focal company), and Engelholms Glass, (the production company) who runs production for Pipers glace. The focus of the study is in the dyad between two companies in the supply chain, and on their inbound

and outbound contact to other actors in the supply chain (see Figure 2.1). However, the companies' quality control and traceability stems from customer demands.

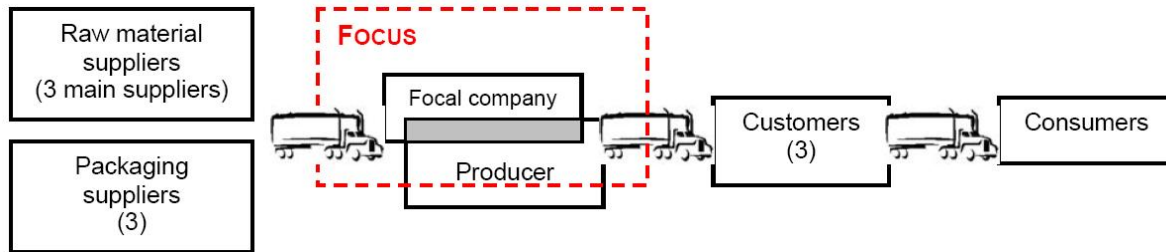


Figure 2.1 Illustrates the different actors in the studied supply chain, how many they are and the selected focus of the study.

Pipers glace started its production as early as the turn of the 20th century. When the founder of the company got older he left his recipes to his son with the exhortation never to be careless with the ingredients (www.ekoweb.nu) and that the son had to personally know every supplier, since:

“You can never trust in people you haven’t seen” (www-old.vastsverige.com)

So this tradition of being careful with ingredients was handed down within the family. In 1993 the company was KRAV⁵³ certified and the company’s products are almost exclusively produced using organic ingredients (www.ekoweb.nu). In 1994 Pipers glace contracted another ice cream producer to produce a small part of its production since it had outgrown its own production facilities. This part of production has gradually increased so that in 2004, it represented the entire production. Nevertheless, production for Pipers glace today is only about 3% of the contracted Engleholms Glass’ turnover. Both companies are categorized within the small and medium-sized enterprises (SME⁵⁴) category, which also characterizes the vast majority of food production companies in Sweden. However, since 1997, Pipers glace has had a large, prestigious customer who has very strict requirements when it comes to food safety.⁵⁵

Due to its own high standards concerning food safety and its organic profile, Pipers glace has attracted large, new customers and the company is expanding step by step. Engleholms Glass is a family-owned company, also known for manufacturing quality products. Their ice cream production started as part of a local dairy. The production of ice cream continued later in a separate company. Since it was founded the company has grown, moved to new production facilities, and made gradual expansions.⁵⁶

⁵³ KRAV develops organic standards and inspects food, and food products to these standards.

⁵⁴ Companies that employ fewer than 250 people and have an annual turnover not exceeding EURO 50 million are included in the SME category. (RECOMMENDATION 2003/361/EC)

⁵⁵ Information provided by the involved companies Engleholms Glass and Pipers glace.

⁵⁶ Information provided by Engleholms Glass, the production company and their homepage.

2.2. Data Collection

The data in the case were collected through interviews, observations, and review of internal documents. This is in line with Yin (2003) who argues that the data in a case study can come from many different sources of evidence and mentions especially: “*documentation, archival records, interviews, direct observation, participant-observation and physical artifacts*” (Yin, 2003). Data collection was complemented with information gathered at the workshops with the companies involved in the case study. The brownboard tool was created and used to visualize the data to all participants.

All interviews carried out in the study were based on open questions with an explorative purpose to achieve an overview of the studied companies and the process. The respondents were chosen with respect to their competence and to their role in the studied companies. The respondents in the studied companies were selected with the purpose to get a good overview of the company and the process. The interviews were of different length from half an hour to two hours due to the role of the respondent and the situation. Respondents and interview procedures are presented in Table 2.1. In order to gain participants’ trust and to ensure an open climate in the interviews (Ejvegård, 2003) different procedures were used, depending on the respondents’ experience of academia. After the interviews notes were transcribed. In cases of uncertainty the notes or questions to follow up the uncertainty were sent to the respondent to minimize the risk of misunderstandings.

