Exploring the Relationship between Information Sharing and Internal Production Processes of Furniture

Sharing information, identifying and addressing flaws within various departments and production sections.

Bachelor thesis for International Logistics Program

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CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden, 2024

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PREFACE

This research would not have been possible without the invaluable support of the case company and Chalmers University of Technology. Our sincere thanks go to our supervisor, Associate prof. Henrik Ringsberg, for his guidance. We are particularly grateful to our supervisor at the company for his mentorship and for providing crucial insights into the organisation's quality control practices.

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SAMMANDRAG

Denna studie utforskar effekterna av informationsdelning på interna kassationsprocesser inom möbeltillverkning. En litteraturstudie grundade det teoretiska ramverket, följt av en fallstudie av en svensk möbeltillverkare, där kvalitativa intervjuer och observationer användes som primära datakällor. Forskningen undersökte praxis för informationsdelning mellan avdelningar, använda metoder och attribut som påverkar effektiviteten, med fokus på tre produktionsenheter. Resultaten avslöjar betydande diskrepanser i felrapportering mellan enheter och avdelningar, vilket belyser systemiska problem som tvetydiga ansvarsområden avseende informationsdelning, kunskapsluckor och ett utbrett missnöje med det nuvarande affärssystemet. Studien föreslår ett standardiserat, organisationsomfattande system för felrapportering för att förbättra informationskvaliteten. Föreslagna åtgärder inkluderar införandet av ett enhetligt rapporteringsformulär, kompletterande med en central databas och telefonsamtal som en sekundär kommunikationskanal för brådskande ärenden. Informationens noggrannhet, aktualitet, koncishet, fullständighet och detaljrikedom betonas. Studien föreslår implementerandet av Electronic Product Code Information Services (EPCIS)-standarden som ett standardiserat rapporteringssystem för datautbyte mellan produktionsenheter om vad som har hänt med den berörda produkten och var, när och varför defekten uppstod, vilket möjliggör förbättrad produktspårbarhet och förståelse av dess tillstånd.

Nyckelord: Informationsdelning; Informationskvalitet; Interna kassationer; Kvalitetsbrister; Produktion; Standardisering; EPCIS

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ABSTRACT

This study explores the impact of information sharing on internal scrap processes within furniture manufacturing. A literature review informed the theoretical framework, followed by a case study of a Swedish furniture manufacturer, utilising qualitative interviews and observations as primary data sources. The research explored information-sharing practices between departments, methods employed, and the attributes impacting the effectiveness, focusing on three production units. The findings reveal significant discrepancies in fault reporting across units and departments, exposing systemic issues such as ambiguous responsibilities regarding information sharing, knowledge gaps and widespread discontentment with the current Enterprise Resource Planning (ERP) system. The study proposes a standardised, organisation-wide fault reporting system to improve information quality. Proposed measures include implementing a uniform reporting form, complemented by a central database and phone calls as a secondary communication channel for urgent matters. Information accuracy, timeliness, conciseness, comprehensiveness, and granularity are emphasised. The study proposes implementing the Electronic Product Code Information Services (EPCIS) standard as a standardised reporting system for data exchange between production units about what has happened to the product involved and where, when, and why the defect occurred, enabling enhanced product traceability and understanding of its condition.

Keywords: Information sharing; Information quality; Internal scrap; Quality deficiencies; Production; Standardisation; EPCIS

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ACRONYMS AND TERMINOLOGY

AIDC – Automatic Identification and Data Capture
EMH – Efficient Market Hypothesis
EPC – Electronic Product Code
EPCIS – Electronic Product Code Information Services
ERP – Enterprise Resource Planning
FM – Facilities Management
GS1 – Global Standards One
IM – Information Management
IQ – Information Quality
ISO – International Organization for Standardization
IT – Information Technology
QMS – Quality Management System
SCM – Supply Chain Management
WPMQ – Workplace Meetings on Quality

1. INTRODUCTION

This chapter presents the background of the problem along with the study's purpose and research questions.

1.1 Background

In the current competitive landscape, quality has become a strategic tool for manufacturers and service providers to gain market shares (Silbernagel et al., 2021; Neves et al., 2018; Costa et al., 2017; Dhafr et al., 2006; Ahmad & Benson, 1999; Batten & Kobayashi, 1993). Ensuring the minimisation of internal defects is indispensable for maintaining a consistent standard of quality output, which is essential to meet the increasing demand for high-quality materials across industries (Fu et al., 2024). As products traverse the production chain from raw materials, their inherent value undergoes escalation, consequently amplifying the ramifications of defects (Kohli, 2016). This pressing concern underscores the imperative for the production industry to discern the causes of defects, thereby facilitating the implementation of efficacious cost-mitigation strategies (Swarnakar & Vinodh, 2016).

Research has consistently shown that information sharing, as defined by Kembro and Näslund (2014, p.181) as the "inter-organizational sharing of data, information and/or knowledge in supply chains", has a significantly positive influence on product quality performance in manufacturing (Nazifa & Ramachandran, 2019; Shin & Zeevi, 2024; Lofti et al., 2013). For instance, information sharing can inspire manufacturers to improve quality (Shin & Zeevi, 2024). Moreover, sharing information is pivotal in guaranteeing efficient inventory management, cost reduction, capacity enhancement, and resource utilisation. It further facilitates improved initial interaction, traceability, and productivity (Lofti et al., 2013). Therefore, a conclusion from (Nazifa & Ramachandran, 2019; Shin & Zeevi, 2024; Lofti et al., 2013) assertions is that insufficient information sharing leads to increased product quality deficiency costs. The costs are" *the costs that would disappear if a company's products and its various business processes were perfect*" (Juran, 1989; Sörqvist, 2001, p. 30, 31).

The quality deficiency costs are divided into two categories: external- and internal failure costs (Schiffauerova & Thomson, 2006; Shin & Min, 2001; Sörqvist, 2001). External failure costs are defined as "*Losses caused by deviation from an unwanted quality level that is discovered after delivery to an external customer.*" (Sörqvist, 2001, p. 37). In contrast, internal failure costs are defined as: "*losses caused by deviations from the desired quality level, discovered during the production stage, before delivery to an external customer*" (Sörqvist, 2001, p. 37). The last-mentioned costs can refer to income and assets, including rework costs, scrapping, inefficiencies, error analysis, and depreciation in all parts of the business (Dunk, 2002; Shin & Min, 2001; Sörqvist, 2001).

Many papers have been published on the relationship between information sharing and external defect costs in the supply chain (Firmansyah & Siagian, 2022; Zhou & Li, 2020; Setiawan et al., 2022; Nazifa & Ramachandran, 2019). For example, information sharing, including product quality data and operational details, fosters collaboration between manufacturers, suppliers, and customers (Firmansyah & Siagian, 2022; Zhou & Li, 2020; Setiawan et al., 2022). Therefore, information sharing has become essential in streamlining today's supply chains (Kumar & Pugazhendhi, 2012). Consequently, manufacturing firms have the potential to improve their product quality and overall business performance by implementing information sharing among their partners in the supply chain (Nazifa & Ramachandran, 2019). Optimised reverse logistics, embodied in the form of returns and complaints from customers to the manufacturer, is a solution to minimise costs (Srivastava & Srivastava, 2006; Niknejad & Petrovic, 2014).

Moreover, when a manufacturing company has a production diseconomy, information sharing between a retailer and manufacturer positively affects the profit for both parties (Zhao & Li, 2017). Thus, an increase in information sharing plays a crucial role in coordinating parties within a supply chain (Yu et al., 2001), resulting in supply chain parties experiencing performance improvements regarding inventory levels and costs (Baihaqi & Beaumont, 2006). By minimising inventories and streamlining production processes, information sharing can optimise the supply chain (Montoya-Torres & Ortiz-Vargas, 2014; Yang et al., 2021) as well as assessing the risks affecting the organisation internally (Carr & Kaynak, 2007; Bhatt, 2000). However, in the context of defects, previously published studies indicate a lack of research on the relationship between information sharing and the handling of the internal production processes (Vo-Tran et al., 2013; Yang et al., 2021; Carr & Kaynak, 2007; Baihaqi & Sohal, 2012). This study aims to fill this gap by providing insight into the praxis for information sharing regarding internal production processes seeking to reduce internal defects and achieve harmonisation across production units.

1.2 Aim of the report

This study aims to explore information sharing between internal scrapping processes within furniture manufacturing.

1.3 Research questions

- How is the information sharing conducted between different departments?
- What methods for information sharing are used in a production facility?
- What are the attributes related to information sharing?

1.4 Delimitations

The report focuses on information sharing regarding the internal defects of a Swedish furniture manufacturing company, excluding the external scrapping processes. The products are delimitated to tables, office furniture and office chairs. Regarding the geographical boundary, the project will be based on three out of six of a manufacturing company's production units located in different areas in Sweden (i.e., Production Unit A, Production Unit B, Production Unit C). The study is also limited to a qualitative method through interviews with employees, excluding an analysis of quantitative data. This is because the study explores subjective experiences, opinions, and perceptions in detail, which quantitative data might not capture directly. The timeframe duration is four months (January - April 2024).

Furthermore, databases are delimited to Scopus, Web of Science, and Chalmers Library. Scopus and Web of Science are well-established and comprehensive citation databases for scholarly publications. The databases cover a significant number of peer-reviewed articles across a wide range of disciplines (Gavel & Iselid, 2008). To capture a broad range of research, the literature review includes articles regardless of publication date.

2. THEORY

This section presents the thesis's theoretical foundation, which includes information sharing, quality deficiencies, standardisation, information attributes, and standard information-sharing methods in factories.

2.1 Quality deficiencies in production logistics

Deliberated errors arise when an employee makes a wrong decision or mistake by choice (Stasiak-Betlejewsk et al., 2017; Sörqvist, 2004), negatively affecting organisational performance (Stern et al., 2008; Reason, 1997). Some of the most frequent human errors are behavioural (e.g., motivational and accidental), communicative, cognitive, and knowledge-based (Hu et al., 2017; Sörqvist, 2004; Mezher et al., 1998). In addition, some errors are initiated by the organisation because of competition (e.g., time and quality savings), unclear goals, personal criticism, and lack of communication (Sörqvist, 2004; Hu et al., 2017).

