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Requirements Analysis for Digital Supply Chain Compliance
Management Platforms: Case of German Meat Industry

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Abstract

The food industry faces increasing challenges in compliance management due to complexities such as evolving stakeholder demands and food industry standards. Digital compliance management platforms can support food supply chains in managing these complexities. It is important to capture the requirements across food supply chains to provide digital compliance management platforms that meet stakeholder needs within the chains. The study aimed to investigate the stakeholder-driven requirements of digital supply chain compliance management platforms within the German meat industry. The study was qualitative through the Delphi study approach. Prior to the Delphi study, stakeholder mapping was used to select the participants who are experts actively engaged with digital meat compliance platforms. In round 1 of the Delphi study, participants were asked to review the relevance of 51 existing requirements from a fresh fruit and vegetable digital compliance platform, with 50 requirements reaching full consensus among the participants. In the same round, the participants put nine additional requirements. In round 2 of the Delphi study, participants were asked to prioritise the nine additional requirements. Some requirements, like database connection, document versioning, and automatic document analysis, were found to influence user satisfaction, while others were less significant. This research shows that requirements transfer from the fresh produce sector to the meat sector is plausible. The transfer should recognise common requirements across sectors and incorporate those specific to the meat sector for improved user satisfaction.

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1. Introduction

The complexity of global food supply chains brings risks relating to food quality, safety, and integrity (fraud and adulteration of products) [1,2]. [3] emphasise that quality risks occur more often in global multi-tier food supply chains compared to short and direct supply chains. According to [3], quality issues could potentially arise from any stage of the supply chain, including raw materials, manufacturing processes, or logistics operations. These complexities of supply chains have led to a rise in quality concerns for global food supply networks, as noted by [1,2,4]. [1] validates that the growing complexity of supply chains has made it more challenging to ensure food safety and quality throughout the entire chain. According to [5], the rising complexity of food supply chains can cause a lack of balanced information flow, potentially resulting in the loss of important data when transitioning between stages. In order to counteract the global prevalence of food scandals, meat suppliers can undergo approval and monitoring processes through compliance management, which involves verifying their certifications [6]. In addition, to overcome such quality concerns, innovative approaches enabling seamless compliance management can help stakeholders to monitor and approve suppliers effectively [7].

In addition to food safety, quality and integrity concerns, [8] highlights an additional challenge: the rising volume of paperwork required to demonstrate adherence to regulations is becoming widespread in global supply chains. [9] discuss that utilising digital platforms for managing compliance in the supply chain can aid global food supply chain participants in ensuring the safety and transparency of their supply chains. With the help of modern technologies, it is possible to create a comprehensive overview of supply chains and collect compliance data, including certification details such as the British Retail Consortium (BRC) and International Food Standards (IFS), and lab analyses, through a single cloud-based platform [9]. [8] found that dealing with quality assurance and compliance demands is expensive and labour-intensive for those involved in the supply chain. According to the study above, compliance management is paramount for producers catering to retail, wholesale, and export markets. Previously, suppliers' compliance information was managed using a manual approach involving emails, Excel spreadsheets, and folders [9]. According to [10], high levels of human involvement in supply chains can increase the likelihood of errors, such as overlooking necessary certifications, raising the risk of food fraud and scandals. Digital platforms for managing supply chain compliance can transform the traditional approach of collecting and sharing compliance data in B2B settings [9].

The intricate nature of meat-food supply chains may benefit from digitalisation. However, the compliance management processes are still relatively manual, for example, through email communications, spreadsheets, and limited utilisation of Enterprise Resource Planning (ERP) systems [9]. This leads to issues like the rising volume of paperwork required to demonstrate adherence to regulations, which has become a widespread issue in global supply chains [8]. Although requirements for supply chain management platforms have been studied, see [9], the requirements for platforms to effectively manage compliance in the meat industry lack digital compliance management adaptation and effectiveness within the context of the meat industry remain uncertain. The need to streamline and enhance compliance management in the meat supply chain is paramount, particularly as regulatory complexities and consumer expectations continue to evolve. Consequently, this research aims to analyse and prioritise the requirements for digital supply chain compliance management platforms, with a specific focus on the German meat industry, while considering the perspectives of key stakeholders in the industry.