Table 2.1: Respondents and procedure (Number of people)*

Company	Function	Procedure
Engelholms Glass	CEO	Notes, semi-structured
Engelholms Glass	Quality manager	Notes, semi-structured
Engelholms Glass	Laboratory staff (1*)	Notes, informal, unstructured
Engelholms Glass	Production managers (2*)	Notes, informal, unstructured
Engelholms Glass	Production staff (2*)	Notes, informal, unstructured
Pipers Glace	CEO	Written, structured
Good Solutions	Consultant	Taped, semi-structured
Lund University	Professor of Engineering logistics	Taped, semi-structured

Information was also obtained through direct observation of the production line. The observation followed the flow of products through the process and was done with the aim to get a clear picture of the process. It was combined with informal, unstructured interviews with the staff to provide a deeper understanding of production procedures and the flow of information and products through the studied parts of the supply chain. The interviews made it possible to add the aspect “why” to the study since according to Carlsson (1990) only answers to “how” questions can be found through observations.

The impact on the observed process by the observer can be considered negligible in this case and thus can the observation with consideration to Merriam’s (1994) classification schemes be qualified as an “observer-participant” observation with a tendency towards “complete observer”. This is the case since the observation was made with the clear purpose of getting a

picture of how the production process is run today. During the observation the intention was not to suggest changes to be made. The questions to the staff never questioned any of their actions but were rather questions concerning how procedures are carried out and how the different steps in the process affect the product. During the observation production staff was well aware of the presence of the observer. During the observation notes were taken and transcribed directly afterwards. With approval from the company some pictures were also taken as visual reminders and were later used in the internal workshops. Directly after the observation a rough draft of production flow was made by the observer.

Internal documents such as contracts, records, policies, HACCP⁵⁷ documents and procedural guidelines were reviewed in order to obtain information to compare, contrast, and supplement the information obtained in the interviews and during the observation.

Information was also gathered from CEOs, the quality manager, production managers and staff throughout two workshops. Without interference from researchers they discussed the process together and gave their views of the production process by their map of the flow through the entire production, from incoming trucks with ingredients to delivery of products, for a selected product. Different possible risk scenarios were then explored through a discussion of the created map with consideration to different traceability-related issues.

3. TRACEABILITY IN THE FOOD INDUSTRY

There are two types of traceability; internal and external (or local and chain). Internal traceability refers to the ability to trace how ingredients and raw material within a plant are mixed and transported between different operations in production, while external traceability links the different actors in the supply chain to a connected chain (Isaksson, 2004; Alklint & Göransson, 2004). Different definitions of traceability exist, including the one posed in the regulation (EC 178/2002) which concerns food safety in the European Union:

“traceability means the ability to trace and follow a food, feed, food-producing animal or substance intended to be, or expected to be incorporated into a food or feed, through all stages of production, processing and distribution” (REGULATION (EC) No 178/2002 Article 3 §15).

Internal and external traceability are based on the control of identity. Identity provides an opportunity to separate a certain quantity of product through some kind of labeling. The batch is a common quantity in this context (Stadig et al., 2002). Every batch receives a number and for internal traceability to be achieved this number must follow the batch in the production line and finally be connected to the number of the finished product. If there is effective control of the identity throughout the production line, and this is kept throughout the supply chain, then it is possible to make a fast recall⁵⁸ or withdrawal⁵⁹ when a problem occurs in production, thereby resulting in unsafe batches (Isaksson, 2004). Traceability is needed to protect consumers by ensuring fast product withdrawal or recall. The financial aspects of a recall or a withdrawal drive an aspiration for a narrow, limited recall or withdrawal through precise identification and location of the damaged products which are managed with traceability (ECR, 2004). Not only are recalls and withdrawals costly for companies in the financial short term,

⁵⁷ Hazard analysis and critical control points, a system to identify, evaluate and manage issues critical for food safety.

⁵⁸ Recall: *“mean any measure aimed at achieving the return of a dangerous product that has already been supplied or made available to consumers by the producer or distributor.”* (DIRECTIVE 2001/95EC Ch. 1, Art. 2)

⁵⁹ Withdrawal: *“mean any measure aimed at preventing the distribution, display and offer of a product dangerous to the consumer.”* (DIRECTIVE 2001/95EC Ch. 1, Art. 2)

but they can also jeopardize the reputation of the company or brand and thus have long-term financial consequences (Töyrylä, 1999).