Josephson's (1998) study supports (Hu et al., 2017; Sörqvist, 2004; Mezher et al., 1998) statements. The study found that the direct causes of construction defects were attributable to five primary reasons. In detail, 50% were ascribed to lack of motivation, 29% to lack of knowledge, about 12% to lack of communication, 6% to risks, and lastly, 3% were due to stress (Josephson, 1998). The author suggests motivational errors can stem from inaccuracies in information. However, a lack of time is the primary factor behind motivation- and information errors (Josephson, 1998). The result is confirmed by a follow-up study, which found that defects were usually caused by individuals who possessed the proper expertise and correct information for their particular role, yet the cause stemmed from a lack of motivation (Josephson & Hammarlund, 1999). However, the authors suggest that a majority of motivational defects stem from forgetfulness; alternatively, carelessness, attributing approximately 29% of the defect cost to knowledge deficiencies and the rest to factors (e.g., stress, risk, wilful intent, and a lack of communication) (Josephson & Hammarlund, 1999).

Moreover, individual errors occur because of communication- and information deficiencies (Sörqvist, 2004). Such errors could be because important communication was not provided, the necessary information was delivered inappropriately, the transfer of information was not up to standard, or the receiver did not pay close enough attention to what was given, as well as missed important information (Sörqvist, 2004). According to a study conducted by Gustavsson and Jonsson (2008), the authors conclude that organisations with significant Information Quality (IQ) deficiencies generally lacked pre-emptive strategies for Information Management (IM). However, focusing solely on IQ will not solve the problem of quality deficiencies because a lack of attention to internal processes is attributed as a considerable cause of internal defects (Bäckstrand, 2009).

Furthermore, the reason why defects persist, despite an implemented Quality Management System (QMS), the primary cause of defects was found to be derived from inefficient knowledge transfer and internal organisational failures (Jingmond & Ågren, 2015). These findings align with a study that statistically showed no significant correlation between operative effectiveness and Facilities Management (FM) (Hajar et al., 2023). Thus, this highlights educational deficiencies and an insufficient holistic approach within an organisation as the prominent influencers of defects, excluding operational factors, such as task performance and material- or equipment functioning (Jingmond & Ågren, 2015).

2.2 Information sharing

Sörqvist (2004) highlights the importance of handling communication errors through various methods, emphasising the need for clear and concise message delivery to prevent misunderstandings. Effective communication involves an equal focus on sending and receiving information, supported by thorough research and explanations. Essential information flows must be identified and planned for successful business communication (Sörqvist, 2004; Lee & Minner, 2021; Holmberg, 2000; Schulz von Thun, 2013).

In contrast, researchers suggest that, as information increases, agents' processing capabilities may not keep up, leading to an excess of information that cannot be fully utilised. While technology can enhance efficiency, there are limitations to what machines can handle (Pernagallo & Torrisi, 2020; Milord & Perry, 1977; Toffler, 1970). The concept of "information overload" challenges the idea of perfectly informed markets, where the cost of processing additional information may outweigh the benefits. Pernagallo and Torrisi (2020) demonstrate that as information grows, the processing cost increases exponentially, leading individuals to find a balance between their chances of success and processing limitations. This may result in decisions being made without utilising all available information, ultimately causing a breakdown in the Efficient Market Hypothesis (EMH) as everyone becomes increasingly less informed (Pernagallo & Torrisi, 2020; Skipper & Hanna, 2009; Saxena & Lamest, 2018).

Sörqvist (2004) asserts that overusing complex terms, jargon, or convoluted sentence structures can dilute the message's meaning. Therefore, it is crucial to balance language usage when tailoring it to the recipient (Sörqvist, 2004; Eppler, 2006). Additionally, choosing suitable communication channels is vital. Information can be communicated through various channels (i.e., phone, cable, text, and email). Selecting the appropriate channel for each situation is essential. When handling crucial information, it is advisable to convey it directly rather than relying solely on informal messages (Nielsen, 2023; Sörqvist, 2004). Lastly, establishing a mutual agreement and understanding is vital, especially for critical performance-related information. Ensuring that the data is received, interpreted, and comprehended correctly can be accomplished through confirmation methods, such as acknowledging receipt (Sörqvist, 2004; Bünzli & Eppler, 2024; Schulz von Thun, 2013).

2.3 Methods for information sharing

Nikolaidis et al. (2021) identified four categories of information-sharing methods based on underlying assumptions: functional relationships, exchangeability relationships, prior relationships, and multiple relationships. While acknowledging a wide range of methods, researchers highlight the challenge of selecting a few without fully exploring all options (Walker et al., 2023; Nikolaidis et al., 2021; Palmer et al., 2023; Ayers et al., 2022). Unintentionally, this can lead to selecting a method that enforces information sharing that falls outside policymakers' desired scope, either overly restrictive or excessively permissive (Nikolaidis et al., 2021).

For example, Bataineh and Hajar (2020) focused on the impact of Information Technology (IT) techniques on Supply Chain Management (SCM) within Jordanian industrial companies, primarily focusing on the internal environment. Their study found a significant positive effect of IT on internal SCM practices. An explanation for this is likely driven by a confluence of factors: the emergence of new technologies, intensifying global competition, and ever-evolving customer demands. These forces necessitate re-evaluating business processes (Bataineh & Hajar, 2020; Fawcett et al., 2011; Li et al., 2009). Consequently, companies require IT techniques and methods to integrate their internal functions. This integration can significantly improve efficiency, productivity, and responsiveness to customer needs (Bataineh & Hajar, 2020; McIvor & Humphreys, 2004; Bayazit, 2007).

In addition, sharing information is essential when it comes to improvement. According to Meroño-Cerdán et al. (2007), information sharing, especially electronic information, increases organisational performance. Devi et al. (2023) support the statement by asserting that a steady stream of information sharing fuels continuous improvement in the organisations' digital service creation process. Research indicates that the implementation of collaborative technologies, which enable companies to access shared documents, data, and information, necessitates active system utilisation to enhance performance (Meroño-Cerdán et al., 2007; Bafoutsou & Mentzas, 2002; Davis et al., 1989).

Moreover, maintaining system operability requires acceptance from all involved parties (Devi et al., 2023). If the system is not accepted, the maximum value is impossible to reach since the actors involved are not committed to the learning process required to share the necessary information (Devi et al., 2023; Swanson et al., 2017). If there is a lack of collaboration culture inside the organisation, openly discussing the issue with everyone involved creates the opportunity to identify solutions and improve collaboration (Devi et al., 2023; Lahat & Sabah, 2021; Budiarso et al., 2021). However, one flaw in the electronic system that is only active online in the company's intrabase is disruptions that can occur. Doetzer and Pflaum (2021) revealed that disruptions can significantly restrict information sharing. Incorporating backup functionality for the comment section can address this (Doetzer & Pflaum, 2021; Ratick et al., 2008; Skipper & Hanna, 2009). In addition, making pre-disruption data readily available during the recovery phase can significantly enhance communication. Finally, having open information sharing allows an organisation to leverage various aspects of flexibility in their processes, leading to better adaptation and efficiency (Doetzer & Pflaum, 2021; Boyson et al., 2003).

2.4 Information Attributes

When considering the significance of information sharing, simply sharing information is not enough without considering the aspect of IQ (Marinagi et al., 2015; Klischewski & Scholl, 2008). IQ assesses how well-shared information fulfils organisational requirements (Qi & Qingyu, 2010). Previous studies emphasise how information is shared to determine efficiency (Hewage, 2018; Holmberg, 2000; Wiengarten et al., 2010). However, while information transmission is a critical aspect of the quality of information sharing, it encompasses more than just the undifferentiated transmission of content (Wang & Chi, 2021). For example, the influence of information sharing on SCM hinges on factors (i.e., the nature of the information shared, the timing, sharing functions and the recipients) the information is shared with (Holmberg, 2000; Li & Lin, 2006).

In Table 1, Grudzień and Osiński (2021) put forward the most critical attributes for assessing IQ, describing their specific traits.

Table 1
Information attributes are selected to evaluate the quality of information.

Information criteria	**Description**
Comprehensiveness	Is the scope of information adequate? (not too much nor too little)
Accuracy	Is the information precise enough and close enough to reality?
Clarity	Is the information understandable or comprehensible to the target group?
Applicability	Can the information be directly applied? Is it useful?
Conciseness	Is the information to the point, void of unnecessary elements?
Consistency	Is the information free of contradictions or convention breaks?
Correctness	Is the information free of distortion, bias, or error?
Currency	Is the information up-to-date and not obsolete?

Note. Reprinted from "The Role of Information Quality in Energy Management Systems," by L. Grudzień and F. Osiński, 2021, *Advanced Manufacturing Processes II. InterPartner 2020*. p. 808. Copyright © 2021 by Springer, Cham.

Extensive research supports the importance of one or more of the information attributes as shown in Table 1 for assessing the value of shared information (Wang & Chi, 2021; Qi & Qingyu, 2010; Gustavsson & Wänström, 2009; Monczka et al., 2008; Li & Lin, 2006; Wiengarten et al., 2010; Busert & Fay; 2020; Meadow & Yuan, 1997; Khoe & Rahkman, 2023). For example, an information system is only perceived as valuable when it provides high-quality, readily accessible, accurate, and relevant information (Qi & Qingyu, 2010). In particular, effective information sharing requires a client base to provide various levels of such information attributes (Barua et al., 1997). Efficient control methods rely on higher-granularity information, which provides a more accurate picture of the natural world (Busert & Fay, 2020). A lack of frequent, accurate and granular information updates can hinder effective coordination and oversight of manufacturing operations (Busert & Fay, 2018; Busert & Fay, 2020). Usually, this is because the provided attribute differs from the required one, which can increase the likelihood of unit decisions diverging, ultimately decreasing returns for both the units and the company collectively (Barua et al., 1997). Hence, developing and implementing an operational system facilitating coordinated information sharing among organisational units can solve the problem (Barua et al., 1997).

Furthermore, as information progresses through the supply chain, it experiences delays and distortions (Li & Lin, 2006). The more stages information needs to be processed through, the greater the latency it experiences in reaching the final recipient (Gill et al., 2022). Delayed information leads to delayed decision-making, while too frequent reports can disrupt manufacturing management (Gustavsson & Wänström, 2009; Busert & Fay, 2020). As a result, manufacturing organisations prioritise consistency and accuracy of information in moderate environments. Consistency ensures that data from different areas align, while accuracy guarantees correct information (Laureano Paiva et al., 2002; Marchand, 1996). From a timely perspective, information sharing can also act as a catalyst for exchanging high-quality information, ultimately enhancing supply chain performance (SCP) (Khoe & Rahkman, 2023). Thus, by seeking information that meets the information criteria in Table 1, organisations can strengthen their internal competencies (Laureano Paiva et al., 2002; Wilkinson & Cerullo, 1997).