The remainder of the paper begins with a background in Section 2, highlighting considerations in meat supply chains and compliance management in food supply chains, followed by methodology in Section 3. The results are explained in Section 4 and discussed in Section 5. Finally, Section 6 concludes by highlighting limitations and areas for future work.

2. Background

2.1. Considerations in Meat Supply Chains

Food supply chains involve transforming raw materials through a sequence of processes to enhance their value, ultimately resulting in a product that delivers added value to the end consumer [11]. Several key considerations in meat supply chains are emerging, including, for example, the importance of transparency, authenticity, compliance, and traceability. *Transparency* is crucial for gaining the trust of customers and consumers and ensuring food safety, as stated by [12]. [25] define supply chain network transparency as the level of shared knowledge and access to product and process-related information among all stakeholders in the network without any loss, delay, distortion, or noise. According to [10,13,14], transparency is crucial in establishing and maintaining trust, which can be achieved by safeguarding consumer data, providing production transparency, improving labour conditions, and promoting social responsibility. [15] suggests that there is potential to incorporate modern technologies into food supply chains to enhance transparency. According to the same study, this will help food manufacturers restore consumer trust and simplify the process of obtaining regulatory authorisation. Trust is one of the most essential factors in food manufacturing, as determined by professionals in the food industry [16]. Additionally, [17] research revealed that 94% of consumers expect food manufacturers to be transparent about their production methods. According to [12], digitalisation can significantly increase transparency in food supply chains, reducing the likelihood of food spoilage, outbreaks of foodborne illnesses, and scandals related to food fraud, such as adding undisclosed ingredients like the horsemeat scandal.

Authenticity is a second factor referring to the legitimacy of a food product through quality checks, and certification procedures are crucial for both commercial and legal reasons [18]. The previously mentioned study found that food labels may contain information about various aspects such as the species or geographic/genetic origin, production method, and processing technologies. Food fraud often targets high-value food producers labelled with specific quality characteristics intended to attract consumers' attention. Therefore, authenticity is essential for consumer protection [18]. Linked to authenticity is *traceability*. According to [19], food traceability is a component of logistics management that involves obtaining, storing, and sharing sufficient details about a food item, feed, food-producing animal, or substance throughout every phase of the food supply chain. Traceability enables the product to be monitored for safety and quality and traced upwards and downwards throughout the chain [20]. The utilisation of food traceability systems is beneficial in mitigating safety risks, rebuilding consumer confidence, enhancing marketing value, endorsing quality enhancements throughout an organisation and its supply chain, promoting animal welfare, and achieving accurate agricultural practices, as highlighted by [21]. *Compliance* is also considered critical in the food supply chains [22]. Compliance refers to ensuring that business practices, processes, and operations comply with a predetermined or mutually agreed upon set of standards [22]. According to [23], companies must comply with regulations that may be imposed externally or internally, and failure to comply with these requirements can result in heavy consequences. Therefore, legislative and regulatory bodies like the European Commission and the U.S. Food and Drug Administration (FDA) are responsible for imposing compliance obligations [22]. Moreover, requirements for compliance may also be derived from various standards and codes of practice, such as ISO9001, HACCP, IFS, and BRC, along with policies within the organisation and contracts with business partners [22,24]. Consequently, compliance requirements (i.e., standards like IFS Food and ISO9001) help to assure specific quality standards in food products [7].