Progress within quality and food safety in general is driven with help from the legislation which requires actors in food supply chains to commit to self-examination, internally through the systematic, preventive approach of HACCP. (Stadig et al., 2002) However the need for traceability is mainly driven by basic regulatory demands (EC 178/2002), customer and consumer demands. Retailers require that their suppliers are certified according to different standards such as the global food safety standard by BRC (British Retail Consortium) (Stadig et al., 2002) or the recent international standard ISO 22 000 that include a farm to fork perspective on food safety (ISO Homepage). In the end, it also comes down to increased consumer awareness of food risks and their demands for safe food (Morrison, 2003).

Internal traceability is maintained through internal revisions according, for instance, to BRC standards where the food safety risks within the company itself are considered. However, in gaining and eventually maintaining supply chain traceability, with a value-adding approach beyond basic regulatory demands, actors need tools which facilitate the acquisition of a commonly shared and holistic approach among the actors which encompasses the entire supply chain.

4. PROCESS MAPPING

Process mapping is an important management tool (Winch & Carr, 2001) to obtain a holistic understanding of a process (Pojasek, 2005; Keller & Jacka, 1999; Matsumoto et al., 2005; Anjard, 1996). By analysis of the processes depicted using the mapping tool, improvements in process performance can be achieved. These improvements can increase customer satisfaction through removal of inefficiencies and duplications, reduction of process cycle time and costs, and increased productivity. The visualization created through process mapping can generate improvements in understanding as well as establishing a commonly shared view of the process and can thereby even enhance communication. (Pojasek, 2005)

According to Anjard (1998; 1996), a process map is a visual demonstration of work processes. The map shows how inputs, outputs, and tasks are linked together and it identifies the major steps in the process, who performs the steps, and where problems occur over and over again (Anjard, 1998; 1996). Process is defined by Larsson & Ljungberg (2006) as: “a repetitively used network of activities linked in an orderly manner using information and resources for transforming “object in” into “object out”, extending from the point of identification to that of the satisfaction of customer’s needs.”

Similarly, according to Anjard (1998; 1996), process mapping is: “identifying, documenting, analyzing and developing an improved process,” i.e. he states that process mapping is not only the creation of the process map but also the improvement process based on the map. In contrast, Biazzo (2002) says that process mapping may: “consist of constructing a model that shows the relationships between the activities, people, data and objects involved in the production of a specified output.” Biazzo (2002) leaves out the improvement process from the concept of process mapping. Keller and Jacka (1999) argue that: “Process mapping is a systematic approach for documenting processes and their related cycle times”. However, they do include both use and analysis of the maps in their posed strategy for process mapping, which includes the following five steps:

1. Establish process boundaries.

2. Develop the data gathering plan.
3. Interview the process participants.
4. Generate the process map.
5. Analyze and use the map.

Differences in definitions of the process mapping concept exist. Anjard's (1998; 1996), definition of process mapping: "*identifying, documenting, analyzing and developing an improved process,*" is adopted. Process mapping in this paper will thus consider the procedure in which a process map is created, reviewed with involved actors, and the steps taken toward the improved process.

Several methods and models exist for conducting process mapping. There are also many different symbols to visualize the process steps on the map. Ljungberg and Larsson (2001) state that the choice of symbols and method is usually based on earlier experience, available computer programs, and how great the need for simplicity is. Despite the choice, the importance of consistency in the use of methods and symbols is highlighted (Ljungberg & Larsson, 2001).

Information gathering before the mapping of a formal process can be done in different ways according to Ljungberg and Larsson (2001); A "walk through", a "virtual walk through" or by a mapping team. A "walk through" means that people responsible for the process mapping simply "walk through" the process and along the way they interview people involved in the different activities, and thereafter produce the map. Ljungberg and Larsson (2001) point out the drawbacks that staff might feel uninvolved, and that it is only the people responsible for mapping the process who gain a complete understanding of it. A "virtual walk through" allows more people to participate in the mapping process, thereby obtaining a holistic perspective but also gaining knowledge of the method. Process mapping based on a "virtual walk through" can be done by calling different representatives from the entire process to a meeting. With guidance and questions from someone in charge of mapping the process participants describe their part of the process. A "mapping team" consists of members who represent the different parts of the process. Team members need to have a good knowledge of the process within their areas and a fair knowledge of other processes in order to have an overview of the complete process (Ljungberg & Larsson, 2001) .