2.5 Standardisation

In an organisation, a management system is rules and routines created for the operation of the business. It includes production processes, personnel, and financial issues (Bergman & Klefsjö, 2021; Grabowska & Takala, 2017; Sfreddo, 2018; Fonseca et al., 2021). In small organisations, management systems are almost non-existent, but the larger the organisation, the greater the need for a set of written rules that employees can use to support their daily work (Garstenauer et al., 2014; Bergman & Klefsjö, 2021; Van Der Wiele & Brown, 1997; Chiarini et al., 2020).

A QMS is an integral part of an organisation's overall management system. The primary objectives are to ensure stakeholder satisfaction by meeting their quality expectations (Barbosa et al., 2021; Fonseca et al., 2021) and foster continuous improvement in operations, ultimately enhancing the quality of both the organisation's processes and products (Shi et al., 2019). Bergman and Klefsjö (2021, p. 252) define these systems as follows: "*A quality management system includes an organizational structure such as routines, processes and resources that are necessary for management and control of the business concerning quality.*" Therefore, more daily work is required, the basis of which are both internal and external audits of the organisation and how it handles quality issues (Gimenez-Espin et al., 2013; Bergman & Klefsjö, 2021; Psomas & Antony, 2014; Ciravegna et al., 2017).

Standardisation barriers to information sharing

International Standards serve as several concepts applicable to production companies to standardise the vocabulary through the organisation for sharing information (Chungoora & Young, 2011). Previous studies assert that standardising shared information is crucial for internal and external organisational collaboration (Khan & Abonyi, 2022; Rachuri et al., 2008; Cutting-Decelle et al., 2004). For example, an Enterprise Resource Planning (ERP) system provides a standardised platform to facilitate seamless information sharing throughout the organisation (Barua et al., 2007). However, despite the availability of advanced technological solutions, they may not, on their own, achieve optimal levels of information sharing (Skyrme, 1997; Barua et al., 2007). This is due to several internal organisational factors, including divergent goals (Nelson & Cooprider, 1996) and an inability to meet information requirements of various workgroups, potential conflicts between individual self-interest and collective information sharing (Barua et al., 2007), and a lack of trust (Nelson & Cooprider, 1996) or incentive structures (Davenport & Prusak, 1997; Caeldries et al., 1994), all of which can impede effective collaboration (Barua et al., 2007).

In addition, formally, the conceptual definitions in the standards are usually associated with impediments to information sharing (Chungoora & Young, 2011). For example, standards frequently rely on textual definitions for concepts, which can limit their interpretability (Gunendran et al., 2007; Young et al., 2007; Michel, 2005; Chungoora et al., 2013). Moreover, ensuring consistency across standards can be challenging, as the interpretation of the concepts can vary (Usman et al., 2010; Chungoora et al., 2013). Still, despite formalising concepts through the establishment of data models, the models lack enough stringency to guarantee effective interoperability among systems (Chungoora & Young, 2011).

Concerning information sharing, the dilemma constituted by the interoperability of the definitions is especially relevant for more substantial manufacturing businesses, particularly given that various activities within the manufacturing sector require multiple standards to address the different requirements (Chungoora et al., 2013). Moreover, another prominent standardisation barrier to information sharing is that standardisations lack formatting data sharing used in tracking systems (Storøy et al., 2013; Ringsberg, 2015). Nevertheless, in the context of facilitating the proper convergence and reducing the coordination gaps between units (Barua et al., 1997). Considering that the necessary information accumulated and processed by the units must align with their requirements in contrast to an organisational standard, the mandate and imposition of the standards could functionally be ineffective (Barua et al., 1997).

Standard for Quality Management Systems (ISO 9001)

ISO 9001:2015, provided by the International Organization for Standardization (ISO, 2015), is an international standard that outlines criteria for a QMS within an organisation. The requirements mainly state that an organisation must manifest its capability to frequently deliver products and services that fulfil customer demands and relevant legislation. To improve quality and performance, ISO 9001 may function as an instrument for sharing information, enabling organisations to obtain the required expertise (Lin & Wu, 2005). According to ISO (2015): *"The organization shall determine the internal and external communications relevant to the quality management system, including:*

a) on what it will communicate;
b) when to communicate;
c) with whom to communicate;
d) how to communicate;
e) who communicates." (ISO 9001:2015, 2015, §7.4).

Standard for Occupational health and safety management systems (ISO 45001)

ISO 45001:2018 is a global standard provided by ISO (2018) that sets out the requirements for an Occupational Health and Safety (OH&S) Management System. The standard aims to help organisations actively prevent work-related injuries and mental illnesses to employees and provide a safe and healthy working environment accordingly (ISO, 2018). Notably, according to ISO (2018): *"Top management shall demonstrate leadership and commitment with respect to the OH&S management system by: a] taking overall responsibility and accountability for the prevention of work-related injury and ill health, as well as the provision of safe and healthy workplaces and activities;"* (ISO 45001:2018, 2018, §5.1).

Electronic Product Code Information Services (EPCIS)

EPCIS is a Global Standards One (GS1) standard, facilitating seamless information sharing among stakeholders across the supply chain (Chua et al., 2019; Främling et al., 2013; EPCIS Standard, 2007). In particular, the EPCIS standard utilises an event-based architecture with four core events: object, aggregation, transaction, and transformation (GS1 EPC Global, 2014b; Ringsberg & Lumsden, 2016). These events contain data on timestamps, specific locations, the reason behind the event, and the unique Electronic Product Code (EPC) identification keys assigned to every object (GS1 EPC Global, 2014a; Ringsberg & Lumsden, 2016). By analysing the EPC key, stakeholders can electronically register and share information about the objects, providing a detailed record of their movement throughout the supply chain (GS1 EPC Global, 2015; Ringsberg & Lumsden, 2016; Ringsberg & Mirzabeiki, 2014; Ringsberg, 2015; Chua et al., 2019).

Automatic Identification and Data Capture (AIDC) has been well-established in Nordic countries for an extended period (Storøy & Olsen, 2007; Thakur et al., 2011; Thakur & Forås, 2015). However, by transforming data capture and exchange into electronic processes, EPCIS establishes its relevance as a standard (Thakur et al., 2011; Thakur & Forås, 2015). As a result, by streamlining information sharing through enhanced object visibility and reduced damages, EPCIS contribute to a more efficient logistic operation (Ringsberg & Lumsden, 2016). Successful attempts at monitoring temperature data with EPCIS were conducted, indicating that EPCIS can improve the food supply chain by minimising quality losses caused by temperature fluctuations (Thakur & Forås, 2015).

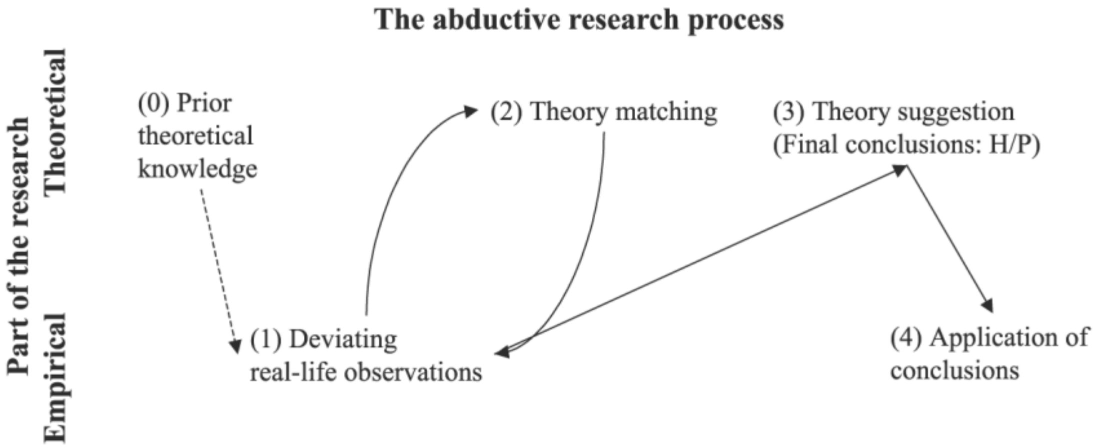
Moreover, in combating standardisation barriers to information sharing, the EPC architecture supports interoperability in supply chains by detecting potential risks related to information visibility (Ringsberg, 2015; GS1 EPCglobal, 2014b). In addition, its two-layered design removes the obligation to standardise elements on the application layer, allowing EPC components to develop and integrate more efficiently. Also, the EPCglobal event data specification offers a standardised description of internal and external communication of event data (Goebel et al., 2010).

3. METHODOLOGICAL APPROACH

The section outlines the methodology to answer the research question and achieve the study's purpose. It is followed by a detailed description of the data collection procedures, including selection criteria. The section also describes the methods employed (e.g., reviewing literature, the case study, and analysing data). Finally, the section addresses the research quality by discussing measures to ensure validity and reliability.

Figure 1

The abductive research approach that was used in the study.



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The study was performed following an abductive research approach provided by Kovács and Spens (2005), as shown in Figure 1. The abductive research process began with a predetermined theoretical framework before empirical observations (Kovács & Spens, 2005; Dubois & Gadde, 2002). Still, while existing theories were initially provided, abductive reasoning in practice began when empirical observations deviated from the theoretical expectations (Kovács & Spens, 2005; Dubois & Gadde, 2002; Kirkeby, 1990). After that, the pre-existing theoretical framework could not explain the observation, which would otherwise be considered a falsification (Kovács & Spens, 2005; Popper, 2002). Following this unexpected observation, a new and relevant theory was explored to discover a new explanatory framework (Kovács & Spens, 2005; Andreewsky & Bourcier, 2000). By exploring this phenomenon (Kovács & Spens, 2005; Alvesson & Sköldberg, 1994), the objective was to develop new theories (Kovács & Spens, 2005; Kirkeby, 1990) through hypotheses (H) or propositions (P) (Kovács & Spens, 2005; Andreewsky & Bourcier, 2000). Finally, the research process was concluded by testing the derived H/P to empirical data (Kovács & Spens, 2005; Alvesson & Sköldberg, 1994; Wigblad, 2003).

3.1 Data collection

This study collected data through a structured literature review, followed by a case study.