2.2. Complexities and Digitalisation in Meat Supply Chains

Supply chain actors involved in meat supply chains range from micro-sized organisations to large scale [25]. Food Safety Management Systems (FSMS) are highly recommended and often enforced to manage and minimise the potential risks of microbial, chemical, and physical hazards throughout the meat supply chain [26,27]. To establish an effective FSMS, it is important to adhere to applicable quality assurance protocols such as Codex Alimentarius, BRC, and IFS, as stated by [27]. For a food business to be certified by schemes like BRC or IFS, it must first pass audits

conducted by neutral, independent, or third-party organisations to confirm its compliance with specific quality assurance standards and guidelines [28,29]. According to a study conducted by [30], food producers are responsible for adhering to their own quality standards and food regulations and ensuring that their suppliers comply with their food safety standards. In today's food industry, companies should adhere to various food standards and specifications [30]. [31] emphasise the importance of monitoring suppliers' compliance to eradicate social and environmental non-compliances within supply chains, which are frequently responsible for food scandals. This is necessary due to the rise in regulations, consumer expectations, and the need to avoid potential supply chain disruptions [31]. According to [10], efficient supply chain management is needed for the success of food companies. [10] emphasise the importance of utilising technology to facilitate the management of complex supply chains, such as cloud computing, to mitigate errors in supply chains. Subsequently, according to [7], combining information databases can cut expenses and allow for broader information sharing with various stakeholders. Digital compliance management platforms can revolutionise food supply chains by streamlining the compliance process and enabling more real-time information transparency [32], thus provide improvements regarding the monitoring of various quality protocols and offer real-time tracking of each actor's compliance within the chain, in addition to reducing manual tasks within the chain.

3. Methodology

This research used a mixed method case study approach (i.e., qualitative and quantitative research), which enabled the analysis of various forms of data, including direct field observations, detailed interviews, written records, and surveys [33]. As delineated in [34], it assumes a pivotal role in the study. The selection of the case study methodology is underpinned by its capacity to facilitate a profound exploration of a particular and intricate context—the German Meat Supply Chain. Focusing on this case provides a deep understanding of compliance management in this industry. It allows for a thorough examination of the parties involved, their obligations, and specific requirements. It is important to note that this choice allows for a detailed exploration of the unique challenges and needs in this particular supply chain, which might be overlooked in broader investigations. The goal is to explain why using a case study approach is essential to comprehensively address research objectives. Qualitative research is well-suited for analysing real-life situations and creating case studies through an inductive approach [33]. Such qualitative research allows the identification of patterns and themes that arise from the examination of cases. Based on the findings of the qualitative research method, quantitative research was applied to prioritise requirements using the Kano model [35]. The study involved two rounds of the Delphi method, including a consistent group of stakeholders with expert knowledge in the German meat industry. The Delphi method was chosen as it offers benefits such as enabling interaction and discussion among experts, which can result in the ability to gather input from a larger pool of expertise and conduct cost-effective research [36]. This approach allows for expert feedback and a chance to revise opinions, resulting in greater efficiency and broader access to knowledge than traditional methods [37].

The case study company is a SaaS scale-up based in the Netherlands that offers a comprehensive solution for refining and enhancing supply chain mechanisms in over 120 countries. Their platform provides efficient data exchange across the entire supply chain, serving over 140,000 fruit and vegetable producers and 200 active users within the food industry. By leveraging automation and database interconnectivity, the firm simplifies quality information management, saving time and ensuring compliance with customer and regulatory demands. With a diverse workforce of 39 employees from 22 different nationalities, the company has a deeper understanding of various global markets and customer requirements. The primary focus of our research is the platform's impact on different organisations and interconnected processes within the broader supply chain context.

There are four steps used for data collection and analysis in this research. In *Step 1, Stakeholder mapping* was used to determine the research participants. According to [38], stakeholder mapping refers to recognising, examining, and comprehending an organisation's or project's stakeholders and their connections with it. Additionally, the same research suggests that a crucial step involves mapping out the stakeholder network and categorising each stakeholder based on their level of interest and power concerning the organisation or project. This approach enables the identification and prioritisation of key individuals and groups who should be involved in the decision-making process for the case study [38,39]. Table 1 provides a typology of stakeholders in the meat industry. The findings are based

on existing literature [40–42]. To prioritise all stakeholders identified during the process, semi-structured interviews were conducted with five food industry experts who held management positions within the case study company. The analysis and placement of stakeholders followed the stakeholder prioritisation matrix [43]. This matrix categorises stakeholders based on their power level and interest in the project. The matrix is divided into four zones, and for each zone, it suggests the type of relationship the project manager should establish and maintain with the stakeholders in that category. Stakeholders in Zone A, who have low power and low interest in the project, will not require much attention from the project manager. On the other hand, stakeholders in Zone B, who have high interest but low power, need to be informed of important project decisions regularly to maintain good communication. Stakeholders in Zones C and D pose different challenges that are equally important to address [44].