According to Wilding and Newton (1996) companies miss out on important steps if they short cut the data gathering and analysis by focusing too early on defining the problem(s). If this is done, the process map becomes based on perception rather than on reality. In accordance Keller & Jacka (1999), and Pojasek (2005) pinpoint the importance of involving employees in the mapping process and of distributing the finished process map not only to management but throughout the entire organization. It is also important to find the right level of detail on the process map. The level must be high enough to provide a good overview but also detailed enough to be useful. Process maps can be split into macro- and micro-level maps. In micro-level maps a subprocess or part of the process is examined in greater detail (Ljungberg & Larsson, 2001).

The process map takes no consideration of traditional organizational boundaries and it is important that mapping is done with a steady focus on *what* is done and not *where* it is done (Ljungberg & Larsson, 2001). The tool is therefore well suited to use in mapping activities which transcend organizational as well as functional boundaries. These characteristics therefore make the tool practical for demonstrating workflow within organizations, such as in production; or between organizations, such as actors in a supply chain.

5. THE USE AND IMPLICATIONS OF THE BROWNBOARD TOOL

Process mapping has successfully been used to gain an overview of processes beyond functional boundaries. The step toward using the tool in a supply chain perspective seems therefore natural. Nevertheless, literature presenting experiences from mapping supply chains is scarce. For the logistician the focus is normally targeted on the issue: “*How value is created through the logistics process*” (Persson, 1995). With the brownboard tool, focus is instead placed on the question of where in the supply chain risks occur, risks which can lead to loss of traceability. The brownboard tool can be seen as traceability-focused tool within process mapping where the process map is created in a dynamical group process where supply chain actors with different competence levels meet and interact. The procedure in which the map is created is facilitated by the visual approach in the tool. In comparison to process mapping in general the brownboard tool encompass not only the activities but also what happens in-between the activities and the different actors. This is also required in order to follow the traceability through the supply chain.

The brownboard is simply brown “wrapping paper” which provides a long, broad area for the ones creating the map to be creative on. The brownboard is very flexible and photos, Post-it® notes, product and package prototypes, symbols, descriptive texts, documents like records and procedural guidelines can be fastened on to the brownboard. Brownboard can also be drawn and written directly on. The entire brownboard can then be mounted on a wall to provide a good overview of the entire process depicted on the brownboard. The mapping of a supply chain with the brownboard tool does not focus on either macro levels or micro levels, as in traditional process mapping, but on bringing in all relevant information from a traceability perspective and still maintaining a useful overview.

The brownboard tool uses special symbols to capture traceability related aspects in contrast to symbols used in ordinary process mapping. The symbols for automatic process, manual process, rest, split, and mix (see Figure 5.1) are used in the brownboard tool to describe the flow and to facilitate the explanation of the process. Mix and split are especially important from a traceability point of view since they point out events which are critical in maintaining the identity and thus the traceability of the foodstuff. The symbols, in combination with a discussion of possible scenarios, generate awareness among the involved actors of the existing risks connected to loss of traceability. The symbols used in the brownboard tool are unambiguous and easy to understand intuitively, even for those unfamiliar with the tool or with process mapping in general.



Figure 5.1: The different symbols used in brownboard mapping

The brownboard tool is a combination of the actual creation of the map on the brownboard and the important journey toward that map. The journey can take slightly different turns depending on different needs and openness in the companies, on their insights and on their size.

According to one of the respondents the most important part of the mapping procedure is the journey itself toward the map and that is why the workshops are an important part of the mapping procedure. Important steps in the journey are schematically depicted in Figure 5.2. The first three steps in the procedure function as a loop where, depending on the situation, you can take different numbers of turns. For instance, one loop can be made for each supply chain actor and then a final loop made with all the actors in the supply chain. The second step of brownboard mapping and the third step of the workshop can be more or less integrated. When a brownboard map is created which the supply chain actor/s agrees upon, the analysis goes further into steps four and five. These steps can also be more or less integrated and run in a loop until a clear action list is established for how the traceability can be improved. The improvements are then followed up in the very last step.