3.1.1 Literature review

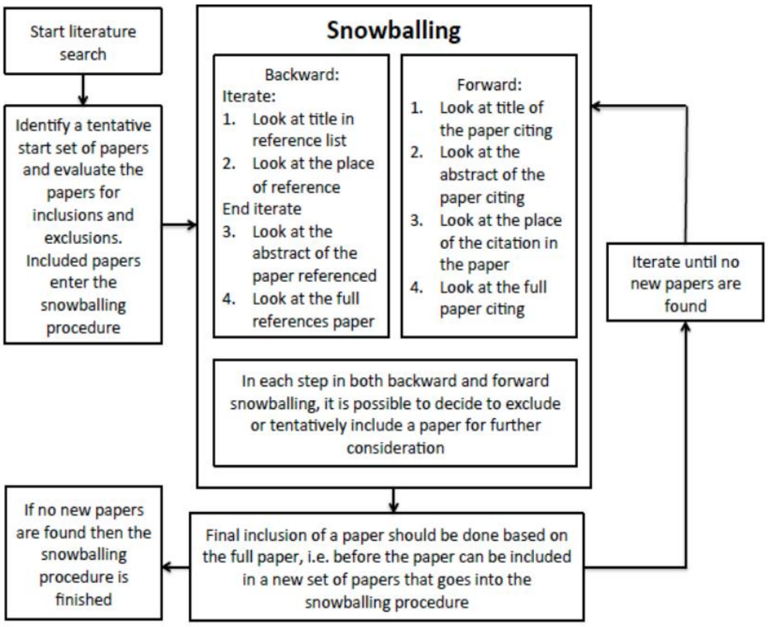
A structured literature review (Seuring & Müler, 2008) was conducted. A literature review is a systematic and transparent method for identifying, evaluating, and interpreting existing scholarly work. This critical analysis of documented research allows researchers to build upon existing knowledge without needing to collect their data from scratch (Fink, 2005; Seuring & Müller, 2008). Defining clear boundaries in a literature review also helps ensure a focused and relevant analysis (Seuring & Müller, 2008). Subsequently, the literature included most peer-reviewed articles and books, all in English, published from different scholarly publications (e.g., Science Direct, Elsevier, Emerald Publishing, Springer, etc.), with a manufacturing, supply chain, or information focus.

Furthermore, as a structured sampling method, backward snowballing was initially conducted in accordance with (Wohlin, 2014; Geissdoerfer et al., 2020), as shown in Figure 2, to identify two types of knowledge: established knowledge and previously undocumented knowledge. This knowledge may not be captured through traditional database searches and could predate the current understanding of information sharing and internal defects (Geissdoerfer et al., 2020). Firstly, the reference list was analysed to identify potentially relevant studies and exclude articles that did not align with the selection criteria (e.g., English, publication type, and year). Articles were then selected based on a detailed evaluation of their title, content, and adherence to the selection criteria. Further on, the abstracts of the additional publications were analysed using the same selection criteria to assess their relevance for inclusion in the sample (Wohlin, 2014; Geissdoerfer et al., 2020).

Secondly, forward snowballing (Wohlin, 2014), as shown in Figure 2, was later conducted to expand the search based on cited works from the selected papers. To assess the relevance of the cited works, an initial screening was performed on all citing authors using information retrieved from the Web of Science. A further analysis was initiated if the initial Web of Science information was assessed inadequately for inclusion. This involved reviewing the abstract, then the referencing text (if available), and finally, the complete text to reach a final assessment for inclusion or not (Wohlin, 2014).

Figure 2

The Snowballing procedure utilised.



Note. Reprinted from "Guidelines for snowballing in systematic literature studies and a replication in software engineering," by C. Wohlin, 2014, *EASE '14: Proceedings of the 18th International Conference on Evaluation and Assessment in Software Engineering.* Article No.: 38. Pages 1–10. Copyright © 2014 by ACM.

Moreover, databases provided by Scopus, Web of Science, and Chalmers Library were the data sources utilised to find applicable scientific literature. Common keywords, (e.g., “quality deficiencies,” “information sharing,” “EPCIS,” “information attributes,” “manufacturing,” and “production,”) were entered into these databases and combined using quotation marks to refine the search. All keywords utilised via the databases are presented in Table 2.

Table 2

The number of hits before and after applying the selection criteria.

Search strings	Database Search	Number of identifided paper		
		Step 1	Step 2	Last step
”information management system”	Scopus	8 375	1 948	57
"information sharing system"	Scopus	652	163	28
"information sharing"	Scopus	28 567	8 830	17
"Digital information sharing"	Scopus	46	19	3
internal AND scraps AND information AND sharing	Scopus	1	-	-
internal AND scraps	Scopus	508	125	18
"Methods for information sharing"	Scopus	16	-	-
method AND information	Scopus	2 360 551	742 163	59
”EPCIS” ”Information sharing”	Web of Science	9	-	-
ISO "information sharing" production	Web of Science	2	-	-
"Information attributes" manufacturing	Web of Science	6	-	-
"Information attribute" information sharing	Web of Science	7	-	-
information attributes production	Web of Science	11	5	-
Information sharing ISO	Web of Science	51	-	-
"information sharing" quality management system	Web of Science	680	-	-
"too much information"	Scopus	1 182	254	10
”EPCIS” Information sharing	Web of Science	33	-	-
"Quality deficiencies" production logistics	Web of Science	2	-	-
Quality deficiencies manufacturing	Web of Science	13	-	-
EPCIS "HURBURGH CHARLES"	Web of Science	1	-	-
RINGSBERG HENRIK	Web of Science	6	-	-
"information sharing" standardization manufacturing	Web of Science	16	-	-
”Trailers” ”EPCIS”	Web of Science	1	-	-
internal defects "increasing" industry manufacturing	Web of Science	19	-	-
"quality management system" small companies	Web of Science	77	-	-
"quality management system" internal external	Web of Science	127 / 37	-	-
"quality management system" stakeholders improve	Web of Science	38	-	-
standardization "information sharing" interoperability	Web of Science	26	-	-
"employee errors"	Web of Science	10	-	-
motivation knowledge human errors	Web of Science	165	-	-
QMS improving quality	Web of Science	326	-	-
information Characteristics manufacturing	Web of Science	21	-	-
"information sharing" "information quality"	Web of Science	132	-	-
"effective information sharing"	Web of Science	134	-	-
"business communication"	Scopus	3 666	621	176

Note. Table 2 displays the number of hits generated by the search terms. To refine the selection, some search terms were enclosed in quotation marks and searched initially without filters, followed by applying time filters and other criteria. A more detailed table can be found in Appendix 1.

3.1.2 Case study

Vital research dives deeper than "what" by asking "how" and "why". It explores the mechanisms and motivations behind phenomena through case studies, historical analysis, or experiments. These approaches often track changes over time to understand trends and developments rather than simply measuring frequency or speed (Yin, 2017).

Following the book *Case Study Research and Applications*, Yin (2017) presents a six-stage process guide to perform a case study adequately. The initial stage requires a comprehensive investigation into the chosen topic to establish its relevance, assess its strengths and limitations, and demonstrate a commitment to a rigorous methodology. This is achieved through a literature review to understand the field, situate the case study, and formulate straightforward research questions to guide the investigation. Additionally, consultation with experts can provide valuable insights. This initial groundwork ensures a focused and well-structured approach throughout the case study.

The second stage focuses on designing the case study itself. This involves developing a theoretical framework with propositions and related issues to guide the investigation and potentially generalise its findings. A well-defined research design establishes a clear link between the data to be collected, the conclusions drawn, and the initial research questions. This ensures that the evidence gathered directly addresses the study's objectives.

For instance, in the context of inter-organisational information sharing, the research design would answer questions like "how" and "why" organisations collaborate to share information. These questions guide the identification of the specific information needed to analyse the case effectively.

The third stage involves preparing to collect evidence for the case study. This includes researcher training specific to the chosen case and the development of a detailed case study protocol. Adequate case studies rely on researchers who can adapt and respond to new information as it emerges during data collection. This necessitates an "inquiring mind" throughout the process, not just during initial planning. Strong listening skills are also crucial, allowing researchers to capture the interviewee's exact words and underlying meaning.

The fourth stage encompasses both data collection and analysis. Case studies utilise a variety of evidence sources, including documents, artefacts, interviews, direct observations, and even participant observation. However, the primary source of evidence is interviews with key individuals involved. Once collected, the data undergoes rigorous analysis to extract meaningful insights and answer the research questions. Then, this analysis is presented and discussed in the final report, concluding that it is relevant to the initial inquiry. Finally, the research study is shared with a relevant audience through a publication of the thesis and a presentation targeting individuals with a stake in the subject matter.

Case description

A leading European provider of furnishing solutions was selected as the case company for this study. The company has established itself as a prominent European furniture manufacturer, offering products for offices, schools, healthcare facilities, and social care settings. Even though the company is global, it has a solid local presence in Sweden and a rich heritage. They collaborate with leading designers and researchers to develop innovative and future-proof furnishing solutions.

Beyond furniture production, the company is a comprehensive provider of furnishing solutions, focusing on sustainability, functionality, and ergonomics. The organisation's ergonomic products are engineered to promote proper ergonomics and prevent strain injuries. They offer various products and services to create effective, inspiring workplaces promoting well-being and productivity. The company emphasises sustainability throughout all stages, from design and material selection to production and recycling. They utilise sustainable materials and certified products to minimise environmental impact. Their products have a long lifespan and are designed for reuse and refurbishment, contributing to a circular economy. As for their furnishing solutions, they are designed to support modern work styles and create flexible environments that can adapt to diverse needs.

Production Site Expertise

In Sweden, the company operates a strategically distributed production network across six distinct production units, employing a workforce exceeding 2,300 individuals. Each unit leverages a unique area of expertise to contribute to the overall production process. The central units are:

- **Production Unit A:** This central hub serves as the final assembly site for the entire production network. Its primary focus is woodworking, encompassing varnishing and meticulous assembly processes. The site is also the consolidation station, where finished products are prepared for final shipment to customers.
- **Production Unit B:** The facility excels in metalworking, specialising in precision welding, high-quality paintwork, and sub-assembly.
- **Production Unit C:** The facility focuses on soft goods and component creation. Significantly, it boasts expertise in needlework, foam, injection moulding, and sub-assembly.

Through this strategic allocation of expertise across its production network, the organisation achieves an efficient and streamlined production process, ensuring consistent quality throughout its product line.

Interviews

Semi-structured interviews were performed to collect qualitative data in compliance with *Doing Interviews* by Kvale (2007). The primary objective of the interviews was to gain insights into the interviewees' working experiences, specifically focusing on how they interpret events and describe situations encountered within the production process (Kvale, 2007). The respondent selection process employed a hierarchical approach. Initially, individuals directly involved in production line operations were chosen. This initial selection ensured a grounded perspective on the production process. Subsequently, interviews progressed upward within the organisational structure to assess coherence across production units. Notably, all interviewees' held responsibilities specific to their designated roles across all production sites. The interview sequence began with production line operators, followed by team leaders, and culminated with department heads. Due to the frequent mention of quality technicians during the interviews, this group was later included in the respondent pool. Descriptions of the interviewees are presented in Table 3.