Table 1. List of Stakeholders Involved with Meat Supply Chain Compliance Management.

Label	Type of Stakeholder	Label	Type of Stakeholder
S1	Processors	S11	Academia research and development
S2	Regulatory bodies	S12	Employees and managers of Agri place
S3	Consumers	S13	Auditing firms
S4	Retailers	S14	Certification bodies
S5	Primary producers	S15	Supply chain partners
S6	Logistics and transportation companies	S16	Government agencies
S7	Industry associations	S17	Food safety organisations
S8	Investors	S18	Traders
S9	Insurance companies	S19	International organisations
S10	Non-governmental organisations (NGOs)	S20	Health organisations

Step 2: Requirements elicitation and review was the first round of the Delphi study. First, a list of requirements was compiled through archival review based on an existing digital compliance management platform in the fresh produce (fruits and vegetables) supply chain. The participants then reviewed the list of requirements and stated the relevance/non-relevance of the platform. If the requirement received a relevant ranking from most participants, it was deemed required and not passed through to the Kano model. Also, in round 2 of the Delphi Study, the participant was asked to bring forth any other requirement deemed useful to the German Meat Supply Chain.

Step 3: Requirements prioritisation was the second round of the Delphi Study. The Kano model was used for questionnaire design and analysis in this step. The Kano model is a prioritisation approach that can help alleviate constraints caused by bias and misinterpretation [35]. In light of the study previously mentioned, the Kano model is a valuable framework for comprehending user requirements and their influence on satisfaction levels. The model classifies various user requirements based on their ability to deliver satisfaction into "Must-be", "Performance", "Attractive", and "Indifferent". Must-be attributes are those that users expect to be fulfilled without question. Failing to meet these requirements adequately will result in user dissatisfaction [45]. Performance attributes have a direct and positive correlation between their fulfilment and user satisfaction. Attractive attributes that are fulfilled will lead to more significant than proportional satisfaction, while when these features are lacking or missing, it does not necessarily lead to dissatisfaction. Requirements in the indifferent category imply that users do not have a strong preference for or against that requirement. A survey questionnaire was developed according to the Kano Model to collect data. Prioritisation was only done on the additional requirements the meat industry experts brought in. These additional requirements are prioritised to provide an understanding of how users may deem their satisfaction when developing a digital compliance management platform for another part of the food industry. For the analysis, the Kano customer satisfaction coefficient approach was applied. The data structure used for designing the questionnaire in this study shares similarities with existing Kano studies that utilise the customer satisfaction coefficient approach (e.g., [45–47]). The technique involves using standardised functional and dysfunctional questions to obtain a well-defined ranking overview of requirements. Moreover, the method enables a better comprehension of user satisfaction concerning whether a requirement has been fulfilled [48]. Therefore, the questionnaire survey contained functional and dysfunctional questions that required the participants to express their opinions by choosing one of the five predetermined answers given in the questionnaire. Participants needed to "express their feelings of whether they like, need, are neutral about, could live with or dislike in both functional and dysfunctional conditions of a requirement" [45]. Fig. 1 illustrates the Kano analysis application, which enabled the evaluation of the questionnaires. Equations 1 and 2 were utilised to compute the coefficients for customer satisfaction (CS) and customer dissatisfaction (CD) [49].

CS is rated on a scale of 0 to 1 to evaluate the impact of including a feature or requirement. A higher rating indicates a more significant influence of the feature. On the other hand, if a requirement is absent, the negative customer satisfaction coefficient is used to measure dissatisfaction, ranging from 0 to -1. A rating closer to -1 reflects a higher level of dissatisfaction [46].