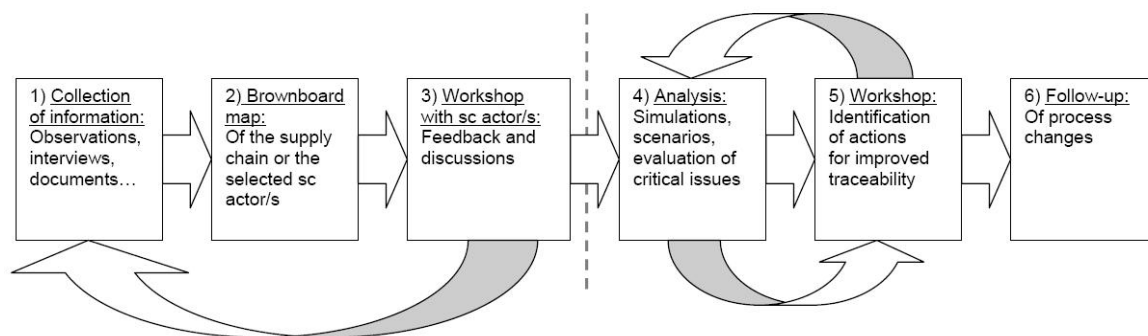


Figure 5.2: The brownboard mapping procedure

According to two respondents, there is frequently no commonly shared picture among the supply chain actors of a process. The description varies between staff from different parts of the process and between different hierarchical levels within an actor. Through brownboard mapping the different supply chain actors or representatives from different functions are given naturally arising opportunities to communicate. Through guided discussions during the workshops, and the visual aid provided by the brownboard tool, commonly shared ground evolves. This facilitates communication between the actors since they then share the same view of the process and thus talk the “same language”.

In the case study made, the brownboard tool was a useful way for the supply chain actors involved to discuss, in a relaxed way. Different possible scenarios connected to traceability and risks of losing traceability were elaborated. Furthermore, the discussion made it possible for them to highlight and discuss problems and possible improvements in order to achieve improved overall traceability, across functional, as well as organizational boundaries.

In a mapping project it is important to have the project fully supported by members of management who are competent to make decisions. However, the respondent’s previous experience of using the tool within the food industry also shows the importance of staff involvement, which is not to be underestimated. The establishment of a feeling among the staff that they and what they do are important can in itself lead to process improvements. Asking the staff if they have ideas on how their part of the process could be improved starts a creative process among the staff which, in the end, can contribute to increased overall performance.

Different actors and staff functions were integrated in the creation process of the brownboard map. The mapping in the case study were conducted with a combination of the “walk thorough” and the “virtual walk through” described by Ljungberg & Larsson (2001) in order to achieve

staff involvement and to widely spread a holistic view of the process. The brownboard tool also facilitated the communication between academia and practitioners in the case through its visual and collaborative characteristics. The brownboard mapping procedure in the case study started, after the initial collection of information, with a first brownboard summing up how the researcher had understood the process.

The brownboard map generated in the case is illustrated in a simplified way in Figure 5.3. The brownboard is to be read from left to right mirroring the sequence in the process studied. The process studied starts with the interface to the suppliers and continues to the right towards the interface to the customers. The yellow *Process description* notes in Figure 5.3 represent notes which were posted on the brownboard describing and providing traceability-related information about each step of the process.