In total, 16 out of 18 respondents were interviewed in this study. All interviews were conducted in person except for quality technicians, who were interviewed digitally. All the respondents were contacted using the organisation's internal email database. The interviews began with an introduction of the study and the researchers, outlining the aims of the thesis project. Subsequently, the interviewees were asked about their work and responsibilities before the interview questions were initiated. During the interviews, data were collected using a combination of written notes and audio recording equipment with permission from the interviewees (Yin, 2017). This ensured informed consent and addressed any potential ethical concerns. The prepared interview protocol incorporated open-ended questions (e.g., "how" and "what") (Kvale, 2007) that delved into the processes surrounding internal defects and explored potential factors that might influence their occurrence along with the communication between internal stations and production units. Furthermore, the interview questions were formulated in plain language, ensuring accessibility and comprehension for the interviewees. The interview format also allowed for flexibility in the sequence and phrasing of questions to effectively follow up on interviewee responses and delve deeper into their narratives.

Table 3

Characteristics of the interviewees

Role	Production Unit	Department	Pseudonym	Time of working experience (role at the company)
Operator	B	Assembly, office chairs	Operator A	17 years
Operator	B	Paintwork, assembly, packaging, delivery	Operator B	35 years
Team Leader	B	Assembly, office chairs	Team Leader A	25 years
Department Head	B	Welding, compression moulding, robotics welding	Department Head A	Five months
Team Leader	C	Needlework, office chairs	Team Leader B	25 years
Team Leader	C	Office chairs, assembly	Team Leader C	18 years
Department Head	C	Needlework, office chairs, injection moulding	Department Head B	14 years
Department Head	C	Needlework, office chairs, screens, assembly	Department Head C	One year
Quality Technician	A	Quality, paintwork, fabrication shop, storage- and table assembly	Quality Technician A	16 years
Quality Technician	B	Quality, insourcing project, detail line	Quality Technician B	Six months
Quality Technician	C	Quality, foam moulding, assemble	Quality Technician C	Seven months
Operator	A	Office chairs, final assembly	Operator C	36 years
Team Leader	A	Office chairs, final assembly	Team Leader D	15 years
Team Leader	A	Tables and final assembly	Team Leader E	1,5 years
Department Head	A	Office chairs, final assembly	Department Head D	Ten years
Department Head	A	Tables, final assembly	Department Head E	Two years

Note. Table 3 displays details about the participants, their roles, including the tenure in their positions at the company, and the units and departments they belong to.

Observations

Direct observations of the production processes occurred in the factories the first three times visiting the production units respectively. The primary objective of the observations was to gain a comprehensive understanding of the production and operational process. This involved tracing the flow of materials and activities from start to finish, focusing on identifying potential causes of internal defects. Occasionally, unstructured observations were documented through notes, and photographs were taken with permission while incorporating a physical examination of the materials. During the interviews, the interviewees' body language was observed and later analysed separately. A practical demonstration of the ERP system was also conducted to facilitate a deeper comprehension of the defect registration process. Furthermore, participant observation was performed by actively navigating the company's internal data system to gather insights otherwise inaccessible to external users (i.e., those not employed by the organisation). This insight is crucial for achieving a faithful representation of the case study phenomenon (Yin, 2017).

3.2 Data analysis

Following Braun and Clarke (2006), thematic analysis was employed to analyse the collected data. Transcribing the interviews was an initial step to becoming acquainted with the data (Riessman, 1993; Braun & Clarke, 2006), ultimately facilitating the development of a more comprehensive understanding. The transcript faithfully captured the essential information conveyed in the verbal account. In the second step, the interviews were coded manually for emerging themes relevant to the research questions. This means that the data analysis was guided by the research questions, which served as a framework for the coding process. The coding process involved systematically analysing all the transcripts, ensuring each data point received equal attention. A multifaceted approach was employed to identify patterns, utilising handwritten notes and digital highlighting on the analysed text (Braun & Clarke, 2006).

After coding, the third step was to organise the data into potential themes, with relevant coded extracts grouped accordingly. This was made utilising a visual coding approach to facilitate the identification of themes. The process involved writing the names of each code and describing them in separate documents. The documents were then digitally arranged into thematic groups, allowing for an exploration of potential relationships between the codes (Braun & Clarke, 2006). In the fourth step, all coded data extracts within each theme were reviewed to assess whether they formed a coherent pattern (Braun & Clarke, 2006). Consequently, aiming to identify the commonalities and variations within the data. Following this, the analysis assessed the validity of each theme compared to the data set. This ensured that the thematic collection validly portrayed the overall implicit meaning within the data, aligning with the theoretical framework (Braun & Clarke, 2006).

Afterwards, the fifth step involved defining and naming the identified themes. This process entailed capturing the essence of each theme, including its overall significance, and determining the specific data elements represented by the themes, respectively. This involved individually reviewing the data segments, which were then systematically organised to create a coherent and consistent narrative. Then, thematic summaries, encompassing both the scope and content, were outlined in a few sentences, providing a concise definition for each theme. The final step presents the identified themes and involves writing the final thematic analysis and report. This stage aims to convey findings from the data, convincing the reader of the analysis's merit and validity concerning the research questions (Braun & Clarke, 2006).

Moreover, the subject of investigation in a case study, often referred to as the "case", constitutes the unit of analysis (Yin, 2017; Grünbaum, 2007). In this study, quality deficiencies, information sharing, standardisation, and lack of information have been chosen as the units of analysis. This study employs a multiphase approach to assess information sharing around quality defects in production processes. The study will explore information-sharing practices within and between production units, focusing on the methods used and what information is not being shared. It will then delve deeper into how these practices relate to quality defects.

Finally, the study will analyse the role of standardisation (i.e., ERP system, ISO 9001; ISO 45001) at the company and relevant information attributes within the defect reporting system, pinpointing how these factors influence information sharing around quality defects.

3.3 Research quality

Yin (2017) establishes four test criteria for judging the quality of research design. Because of this, to ensure the quality of this case study, the study has focused on the following criteria defined by Yin (2017). Firstly, *construct validity* ensures that the study uses appropriate operational measures to capture the concepts studied accurately (Yin, 2017). This study explores clear theoretical concepts (e.g., information-sharing practices and quality defects). Considering that qualitative interviews were selected as the primary data collection method to assess information-sharing practices within production processes. This choice aligns with research conducted by Ringsberg and Lumsden (2016) and Coughlan and Coghlan (2002), who highlight the effectiveness of interviews in collecting data, enhancing the study's validity. Thus, the chosen operational measures, supported by established research, strengthen the study's construct validity. This suggests that the interviews will accurately capture the intended concepts.

Secondly, *internal validity* applies to studies aiming to establish a cause-and-effect relationship. This ensures that the study design minimises the influence of extraneous factors, allowing researchers to confidently attribute any observed effects to the independent variable (Yin, 2017). This study employed a mixed approach to participant selection. Ideally, all participants would have been randomly assigned to the treatment group. However, due to the limited number of individuals in certain key positions, a purposive sampling approach was used for some participants. While purposive sampling can introduce selection bias (Seawright & Gerring, 2008), ensuring the representation of these crucial roles within the study was necessary. The selection of some participants was also made by staff, raising the concern that the final treatment group might not fully represent the entire working experience. Thus, the non-random selection of some participants is a study limitation. Future research with larger sample sizes could aim for complete randomisation to strengthen the internal validity of the findings. However, to avoid any preparation affecting the answers, the participants were not provided with the interview questions beforehand; they only received a brief overview of the interview subject.

Furthermore, while the study utilised audio recordings for data collection, it became evident that some participants felt uncomfortable with this approach. This discomfort was observed through nonverbal cues, such as a participant frequently looking at the audio recording device. One interview also involved the unexpected presence of management, which could have influenced the interviewees’ responses negatively. The study utilises data triangulation (Patton, 1999), involving data collected from multiple sources (e.g., research articles, observations, and interviews), enhancing its overall validity.

The third test is *external validity*, which assesses how well the findings from the case study can be generalised to a broader population or context (Yin, 2017). For example, how research questions are phrased can either promote or impede the efforts to achieve generalisability. Therefore, formulating research questions that delve into the ‘how’ and ‘why’ is crucial for designing a study with robust external validity (Yin, 2017). Thus, this study has taken steps to enhance its external validity by incorporating a how question that explored how information sharing is conducted between different production departments with additional data collected. This suggests that the findings on information-sharing practices may apply to similar contexts; however, additional why questions could provide even deeper insights and further strengthen the generalisability of the findings. Still, while the study was conducted in a real-world production setting, making the findings representative of what happens in the actual workplace, it is essential to acknowledge that specific company practices, cultures, and willingness (i.e., attitudes towards changing the report system) can influence how information about defects is shared. Therefore, the findings of the Swedish furniture company may be more applicable to manufacturing companies with similar production structures and communication practices.

Finally, the last test is *reliability*, demonstrating that the research methods, including data collection procedures, are consistent. In practice, this implies that if the study were replicated with a similar sample, it would likely obtain similar results (Yin, 2017). This study adheres to the practice suggested by Yin (2017) of employing two observers during observations of the company's furniture production processes. This approach minimises potential observer bias and provides a more comprehensive picture (Yin, 2017) of how defects are addressed communicatively on the production line. Considering that the study utilises standardised approaches for collecting and analysing data (i.e., structured literature review, case study, structured interview protocol, snowball sampling, semi-structured interviews, and thematic analysis), this ensures consistency and reduces the chance of biases introduced by variations in how data is collected or analysed.

4. RESULTS AND ANALYSIS

Following the unit of analysis identified in the literature, interview data are used to categorise and organise participant responses. Each theme represents a specific area or recurring topic raised by respondents and provides a thorough description to understand critical aspects of their experiences. The following themes are presented in headings and subheadings.

4.1 Quality deficiency

Upon detecting a quality defect, the production operator communicates with the team leader. This communication aims to determine the appropriate action for the deficient item. The operators' station may be able to rectify the defect and salvage the item. The defect might necessitate a return to the preceding production station or even the supplier for correction. If the item cannot be rectified or returned, it will be classified as irreparable waste and disposed of accordingly. If an issue cannot be resolved, it is documented as an error code in an ERP system. Which then places the scrapping cost on the responsible department. This is the reoccurring theme across all the production units, regardless of what stations they are in. However, they consult with quality technicians when the group leader lacks the authority or expertise for a definitive judgment. Each production site has at least two available technicians to evaluate if the defect falls within the established tolerance limits for the product's intended functionality. The relationship between operation and quality technicians is different for each unit. In Production Unit A and Production Unit C, a collaborative spirit thrives. The production team highly regards the technicians, frequently seeking their insights. This positive dynamic is further evidenced by the technicians' frequent solicitations of the team's opinions.