Fig. 1. Kano Analysis Application adopted from [50]

CRs		DYSFUNCTIONAL				
		1. like	2. must-be	3. neutral	4. live with	5. dislike
FUNCTIONAL	1. like	Q	A	A	A	O
	2. must-be	R	I	I	I	M
	3. neutral	R	I	I	I	M
	4. live with	R	I	I	I	M
	5. dislike	R	R	R	R	Q

A = Attractive M = Must-be R = Reverse
 O = One-dimensional I = Indifferent Q = Questionable

$$Customer\ Satisfaction\ Coefficient\ (CS) = \frac{(A + O)}{(A + O + M + I)} \tag{1}$$

$$Customer\ Dissatisfaction\ Coefficient\ (CD) = \frac{(O + M)}{(A + O + M + I) * (-1)} \tag{2}$$

4. Results

4.1. Stakeholder Mapping

The stakeholder mapping results are in Fig. 2. The results suggest that Consumers (S3) and primary producers (S5) were prioritised as 'minimal effort' with low power and interest. Next, academia research and development (S11), auditing firms (S13), supply chain partners (S15), government agencies (S16), and food safety organisations (S17) can be found in the 'keep informed' quadrant with low power and high interest. After that, regulatory bodies (S2), industry associations (S7), investors (S8), insurance companies (S9), NGOs (S10), international organisations (S19), and health organisations (S20) were prioritised as 'keep satisfied' with high power and low interest. Lastly, processors (S1), retailers (S4), logistics and transportation companies (S6), employees and managers of Agriplace (S12), certification bodies (S14), and traders (S18) were identified as 'Key Players'. Acknowledging that only some of the identified stakeholders were deemed highly significant for inclusion in this study is crucial. Consequently, the focus was set on the most influential stakeholders, namely, the 'Key Players'.

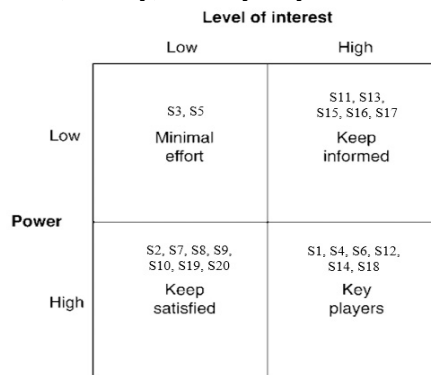


Fig. 2. Stakeholder Mapping Results.

4.2. Requirements Elicitation and Review

Based on the review of existing platform requirements in the food industry but not in the meat sector, participants assessed the relevance of 51 existing requirements. When asked about the relevance of the existing requirements, the experts reached full consensus on 50 of the 51 requirements for a digital compliance management platform in the German meat industry. These 50 requirements are in Box 1. However, the requirement “Database connection with

GLOBALG.A.P. (R17)” stood out as a consensus was not fully reached as only 7 of the 9 stakeholders stated its relevance. These requirements are considered relevant for the meat supply chain.

Box 1 List of Existing Requirements

Document validity monitoring (R1), Document preview (R2), Manual document requests (R3), Document evaluation (R4), Creation of bulk request rules (R5), Single and bulk document upload (R6), Automatic document collection (R7), Customisable compliance overview (R8), Customisable default user settings (R9), A complete record of the supply chain (R10), Retrieve supplier information (R11), Search suppliers (R12), Filter suppliers (R13), Filter documents (R14), Categorise suppliers (R15), Tag suppliers (R16), Database connection with GLOBALG.A.P. (R17), Database connection with BRC (R18), Database connection with QS (R19), Consolidation of all due diligence communication in a single channel (R20), Document saving (R21), Document indexing (R22), Document sharing (R23), Default role-based access control (R24), Preparation for auditing (R25), Integration with internal systems (R26), Risk monitoring of environmental, governance, and social risks (R27), Automatic retrieval of laboratory analyses (R28), Document and data security (R29), Default email notifications and reminders (R30), Single document download (R31), Tag documents (R32), Automatic season-based supplier archival (R33), Request information per product (R34), Customisable notifications and reminders (R35), Customisable messages sent with automatic document requests (R36), Non-delivery notification (R37), Standard message templates (R38), Bulk document download (R39), Customisable role-based access control (R40), Document Archival (R41), User company logo email display (R42), Delete suppliers (R43), Bulk update sub-supplier status (R44), Supply chain tree diagrams for visualisation (R45), Create requirement rules templates (R46), Document search function (R47), Messenger within the platform (R48), Bulk update tags (R49), Notes function for suppliers (R50), Sub-supplier intake request (R51)