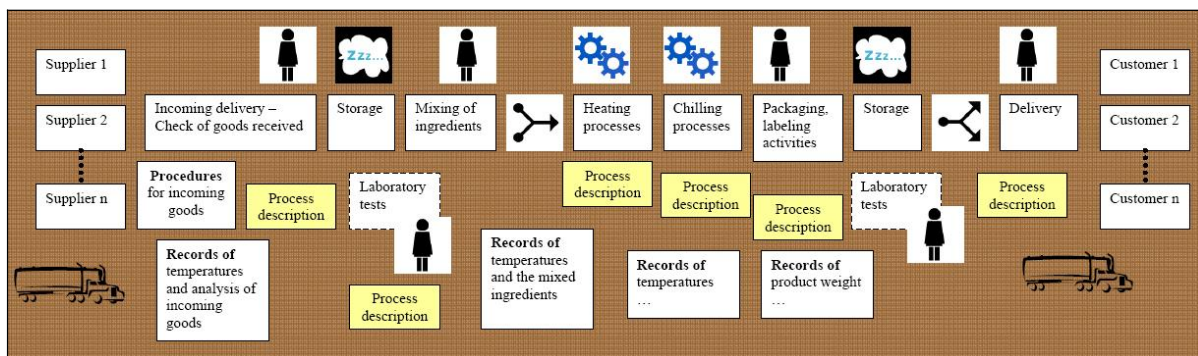


Figure 5.3: A simplified sketch of the brownboard in the case

The initially created brownboard was presented to the CEO at the focal company during a workshop. During this workshop the brownboard was posted on the wall. The entire process was gone through and additional information was provided by the CEO. During this session it was noted that there are several manual activities in the receipt of incoming goods and during the production process. It was also noted that the finished products were repalletized before they were finally stored. In contrast to other ingredients, one ingredient was identified during the session as being missing from the flow chart in the HACCP plan of the production. It was also noticed that the full potential of the ERP system was not used. The ERP system could provide collection of digitalized information that could be used as a support, for instance, in planning, making decisions, and ensuring control along the flow through production. It could, for instance, link amounts of incoming goods, ordering points, inventory levels of raw ingredients and finished products so that purchase orders could be automatically generated by the program. Production planning could be done automatically or be aided by the program.

In addition to the observations mentioned above, a list of critical issues related to overall safety and quality aspects was made during the workshop with the CEO from the focal company. The list was later complemented with issues listed by the quality manager from the production company. The issues found are summarized in Table 5.1.

Table 5.1: List of identified critical issues

<ul style="list-style-type: none"> • avoiding contamination with allergenic substances and foreign substances throughout the supply chain • maintaining correct temperature throughout the supply chain • cleanness in the production facilities and in storage 	<ul style="list-style-type: none"> • correctness of measuring equipment • maintaining correct information and labeling throughout the supply chain • access to enough ingredients, delivered on time 	<ul style="list-style-type: none"> • maintaining hygienic zones • ensuring that the ingredients are organic • clean and healthy staff • managing opened packages in the raw materials warehouse
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Objects to protect connected to these critical issues were found to be the brand, the production company and the focal company, as well as the company's contracts with customers, the health of consumers in general, and the health of children and allergic people in particular. The stakeholders were listed as being the production company, the focal company, the customer, and the consumer.

After this first brownboard session in the case, the course was set on deeper involving the production company in the mapping procedure. A second loop, according to Figure 5.2, was started with a collection of additional information and this brownboard mapping was integrated with the workshop so that the production company was able to map its production process and its connections to its suppliers and customers. During this mapping the CEO, the quality manager, the production managers, and representatives from the production staff sat together to discuss and map the process. After the process had been mapped, critical issues along the process were discussed and focus was placed on creating tasty ice cream, quality products, efficient production, profitability, all of which would lead to increased value for the customer and consumer. Issues like labeling batch numbers, best-before dates, and pallet labels were discussed and followed through the entire flow.

As an outcome of the workshop three target areas were identified for improvements and were set out in an action plan:

- How can planning and prognoses be improved?
- How can the handling of manual documents be more efficient and perhaps become automated?
- Incoming ingredients – how can the amount of product in the packages and the size of packages be adjusted to match the quantity needed for one batch?

The spontaneous feedback from the group was that the interactive and dynamic brownboard session had been useful since it made them take a break from their everyday routines and they had had to discuss these types of overall safety- and quality-related questions. Through the brownboard mapping of the process they were able to make the process clear to themselves. In addition, other people in the staff became introduced to the project and to the brownboard map, since it was posted on the wall in the lunch room. The role of the researcher is to look at the production from an "outside" perspective and to enhance the identification of potential savings within the traceability project. The benefits experienced by the production unit was that it has been indicated where potential savings are located in production.

The case study indicates that the brownboard mapping and the workshops led to greater involvement and collaboration between the involved companies in overall quality and safety questions. The workshops triggered discussions of possible improvements at the company irrespective of functions and hierarchies.

The companies studied are small companies (i.e. within the SME category), which characterizes the vast majority of food production companies in Sweden. The typical SME food company is based on experience-based knowledge rather than degrees. The use of the brownboard tool to visualize the entire production, including the interfaces between companies, has helped individuals with different levels of experience and educational levels to meet to discuss overall safety and quality issues related to traceability, and from there to resolve critical issues. Therefore the brownboard tool serves as a pedagogical instrument.