In contrast, the situation in Production Unit B reveals a markedly different reality. A report submitted by Department Head A expresses significant concerns regarding the absence of random quality control measures for a period exceeding a decade. This suggests a potentially less engaged role for the quality technicians on the production line in Production Unit B, aligning with the theory (2.3) that a collaborative culture improves information sharing and may warrant further investigation. The interviews show that it mitigates employee knowledge gaps, fostering a culture of mutual support. Colleagues readily assist one another, and new hires benefit from a comprehensive onboarding program. Each new employee is paired with an experienced mentor who guides them through the introduction phase, ensuring familiarity with common defects.

Additionally, relevant informational resources are readily accessible at workstations or in proximity. This falls under the theory (2.1), which states that lack of knowledge is a common factor for quality deficiencies. However, a clear distinction emerges between the production units regarding the prevalence of quality defects attributed to employee negligence. In Production Unit B, common faults appear to be linked to carelessness or negligence. The theory (2.1) supports this since 3% of quality deficiencies were due to stress. This could stem from pressure to meet daily production quotas, leading to employee stress and decreased focus.

Conversely, the situation in Production Unit C presents a different scenario. While the team acknowledges the presence of stress on the production line, they maintain that it remains manageable and does not appear to contribute to quality defects. In fact, Production Unit C has the most minor quality deficiencies of all the three units investigated, which aligns with the theory (2.3) that information sharing can improve organisational performance. The inherent nature of specific production processes introduces unavoidable quality deficiencies. For instance, the initial production batch often requires adjustments to ensure complete mould filling in injection moulding. Similarly, the initial paint application process may necessitate refinements before achieving optimal results. These deficiencies are typically detected early within the production units. However, occasional oversight occurs, particularly in high-volume batches. The sheer volume can hinder individual operator inspection of each item, potentially leading to increased costs.

In addition, traceability practices within the organisation vary by location. A colour-coded stripe system is employed at the Production Unit C needle station. These stripes are sewn onto the fabric and serve to identify the individual responsible for producing that particular piece. In Production Unit B, a distinct method is utilised. Each worker is assigned a unique personal number. This number is then registered for each product they contribute to, enabling the identification of the team responsible for its creation and the subsequent allocation of fault, if necessary. These can be seen as methods to improve information sharing regarding the origin and potentially the cause of defects, aligning with the theory (2.1) of traceability. In Production Unit A, they provide supplementary descriptions on separate paper documents with the discovered faults and send them back to the responsible unit, transferring the responsibility of error code reporting back to the relevant unit. This method introduces traceability issues since there is no record of who identified the fault.

4.2 Information sharing

The organisation's production facilities use various methods to communicate quality issues. Internally, one unit uses paper forms, while the other relies on verbal communication. However, they all use an internal database as well. Coordinators primarily communicate through phone calls between facilities, which can lead to information loss compared to visual representations. A new information-sharing strategy involving meetings is being explored, but there are concerns about follow-up information sharing.

Inhouse

Production Unit B employs designated workflows to address various quality issues. Paint defects, where coverage falls short of the required area, are rectified promptly. The entire batch is returned to the paint station for immediate repainting, initiated through a direct call-over system. Welding problems are identified and brought to the attention of quality technicians by the team leader, ensuring swift removal of the faulty product from the production line. The assembly line has a system in place for handling detected faults. Defective items are removed from the line, and depending on the complexity of the repair, they are either addressed on-site or designated for rectification by a dedicated operator.

However, a critical gap has been identified. In certain instances, removed items are not accompanied by written documentation outlining the fault. This omission hinders efforts to prevent future occurrences and necessitates proper registration of faults on designated paperwork. According to the theory (2.3), user acceptance is crucial for successfully implementing information-sharing systems. Unregistered and registered faults that are ultimately scrapped are logged in the ERP system. This comprehensive logging, however, cannot compensate for the lack of specific details, which proves crucial for improving production processes and preventing similar issues in the future.

Following Production Unit B's approach, Production Unit C utilises internal communication methods tailored to their needs. Despite this, they rely on the ERP system to register all quality faults. In addition, upon identifying an issue, the team leader documents the details on a paper note. This information is then compiled by a technician and distributed to the entire site monthly, promoting collective learning and improvement. However, this is not accurate anymore, according to Quality Technician C, as the respondent claims that they have removed this since it did not seem to work as efficiently as claimed. The sewing station employs a unique system for rectification needs. They utilise a hanger system with paper documentation and sticky notes to convey the required alterations and their locations to the resewing station.

Quality Technician C has arranged a paper form for the sewing station where they are writing, who discovered it, what was wrong, when it was found, etc., before it is sent to the repair station. This is aligned with the theory (2.4) about accuracy, conciseness, and comprehensiveness. The assembly line adopts a hybrid approach, leveraging the paper and ERP systems for fault registration.

Additionally, they physically present defective products at the designated station to demonstrate the problem. However, the injection-moulding department presents a contrasting approach. They maintain a separate database for error codes, citing the limitations of the ERP system in meeting their requirement for up-to-date information. According to the theory, this inconsistency in information recording methods can lead to information gaps and hinder the overall effectiveness of the information-sharing system (2.3). While they acknowledge the use of the ERP system, they express concerns regarding its complexity hindering efficient operation, contradicting the theory (2.3), which states that the actors involved must be committed to the learning process required to share the necessary information. Despite the variations in internal communication methods across locations, all stations consistently utilise sticky notes affixed directly to salvageable products. These notes provide crucial details regarding the identified faults, facilitating the rectification process. However, Production Unit B has identified instances where these notes lack comprehensive information, potentially hindering complete rectification.

Moreover, within Production Unit A, Quality Technician A convey a positive impression of their error code and deficiency reporting practices. The respondent acknowledges the existence of occasional flaws and errors but maintains that information sharing is generally adequate. The primary action involves a phone call to the quality technicians, allowing for immediate requests for additional product and fault information. This aligns with the theory (2.4) regarding information accuracy. Conversely, in Production Unit B, most faults appear to be relayed directly to the relevant department head. While Department Head A can request additional information, Quality Technician B typically only visits the production line and consults blueprints if specifically requested. This practice also aligns with the theory (2.4) on accuracy, as the individual responsible for rectification is directly informed. However, instances still exist where Quality Technician B intervene directly on the production floor, notably when many faults are reported, aiming to prevent further errors.

Between production units

Communication of quality faults across production sites necessitates adaptation based on location. Generally, a coordinator contacts the accountable site via phone to initiate a replacement order. During this call, details concerning the quality issue are verbally relayed. However, while some instances rely solely on database entries, both methods are aligned with the theory (2.2), where a suitable channel depends on the event. However, in the latter method, the planning technicians responsible for new orders lack the crucial details provided by a direct conversation, often resulting in information loss due to the generic nature of error codes. To mitigate this issue and ensure future production adjustments, the accountable site is encouraged to request visual representations of the faults encountered. However, this process is subject to time constraints. Delays in reporting faults may result in the affected products being scrapped, rendering illustrations unfeasible and disregarding the importance of timely information according to the theory (2.4).

Production Unit A deviates from the standard quality error reporting protocol by implementing an alternative approach that bypasses the company's centralised database system. This alternative method applies to most of the identified quality deficiencies, except for a specific set of critical error codes that require mandatory recording within the system. Final assembly line workers forgo the electronic reporting system and use a paper-based documentation process. They adhere to practices other units implement, utilising adhesive notes to document faults directly on the affected products. Additionally, they provide supplementary descriptions on separate paper documents that accompany the faulty items. These documents are then shipped back to the responsible unit for further investigation and rectification of the identified error codes. However, this workaround introduces traceability concerns, as the current paper-based system cannot capture and record the identity of the individual who initially identified the fault. Consequently, this alternative method circumvents the database. It transfers the responsibility of reporting error codes to the relevant unit, creating potential obstacles in tracking accountability within the quality control process.

Quality Technician A report the implementation of a new information-sharing strategy across production units. This strategy involves a meeting between the quality technician, the head of the department responsible for the defect, and the department head where the fault was discovered. This approach aligns with the theory (2.4) regarding information accuracy, as it ensures relevant personnel are directly informed. However, the strategy is still in its early stages, and uncertainties remain. The primary concern relates to the distribution of follow-up information after the meetings. This lack of clarity regarding information flow contradicts the theory (2.4) on management clarity. Effective information sharing requires clear communication channels to ensure everyone understands their role and responsibilities.

A positive trend is observed in inter-unit collaboration, with most respondents indicating successful cooperation. However, Operator C has raised concerns regarding implementing their proposed improvements to product prioritisation. They expressly point to the inefficiency of loading prioritised items last in the production sequence. This practice undermines the prioritisation system, as the receiving unit is required to unload all preceding items before accessing the critical products. The resulting delays in acquiring and assembling prioritised goods generate stress for operators. This aligns with established theories (2.1 & 2.5) demonstrating a correlation between stress and increased quality defects.

4.3 Standardisation

Analysed interviews from the production sites revealed a general absence of formal and standardised quality control procedures throughout the production process. Assemblers primarily rely on visual pre- and post-inspections, with limited guidance beyond basic knowledge of common faults learned during mentorship. Basic knowledge transfer suggests a less rigorous approach, as confirmed by the theory (2.1). While individual operators, like Operator A, take responsibility for ensuring product quality before passing it on, and some team leaders, like Team Leader A, have specific pre-inspection measures in place (e.g., checking the chair back for defects), there seems to be no systematic and documented approach for guaranteeing quality at each stage. Operator B acknowledges the lack of a formal pre-inspection routine but mentions that they try to check products as best they can within time constraints.

Similarly, post-inspection often relies on random sampling, like Operator B's approach, checking 20-25% of products. This suggests that the inspections might not be consistently performed at every production stage. Team Leader A confirms the absence of a formal post-inspection routine, relying on the discontinued practice, as mentioned earlier, where a quality technician inspects some chairs daily. This lack of ongoing post-inspection oversight leaves room for potential defects to slip through. According to Department Head A, the focus seems to be on pre-inspection for some tasks, such as welders checking material before welding. However, there is an acknowledgement that some material quality issues might be outside their control, as mentioned by Department Head B regarding pre-approved incoming materials.

Moreover, Department Head C describes the operator's role in checking specific points on the chair and marking missing components. The group leader collects and categorises these defects based on who is responsible (internal production or supplier). However, the effectiveness of this system appears limited by the lack of documented procedures and potential reliance on judgment calls. For some materials like plastic parts, Department Head C mentions that operators notify the group leader, who then contacts the quality manager for assessment. This suggests a more involved approach for certain materials but does not represent a consistent or documented routine for all components.