After reviewing existing requirements, the experts were asked to suggest additional requirements or implications that could enhance the value of such platforms in the meat industry. All five experts confirmed the resulting list of requirements, comprising nine requirements, as complete and accurate. Table 2 includes three columns indicating a linguistic variable for each requirement, a brief description, and an explanatory note for better understanding.

Table 2. Proposed New Requirements of Digital Supply Chain Compliance Management Platforms for the Meat Industry.

Linguistic Variable	Requirement	Definition
R52	Database connection with IFS	The platform automatically retrieves IFS certification statuses per IFS identifier.
R53	Specific user roles to confirm incoming documents	The user can grant the certification authorities access to specific user roles. As an example, a Rabbi can receive access to the platform to review incoming Halal documents from suppliers to establish their validity.
R54	Document versioning	The platform automatically bundles and organises similar document types (e.g., IFS, BRC, and HALAL certificates) according to expiry dates to create a clear overview. The most recent document per type will be shown to avoid document cluttering. Users can unfold a tree diagram per document type to see all documents.
R55	Notes function for documents	Users can enter remarks in a note box assigned to specific documents.
R56	Online fillable and signable forms	Within the platform, users can generate online fillable forms, which can be conveniently completed by suppliers through the upload portal.
R57	Automatic information sharing	The platform automatically distributes pertinent information and documents to customers.
R58	Automatic analysis of documents	The platform is designed to independently analyse information stored within the platform. It is capable of extracting data from PDF documents and transforming it into metadata.
R59	Supplier evaluation and rating system	The platform enables users to assess and rate their suppliers based on various criteria, facilitating supplier evaluations and ratings.
R60	Frequency-based document collection	Allow users to gather specific documents on a recurring basis without an expiration date.

4.3. Requirements Prioritisation

The prioritisation of the additional 9 requirements is shown in Table 3, indicating the Kano results and CS and CD values. Based on the outcome of the calculations in Table 3, the CS and CD values were plotted into a Kano scatterplot graph for further visualisation as presented in Fig. 3. "Document versioning (R54), Online fillable and signable forms (R56), Specific user roles to confirm incoming documents (R53), Automatic analysis of documents (R58)" were prioritised as attractive. Next, "Database connection with IFS (R52)" was prioritised as a performance requirement. After that, the requirements "Automatic information sharing (R57), Notes function for documents (R55), Supplier evaluation and rating system (R59), Frequency-based document collection (R60)" have been prioritised as indifferent by the experts. Finally, none of the requirements were rated as must-be.

Table 3. Kano Results.

Requirement	A	M	R	O	I	Q	Customer Satisfaction coefficient (CS)	Customer Dissatisfaction coefficient (CD)
R52	2	1	0	4	2	0	0,6667	-0,5556
R53	5	0	0	1	3	0	0,6667	-0,1111
R54	3	1	0	3	2	0	0,6667	-0,4444
R55	3	2	0	1	3	0	0,4444	-0,3333
R56	3	0	0	2	4	0	0,5556	-0,2222
R57	1	1	0	3	4	0	0,4444	-0,4444
R58	6	0	0	0	3	0	0,6667	0,0000
R59	2	1	0	1	5	0	0,3333	-0,2222
R60	3	1	0	0	5	0	0,3333	-0,1111