According to the focal company, an additional possible outcome would be a calculation and visualization of how much energy it takes to produce one liter of ice cream. This energy inventory taking would go well with the environmental profile of the focal company and would be in line with current discussions of carbon footprints. In addition, a presentation of the energy consumption of the product could create added value for consumers.

6. DISCUSSION

The brownboard tool can be seen as a tool within process mapping. The tool is focused on traceability and highlighting risks of losing traceability. Traditional process mapping is mostly focused on activities or subprocesses in order to make a process or the flow through a process more efficient and less time-consuming. The brownboard tool does not primarily focus on minimizing time consumption along the process but rather on grasping the interfaces and connections between different activities or between different actors in a supply chain in order to provide a good overview of the process/supply chain which is required in order to ensure efficient traceability. It also strives to encompass the flow of information, information which is crucial for maintaining a good level of traceability.

This case indicated that through its visual, interactive and collaborative approach the tool contributes to facilitate the communication between academia and practitioners, and thus to some extent contributes to bridging gaps in-between academia and practitioners. The overall characteristics of the brownboard tool indicated by this study are summed up in Table 6.1.

Table 6.1: The brownboard characteristics

• Easy to understand	• Interactive and dynamic	• Enhances communication between actors
• Focused on traceability	• Overview of the process	
• Pedagogical instrument	• Especially suited for SME	• Bridging gaps between academia and practitioners

The tool and the approach to embrace and facilitate communication can seem simple and self-evident. However experiences from the food industry show the opposite. Actors in a food supply chain rarely have a natural forum for discussion of supply chain-related issues; neither do staff from different functions in a company according to one of the respondents. This means that processes transcending organizational and functional boundaries do not have a dedicated overall responsible process owner nor do the supply chain actors have a common concern and communication in traceability-related issues. Since the overall traceability in a supply chain is dependent not only on each actor separately, but also on the connections between the supply chain actors, the supply chain traceability should be a commonly shared responsibility.

Experience of mapping entire supply chains is scarce and thus the approach in this study is of an explorative kind. The supply chains of today are not just chains, but rather complex

networks of different actors interacting with each other. This makes the mapping process complex and for a reasonable amount of data to be obtained, the focus in this study was placed on the flow of one of the products in the focal company's product range. The study encompasses only the focal company, the production company and the inbound and outbound deliveries related to the selected product. In further research within the research project suppliers as well as customers will be involved to gain a complete supply chain perspective.

When mapping a separate company it can be hard to find a natural process owner but it is even harder to identify when mapping an entire supply chain due to its complex structure and the involvement of several different supply chain actors/companies. This difficulty can be lessened by forming, for instance, a supply chain group with representatives from the different companies' management teams. They can meet and discuss topics related to the entire supply chain. However, this is also complicated since companies today are often involved in many different supply chains so they must all then take part in, and contribute to, different constellations.

A basic form of trust between the actors is also required since efficient supply chain traceability encompasses all the actors in the supply chain. They thus have to commit to sharing information, at least information which is crucial to maintaining traceability. This is important when working with traceability in a supply chain context.

7. CONCLUSIONS

This paper attempts to make a method contribution for both researchers and practitioners within the logistics area in general, and in food supply chains in particular, by its presentation of the use of the brownboard tool.

This study indicates that the brownboard tool enables identification of potential traceability-related improvements by its visualization of a flow transcending functional, as well as organizational, boundaries. It makes potential risks of losing traceability visible to supply chain actors. An overview here in this case created by the visual approach in the brownboard tool is a requirement in gaining and maintaining supply chain traceability. Furthermore, the tool facilitates communication between individuals with different educational backgrounds and levels of experience. The relevance for academia with the presentation of the brownboard tool also lay in its indicated possibilities to bridging gaps between academia and practitioners through its cooperative approach where a focus is set on a mutual exchange of knowledge and experience.

Through its visualization of the process the brownboard tool facilitated the identification of critical issues connected to overall safety and quality aspects which would have not been addressed. This case study also indicated that through efficient traceability there are potential savings to be made in terms of increased efficiency in production, increased customer value, and higher protection of a brand, for instance.

This study will be extended to the entire supply chain and thus encompass suppliers as well as customers. The tool will thereafter be tested on other supply chains in other settings in order to increase the ability to make generalizations.

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