Furthermore, while some standardised level of control routine exists for chairs and tables at Production Unit A, its application appears inconsistent. Operator C relies on test-sitting most chairs, excluding one model, and uses experience to identify potential problems. Team Leader D highlights that defects often become apparent during assembly, suggesting pre-assembly checks might be lacking. Like Production Unit B and Production Unit C, there is a mentor system to train new assemblers at Production Unit A. However, Team Leader E emphasises the underutilised quality binder with defect examples. Department Head D confirms a reliance on assembler experience for fabric quality assessment, with production leaders handling identified issues.

A standardised approach is followed for ERP system utilisation. All departments register their identified defects within the system every week. This consistency ensures centralised tracking and analysis of quality issues. Most interviewees at the company seemed to have a somewhat resigned acceptance of the ERP system, the current system for quality control reporting. While acknowledging its outdatedness, as Quality Technician A phrased it, "the ERP system feels quite outdated", they expressed a sense of practicality. The ERP system may not be ideal, but it "functions" for their current needs, as Quality Technician A explained: "It's the program we have, and I can't see how we would report otherwise. We have all the necessary information readily available for daily reports, monthly summaries, and so on." This highlights the importance of usability when considering a QMS. However, this perspective contradicts quality management principles according to theory (2.5) about continuous improvement of processes and products. Despite its functionality, the ERP system might not be the best tool to achieve these goals. The finding converges with the theory (2.5) about internal organisational factors and a lack of collaboration (2.3). As mentioned in (4.2), some respondents at Production Unit A perceive the ERP system as challenging and impractical because they rarely deal with defects caused by their unit. They emphasise the need for more precise instructions and fewer error codes to improve user experience. Limited use hinders learning and acceptance of the system within the workflow.

Furthermore, as indicated by Team Leader A and Operator A, stress is identified as a contributing factor to careless errors among operators. This aligns with established theories (2.1) on stress and its detrimental effects on performance. Despite acknowledging the role of stress, operators often overlook its influence on their work, attributing mistakes to other factors. Interestingly, while operators express feeling stressed, neither team leaders nor the department head explicitly mention stress as a significant factor in the work process. While most interviewees indicate receiving support from management when needed, Department Head B highlights a decision by management to maintain production throughout the summer to prevent market share losses, aligning with the theory (2.1). This decision, perceived as a stressor by all involved, particularly team leaders, contradicts the principle of stress prevention emphasised in ISO 45001.

4.4 Lack of information

The differing information needs between the three production units become apparent during the interviews. In Production Unit B, particularly in the welding department, there is an intense desire for more detailed information regarding fault types. Department head A emphasises the need for extensive data on quality deficiencies in welds, including images or additional comments. This aligns with the theory (2.4) that information comprehensiveness, as an attribute, is vital for effective decision-making.

Conversely, Production Unit C, apart from the injection moulding department, which utilises a separate error code reporting system, indicated satisfaction with the current level of error code coverage. Interestingly, while Production Unit C possesses over ten unique plastic error codes, welding in Production Unit B is covered by only one. This lack of standardisation can hinder information sharing, as claimed in the theory (2.5). This discrepancy suggests a potential disconnect between the information needs of the receiving unit and the perceived sufficiency of the information provided by the unit registering the codes.

Despite claiming comprehensive fault coverage through ERP error codes, Production Unit C utilises additional internal methods and systems for quality deficiency descriptions. While this approach receives praise from staff, it necessitates multiple reporting transactions instead of a streamlined process. According to the theory (2.3), it is suggested that information overload can hinder performance. Production Unit C utilises multiple reporting methods beyond the ERP system, potentially overloading, yet still reports satisfaction with the information level. However, this raises concerns about the actual comprehensiveness (2.4) of the ERP system. Quality Technician B interviewed believes there are too many error codes. The respondent argues that this may lead to information overload, aligning with the theory (2.2) and suggests focusing on unit-specific codes. Quality Technician B also expressed concern that a lack of computer knowledge among those assigning codes might lead to incorrect selections, contradicting the theory (2.1).

Quality Technician C identifies a correlation between quality defects and knowledge gaps among operators. While acknowledging the vast product range and the impracticality of expecting complete knowledge, the respondent argues against a comprehensive information folder, which does align with the theory (2.2 & 2.4) concerning information overload. Instead, Quality Technician C recommends a streamlined resource with task-specific information but expresses concern regarding some operators' perceived lack of motivation and resistance to acquiring information, potentially contributing to quality defects. This perspective, however, contrasts with the findings of other respondents who reported a generally motivated workforce, necessitating further investigation to reconcile these contrasting views.

According to the quality technicians, all three units report quality deficiencies weekly, with additional reports for high-volume periods and discrepancies in follow-up practices. Production Unit B acknowledges instances of neglecting the assembly line reporting system. Here, operators initially record deficiencies on paper left on carts, which are later used for bulk input into the ERP system. However, Team Leader A admits that paper forms are sometimes skipped, leading to data loss. As a result, this act neglects the importance of accurate and comprehensive data for assessing IQ, as outlined in the theory (2.4). In addition, Production Unit B lacks a systematic approach to address this issue, which contradicts the theory (2.2) that proper management systems, including established procedures for information collection and analysis, are crucial for effective information sharing.

Conversely, Production Unit C and Production Unit A demonstrate a more proactive approach. They hold monthly Workplace Meetings on Quality (WPMQ) focused on quality improvement and preventing recurring deficiencies. Production Unit B has recently implemented WPMQ in some areas, while others receive emails regarding internal scrap costs. This suggests that Production Unit B is taking initial steps towards a more structured QMS.

Furthermore, quality technicians are provided with daily scrap reports outlining internal production defects every morning by email. This aligns with theory (2.3) regarding the positive impact of IT on internal SCM practices. There is a shared belief among them that department heads should also be included in this information loop to enable them to independently identify and address the causes of quality issues. While the daily influx of internal scrap data could be perceived as information overload, all personnel directly involved consistently report that it has proven effective in facilitating the early detection and resolution of quality problems. This practice contrasts with theory (2.2) regarding information overload.

Additionally, the reports might lack the necessary context, as evidenced by the Production Unit B welding department's incomplete fault information due to limited error codes. Providing department heads with additional data without addressing the IQ could be counterproductive. Quality Technician A indicates that an abundance of statistical data is available to identify recurring defects, provided there is a strong interest and initiative to utilise it, which aligns with the theory (2.1). The existence of separate production units significantly influences current information-sharing practices within the organisation. According to theory (2.5), a standardised approach across all units would be ideal. However, while personnel possess a clear understanding of departmental responsibilities within their respective units, this clarity seems to diminish when information needs to be disseminated across different units. Although information sharing is demonstrably transparent within individual units, the same level of transparency is not evident when communication transcends unit boundaries.

Moreover, there is a difference of opinion among quality technicians regarding their involvement in reporting defects. Quality Technician A expresses concern that the current process might exclude them from receiving crucial information. This raises the possibility that the responsible unit's quality technicians are not kept fully informed, necessitating a clear delineation of responsibility regarding follow-up communication on shared information. In contrast, Quality Technician B believes that his role in reporting certain defects is unnecessary. The respondent argues that department heads can handle these situations alone, suggesting a potential reduction in the technicians' responsibilities.

In addition to reporting discrepancies, information sharing regarding upcoming orders presents another challenge. Quality Technician C claims that the ERP system withholds details about future orders from operators, hindering their ability to prepare for larger volumes. This lack of transparency can lead to an increase in stress and potentially careless errors during production. Considering IQ, this indicates that the system disregards timeliness and comprehensiveness as essential information attributes, as established in the theory (2.4).

5. DISCUSSION

This study explores information sharing between internal scrapping processes within furniture manufacturing. The results are discussed based on standardisation, information overload, information attributes, and communication gaps.

Standardising Reporting

The results show significant concerns surrounding the current lack of standardisation in reporting error codes across different units. This inconsistency hinders the efficient identification and resolution of faults. It suggests a potential compromise in data accuracy (Grudzień & Osiński, 2021; Khoe & Rahkman, 2023). Even though all production units report quality deficiencies weekly, discrepancies exist in follow-up procedures. Production Unit B's practice of initially recording deficiencies on paper for later bulk input into the ERP system raises concerns about data loss. Without sharing this information, coordinating and overseeing manufacturing operations becomes significantly more challenging (Busert & Fay, 2018; Busert & Fay, 2020).

Additionally, the occasional skipping of paper forms further undermines data accuracy. To address this inconsistency, a standardised form, much like the one Quality Technician C has provided for the sewing station, for reporting deficiencies is recommended (Chungoora & Young, 2011; Khan & Abonyi, 2022; Rachuri et al., 2008; Cutting-Decelle et al., 2004). However, the need for flexibility to accommodate diverse departmental manufacturing processes is acknowledged. The standardised form should capture critical information consistently across all departments, including the operator who identified the fault, the time of discovery, the affected batch (if applicable), a clear description of the identified deficiency, and the department responsible for addressing the issue (Holmberg, 2000; Li & Lin, 2006; Qi & Qingyu, 2010).

Following established protocol, the acting team leader undertakes a weekly compilation of the documents. Upon reaching the agreed capacity, the corresponding pallet of defective components, accompanied by the documentation, is returned to the responsible unit. This facilitates a collaborative effort, leveraging the unit's expertise to assess the cause of the failures and assign the appropriate error codes within the ERP system. This approach offers several advantages. It enhances information accuracy and transparent traceability of deficiencies (Grudzień & Osiński, 2021). Furthermore, the system facilitates the capture of valuable information for preventative measures. However, in the event of many recurring defects, direct contact with the responsible unit is necessary to ensure immediate corrective action.

The study shows that existing unit-specific reporting systems may seem convenient, but a standardised form offers significant benefits. Reports can be readily understood between units, regardless of origin (Chungoora & Young, 2011). The responsible department can take immediate corrective actions based on clear and consistent information (Sörqvist, 2004; (Grudzień & Osiński, 2021). Furthermore, the location of discovery (in-house or another unit) becomes irrelevant for effective resolution with a standardised approach. Implementing a standardised deficiency reporting form, with room for minor departmental adjustments, will lead to improved communication (Khan & Abonyi, 2022; Rachuri et al., 2008; Cutting-Decelle et al., 2004), facilitate preventative actions, and ultimately enhance overall product quality (Meroño-Cerdán et al., 2007).

ERP system

The study revealed concerns regarding the transparency of upcoming orders in the ERP system. Production Unit C representatives pointed out that withholding order details hinders operators' ability to prepare for production fluctuations and effectively adjust production processes. This lack of timeliness (Grudzień & Osiński, 2021; Khoe & Rahkman, 2023) provision can lead to increased stress (ISO, 2018), delays and potentially contribute to careless errors (Bäckstrand, 2009) during high-volume periods. However, a critical challenge in manufacturing management is achieving an optimal information flow. While delayed data impedes timely decision-making, overly frequent reports can disrupt production workflows and management focus (Gustavsson & Wänström, 2009; Busert & Fay, 2020).