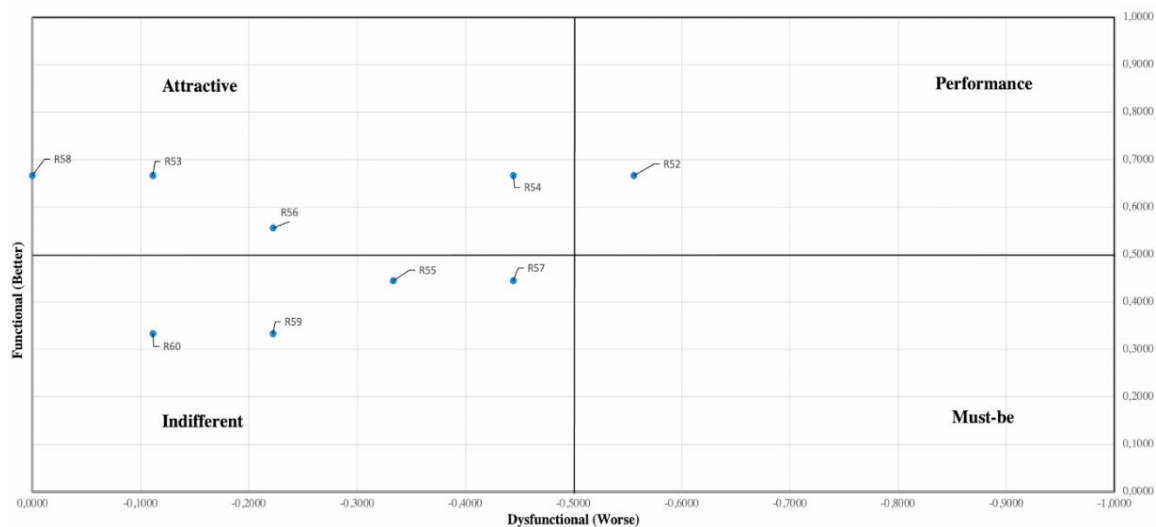


Fig. 3. Kano Categories.

5. Discussion

The results from archival observations and semi-structured interviews, which involved nine key stakeholders, offer valuable insights into the applicability of current requirements utilised by digital supply chain compliance management platforms for fresh produce within the meat industry. This case study specifically focuses on their relevance within the context of the German meat supply chain. All existing requirements were deemed relevant for the German meat industry, highlighting commonalities and the ability for transferable learning across the industries. These requirements encapsulate crucial elements for supply chain compliance management, such as traceability, transparency, communication, data security, and adaptability, thus confirming their universal relevance across various food industry sectors [9,49–51]. The requirement "Database connection with GLOBALG.A.P. (R17)" - stood out as an exception. While seven participants deemed this requirement relevant, two did not share this viewpoint. This discrepancy can be attributed to the primary focus of GLOBALG.A.P. on the fresh produce sector. The emphasis of this standard on fruits and vegetables might suggest a lesser relevance to the meat industry. However, it is essential to highlight that some meat companies also engage in processing or trading fresh produce, thereby necessitating a connection with GLOBALG.A.P. Additionally, the existence of the Sustainable Meat Initiative (SMI) as an Add-on to GLOBALG.A.P., designed explicitly for Dutch retail (CBL), supports the potential relevance of this requirement to the meat industry [54].

The Kano analysis showed participants' preferences towards proposed requirements. "Database connection with IFS (R52)" had high functional value with a significant impact on user satisfaction. Its absence could lead to dissatisfaction. "Document versioning (R54), Online fillable and signable forms (R56), Specific user roles to confirm incoming documents (R53), Automatic analysis of documents (R58)" were categorised as attractive, which can enhance customer satisfaction if well-implemented.[56], such attractive quality requirements are often unexpected, as

opposed to performance and must-be requirements. However, when present, they yield satisfaction, and their absence does not result in dissatisfaction [56]. [57] indicates that these attractive quality requirements hold a significant influence over user satisfaction. Interestingly, [58] suggests that these attractive quality requirements may transition over time into performance and must-be Kano categories, reinforcing their importance during the technology development stages. Therefore, it is essential to explore these requirements in further detail, as they have the potential to significantly improve user satisfaction and thus have a significant positive impact on the platform's success. According to the outcome of the Kano analysis, the indifferent requirements include "Notes function for documents (R55)", "Automatic information sharing (R57)", "Supplier evaluation and rating system (R59)", and "Frequency-based document collection (R60)". These features are viewed as beneficial to user satisfaction. While these requirements may not be top priorities based on the Kano analysis, they might be relevant for specific subsets of users or could contribute to the overall completeness of the platform. For instance, R60 may be more attractive for specific stakeholders and only apply to some across the industry. This could be related to the specific expertise or needs of the stakeholders. Not disregarding these requirements is critical, as they may provide additional value to the platform and its users [45]. The absence of must-be requirements in this study may reflect on the fact that some of those are included in already existing platforms, R1 through R51 that were not prioritised in the Kano Model.

This research focuses on identifying requirements within the meat supply chain for compliance management platforms. Each different supply chain in the food industry has unique requirements, and this study emphasises the importance of new requirements for those unfamiliar with such digital compliance management platforms. Prioritising the requirements will lead to improved understanding of platforms regarding efficiency and user satisfaction. The study analysed compliance management platforms in German meat supply chains, providing insights for similar markets. Future research can broaden the geographic scope and include a diverse set of stakeholders to reveal unique requirements specific to each sector. A longitudinal approach and collaboration with industry associations and regulatory bodies would increase the study's applicability and contribute to advancements in digital compliance management within the meat sector. A key finding in this research reflects on the identification of attractive quality requirements. Unlike performance and must-be requirements, the attractive quality requirements are often unexpected and might be unknown to the potential user of systems. The attractive requirements bring satisfaction when present, but do not bring dissatisfaction in the absence of it [56], and have been discussed as the most influential category concerning user satisfaction [57]. Thus, the newly identified requirements within the attractive Kano category should be considered for future system development.

6. Conclusion

This research aimed to analyse digital supply chain compliance management platform requirements to meet the needs of stakeholders in the German meat industry. Five key findings are found. i) in the first round of the Delphi study, all 51 existing requirements utilised by a fresh produce digital supply chain compliance management platform have been identified as relevant. There was remarkable concordance between the fresh produce and meat industry regarding digital supply chain compliance management requirements, with an almost unanimous agreement on 50 out of the 51 proposed requirements. ii) 9 additional requirements that could add value to a digital supply chain compliance management platform for the meat industry were also elicited. iii) The Kano model shed light on the priorities of requirements, such as database connection with IFS (R52) as a performance requirement, document versioning (R54), online fillable and signable forms (R56), specific user roles to confirm incoming documents (R53), and automatic analysis of documents (R58) as attractive requirements, and "Notes function for documents (R55)", "Automatic information sharing (R57)", "Supplier evaluation and rating system (R59)", and "Frequency-based document collection (R60)" as indifferent requirements. iv) no must-be requirements were identified in the study, which may result from excluding the 51 existing requirements in the Kano Model Analysis. v) Digital supply chain compliance management platforms should primarily emphasise the common features that exist across sectors while allowing for sector-specific customisation and flexibility. The research presented in the paper is not without its limitations. A case study's generalisability can be limited due to its small sample size. The findings may be unique to the specific case (e.g., focus exclusively on requirements of digital supply chain compliance management platform in the German meat industry). Consequently, the importance of requirements may differ for other markets and types of food products. Also, the Kano model has limitations, including its narrow focus solely on customer requirements without considering

technical feasibility, cost, or time. Future research could incorporate studies to capture the changing interests and power dynamics of stakeholders over time. This would provide a more holistic understanding of their evolving needs and influences. Additionally, studies exploring ways to increase engagement from low-interest, high-power stakeholders could be beneficial, as their influence could be key in shaping the software development process and outcome. Thereafter, a larger and more diverse expert panel involved in stakeholder prioritisation could be employed to diminish the possibility of biases.

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