Furthermore, the results show that the current system for reporting faults through the ERP system presents challenges related to information overload and code granularity **(**Busert & Fay, 2018; Busert & Fay, 2020). While the ERP system allows for centralised data collection, these codes lack the crucial details provided by direct communication (Sörqvist, 2004; Pernagallo & Torrisi, 2020; Skipper & Hanna, 2009; Saxena & Lamest, 2018). Consequently, the results indicate that the generic nature of error codes can lead to information loss. One way to address information overload and code granularity may be to implement a two-tiered reporting system in the ERP system. For initial reporting, use fewer error codes that only apply to the specific unit to identify the general nature of the fault quickly. For more detailed reporting, facilitate direct communication between quality personnel and planning technicians to gather information about the fault (Pernagallo & Torrisi, 2020; Skipper & Hanna, 2009; Saxena & Lamest, 2018). This means that the information delivered is based on user roles and responsibilities, ensuring that users receive only the information relevant to their tasks (Sörqvist, 2004; Eppler, 2006).

In addition, according to literature, time constraints can impede the gathering of visual representations of faults, further hindering the acquisition of crucial details (Pernagallo & Torrisi, 2020; Milord & Perry, 1977; Toffler, 1970). Delays in reporting faults due to lengthy processes can mean affected products have already been scrapped, making visual descriptions unfeasible. Both these aspects mean that the reporting system does not consider the principle of comprehensiveness and timeliness in IQ (Grudzień & Osiński, 2021). Hence, exploring alternative reporting methods that capture richer details alongside error codes in a brief customisable description of the defect may improve information comprehensiveness (Nielsen, 2023; Sörqvist, 2004).

Electronic Product Code Information Services (EPCIS)

The study shows that the current lack of standardised quality control procedures at the company, as revealed by interviews with Team Leader A, Department Head A, and Operator B, exposes vulnerabilities in their logistics. EPCIS can solve two key challenges: product defects and inventory management. Firstly, considering that EPCs work as unique identifiers assigned to individual products. They can be embedded in tags attached to products or packaging (GS1 EPC Global, 2014a; Ringsberg & Lumsden, 2016), providing real-time visibility into product movement (Ringsberg & Lumsden, 2016). Therefore, by tracking EPCs from raw materials to finished goods and identifying any discrepancies (i.e., defects) within the logistics (Ringsberg, 2015; GS1 EPCglobal, 2014b), the production units can immediately share and receive detailed data about the product at any point. This allows swift intervention against defects, potentially contributing to a more efficient logistics operation (Ringsberg & Lumsden, 2016).

Secondly, considering that EPCIS captures data on product movement and transformation throughout the supply chain, which can be utilised to maintain accurate and up-to-date information on product location and status (GS1 EPC Global, 2015; Ringsberg & Lumsden, 2016; Ringsberg & Mirzabeiki, 2014; Ringsberg, 2015; Chua et al., 2019). The organisation can readily track inventory levels at all stages, from raw materials entering production to finished goods awaiting shipment. This eliminates discrepancies and ensures optimal stock control. Moreover, the company can make informed production and ordering decisions with real-time inventory data. They can anticipate stockouts and prevent production delays by proactively replenishing materials, potentially reducing stress, as presented in (4.1).

Streamlining Meetings

The study shows that the current procedure for arranging meetings between department heads regarding inter-unit quality defects indicates signs of being flawed. As highlighted by Quality Technician A, the affected unit's technician is currently tasked with initiating communication with the affected and responsible department heads. This approach raises concerns about accountability and efficiency. Theoretically, the responsibility for ensuring resolution should reside within the accountable unit, facilitating concise information (Sörqvist, 2004; Grudzień & Osiński, 2021).

However, the study proposes a more streamlined approach because of the potential geographical separation between units. In this case, the coordinator or team leader who initially identifies the fault reports it directly to the quality technician in the responsible unit. This appears promising in the context of providing accurate information (Grudzień & Osiński, 2021; Qi & Qingyu, 2010). It also places ownership for addressing the issue squarely within the responsible unit, where expertise resides, contributing to information clarity (Grudzień & Osiński, 2021). Although the affected unit's quality technician can still play a valuable role, their involvement should be focused on confirming the validity of the defect and managing stock control in case of a broader issue within their facility (Sörqvist, 2004; Bünzli & Eppler, 2024; Schulz von Thun, 2013). Centralising responsibility within one unit simplifies case follow-up and minimises disruption to the process, aligning with concise information (Sörqvist, 2004; Grudzień & Osiński, 2021).

Communication Gap Hinders Quality Improvement

A critical issue emerged during employee interviews: a deficient procedure keeps recurring with no corrective action enacted or reported to higher management. This lack of action results in lost information and hinders process improvement. The study addressed that employee morale seems high, but the repeated occurrence of this unaddressed deficiency is concerning and warrants further investigation.

Furthermore, requests to implement a program of randomised quality checks have not been implemented. This is particularly concerning as information on daily scrap has already been reported. Given the existing data collection, prioritising randomised checks seems like a logical next step for the quality department. This would provide a more comprehensive overview of quality control and allow for a targeted improvement approach. Adding to the concern, employees expressed fear that a lack of computer literacy among those assigning quality codes might lead to incorrect selections. This highlights the need for training programs to ensure accurate code selection and minimise misinformation (Barua et al., 1997). The lack of action on the recurring deficient procedure and the request for randomised checks, coupled with concerns about code accuracy, suggests a potential gap in communication or a disconnect between identified problems and implemented solutions.

6. CONCLUSION

This study explored information sharing between internal scrapping processes within furniture manufacturing. To comply with the stated purpose, three RQs were formulated:

How is the information sharing conducted between different departments?

The study revealed that the production facilities employed a multifaceted approach to communicating quality issues. Internally, communication methods differ between units. One unit utilises paper forms, while another relies solely on verbal communication. However, all units leverage a central internal database for recording and tracking issues. Communication between facilities primarily occurs through phone calls coordinated by designated personnel. Quality technicians act as a vital intermediary between the units. They are tasked with investigating reported issues and ensuring effective communication throughout the processes.

What methods for information sharing are used in a production facility?

According to the presented results in this study, internal communication lacks uniformity, relying on a mix of paper forms, verbal exchanges, and a central database (i.e., the ERP system) with limitations. Inconsistencies arise from departmental use of separate databases. Additionally, the clarity of information conveyed via sticky notes affixed to products varies. Communication between production units primarily utilises phone calls, is prone to information loss, and uses ERP system entries, often lacking crucial details due to generic error codes. Even though a new meeting-based strategy is being explored, concerns regarding follow-up information dissemination remain unaddressed.

To improve communication and consistency in reporting quality issues, it is recommended that a standardised deficiency reporting form be implemented. This form, used by all departments, should capture essential information consistently: the operator who identified the fault, the date and time of discovery, the affected batch (if applicable), a clear and concise description of the identified problem, and the department responsible for addressing the issue. This standardised form would be the primary reporting method, submitted electronically or physically with the corresponding pallet of defective components, a central database. Phone calls can serve as a secondary communication channel for urgent or complex issues requiring immediate attention. However, the standardised form should remain the prioritised method for all quality-issue reporting.

What are the attributes related to information sharing?

The results of this study suggest that attributes like accuracy, timeliness, clarity, conciseness, comprehensiveness, and granularity are essential to achieving IQ. As a standardised reporting system, EPCIS may be applicable here, answering crucial questions by exchanging information about what happened to the product and where, when, and why the defect occurred. Thus, it offers advanced tracking capabilities within logistics, enhances product traceability, and gains a holistic view of quality across the entire production network, ensuring an alignment with the information attributes.

6.1 Recommendations for further research

This study holds the potential to yield significant practical contributions by proposing structural reforms for information sharing regarding internal defects within organisations. These reforms aim to ensure consistency across all production units. Future research endeavours could broaden their scope to include external scrap and a wider range of products. Additionally, analysing data from all production units would bolster the generalizability of the findings. Incorporating quantitative data through surveys and production data analysis, with qualitative interviews, would enhance the research's robustness. Further refinement of the literature review with industry-specific publications and the latest research findings would strengthen the study's foundation. Lastly, comparative studies offer promising avenues for further exploration in this field.

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APPENDIX 1

Search:	Matches:	Limited to years:	Matches:	Limited to document type: Article	Matches:	Limited to subject area: Business, Management and Accounting	Matches:	Limited to keyword	Matches:	Scopus	Web of Science
"information management system"	8 375	2020-2024	1 948	Yes	1 064	Yes	57			Yes	
"information sharing system"	652	2020-2024	163	Yes	82	Yes + Social sciences	28			Yes	
"information sharing"	28 567	2020-2024	8 830	Yes	5 859	Yes	1 201	Information technology	17	Yes	
"Digital information sharing"	46	2020-2024	19	Yes	12	Yes	3			Yes	
internal AND scraps AND information AND sharing	1									Yes	
internal AND scraps	508	2020-2024	125	Yes	95	Yes	18			Yes	
"Methods for information sharing"	16									Yes	
method AND information	2 360 551	2020-2024	742 163	Yes	521 439	Yes	13 379	Information Sharing	59	Yes	
"EPCIS" "Information sharing"	9	2020-2024									Yes
ISO "information sharing" production	2										Yes
"Information attributes" manufacturing	6										Yes
"Information attribute" information sharing	7										Yes
information attributes production	11	2019-2024	5								Yes
Information sharing ISO	51										Yes
"information sharing" quality management system	680										Yes
"too much information"	1 182	2020-2024	254	Yes	147	Yes	10			Yes	
"EPCIS" Information sharing	33										Yes
"Quality deficiencies" production logistics	2										Yes
Quality deficiencies manufacturing	13										Yes
EPCIS "HURBURGH CHARLES"	1										Yes
RINGSBERG HENRIK	6										Yes
"information sharing" standardization manufacturing	16										Yes
"Trailers" "EPCIS"	1										Yes
internal defects "increasing" industry manufacturing	19										Yes
"quality management system" small companies	77										Yes
"quality management system" internal external	127 / 37										Yes
"quality management system" stakeholders improve	38										Yes
standardization "information sharing" interoperability	26										Yes
"employee errors"	10										Yes
motivation knowledge human errors	165										Yes
QMS improving quality	326										Yes
information Characteristics manufacturing	21										
"information sharing" "information quality"	132										
"effective information sharing"	134										
"business communication"	3 666	2020-2024	621	Yes	379	Yes	176			Yes	

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