Title: Requirement Prioritization for Fresh Produce Digital Supply Chain Compliance Management Platforms

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Preface

Fourth-year student Adrian Längle wrote this Bachelor's Thesis to graduate from the double degree International Food Business program at Aeres University of Applied Sciences in Dronten, The Netherlands, and Dalhousie University Faculty of Agriculture in Truro, Nova Scotia.

Based on my experience working as an intern at a digital supply chain compliance management company in Amsterdam, The Netherlands, I could recognize a knowledge gap in the available research on requirements for digital supply chain compliance management platforms in the fresh produce sector. This research outlines how digital supply chain compliance management platforms can benefit and add value to the fresh produce industry. Digital supply chain compliance management platform developers can use this research to make compliance management platforms more attractive to users. The use of such technologies can lead to making supply chains safer, more transparent, and sustainable. Therefore, consumers will benefit from the application of compliance management platforms due to increased food safety and quality.

Moreover, this research will also benefit the users of digital supply chain compliance management platforms as the user experience can be improved based on the findings of this research. Finally, this research will support the development of digital supply chain compliance management platforms and can help businesses to save time and costs through the application of key requirements within such platforms.

I want to thank my company coach Frederic Unger and my thesis coach Pat Burgess for all the support and mentoring provided during this research. Furthermore, I want to thank all experts willing to participate in the Delphi study.

To address the feedback previously given by the accessors, it is worth mentioning that all comments for the introduction and methodology are covered. Modern sources are already included in the research to back up the relevance of this study. Therefore, older sources have been used as a reference just to back up current developments. Next, the purpose of relevance and research is outlined in detail in Chapter 1.7. Additionally, although it is understood that there are IT systems, it is not clear if the requirements of the systems fit the fresh food agribusiness sector or not.

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Summary

The research presented in this paper aims to outline how digital supply chain compliance management platforms can benefit and add value to the fresh produce industry. It seems that increased quality risks confront global food supply chains due to the accelerated complexity of supply chains (Aung & Chang, 2014; Behnke & Janssen, 2020; Priefer et al., 2016). Research by Astill et al. (2019) explains that transparency becomes vital to establishing food safety and gaining the trust of customers and consumers. Pettey (2018) explains that there is a great potential to implement modern technologies that allow food supply chains to become more transparent.

A new digital supply chain compliance management platform facilitates the process of retrieving, managing, and sharing compliance information in the fresh produce sector and appears to support the development of sustainable, safe, transparent, and socially just fresh produce supply chains (Broersen, 2019).

The scope for this qualitative research case study approach is the focus on the internationally based AgriPlace Chain platform. The main objective of this research was to prioritize the requirements of a digital supply chain compliance management platform to improve the overall user experience and increase the success of such platforms. Based on the findings of this Delphi study, the main question about what key requirements should be included in fresh produce digital supply chain compliance management platforms was answered. In total, 65 currently implemented and value-adding requirements have been found throughout a two-round Delphi study involving 17 experts. The results show that 32 requirements have been prioritized as "Must have (Mo)", 22 as "Should have (S)", 11 as "Could have (Co)", and none as "Will not have (W)". The most important requirements have been identified as "Automatic document collection (R7), Search suppliers (R12), Document monitoring and handling capabilities (R1), Document review (R4), and Single and bulk document imports (R6)".

Overall, limitations are bound to the case study. These could be mitigated by further research in food sectors other than fresh produce. Further research can enable to justify if the findings of this study apply to other sectors in the food industry. Finally, it has been found that the digital supply chain compliance management platform used for this case study currently has only 25 of the 32 "Must have (Mo)" requirements implemented. Therefore, it is recommended that the platform adopts the missing "Must have (Mo)" requirements as soon as possible.

1. Introduction

1.1. Supply chain challenges due to globalization

Due to the globalization of food trade (i.e., international food trade), food must travel longer distances until it reaches the final consumer (Aung & Chang, 2014; Priefer et al., 2016). Research from Tse & Tan (2011) stresses that quality risks, i.e., the events that might cause deterioration in the quality performance of food products (e.g., food fraud in the form of food adulteration or mislabeling), occur more frequently in global multi-tier supply chains. In the same research, Tse & Tan (2011) explain that "the threat of quality risks could be from raw materials, manufacturing processes, or logistics operations in any tier of the supply network." Therefore, food supply chains are confronted by increased quality risks due to the accelerated complexity of supply chains (Aung & Chang, 2014; Behnke & Janssen, 2020; Priefer et al., 2016). The research of Aung & Chang (2014) has confirmed that the new level of complexity in food supply chains has increased the difficulty of ensuring safety and quality throughout the entire supply chain. Furthermore, Hassoun et al. (2020) explain that supply chains are highly complex due to the involvement of numerous stakeholders and several intermediary processes. This complexity may cause to create an asymmetry of information flow which could result in a possible loss of important information during transitions (Hassoun et al., 2020). New ways of managing compliance can help stakeholders in fresh food supply chains to manage quality risks better. Compliance management refers to the continuous process of monitoring and approving suppliers and is discussed in further detail in Chapter 1.6.

In addition to increasing quality risks, Fiorino et al. (2018) emphasize that the increasing international trade due to globalization, complex supply chains and fewer barriers to export and import agricultural goods foster food fraud. The past has shown that the occurrence of sophisticated cases of food fraud is rising and that the detection of their origin has become increasingly challenging (Fiorino et al., 2018). Food fraud is often combined with false claims on a food product as ingredients are partially or fully substituted with different food components that are not expected by the consumers due to the absence of an indication on the food labeling (Fiorino et al., 2018). This demonstrates that new solutions that help decrease the likelihood of occurring quality risks and food fraud are essential. Flawless compliance management can allow food companies to manage suppliers effectively and keep a clear overview of the entire supply chain (Broersen, 2019). The concept of transparency and its ability to fight food fraud will be further discussed in Chapter 1.6.

1.2. Effects of globalization and food spoilage on the environment

Besides the growing concern about increasing quality risks and cases of food fraud, research by Aung & Chang (2014) stresses that the increase in international food trade and its effect on the complexity of supply chains results in a growing environmental impact. The same research outlines that the distance food travels from farm to fork is longer than ever. Therefore, increased use of energy and resources is required during production and transportation until a food product is made available for consumers (Aung & Chang, 2014). Consequently, this increases Green House Gases emissions (GHG) caused throughout the entire food cycle (Aung & Chang, 2014). Overall, this shows that the food industry needs more sustainable solutions to reduce its environmental impacts contributing to pollution and global warming (Aung & Chang, 2014).

Next, the Codex Alimentarius Commission (2003) reports that another problem regarding food safety and quality is food spoilage. According to Codex Alimentarius Commission (2003), "food spoilage is wasteful, costly and can adversely affect trade and consumer confidence." Generally, most foods are perishable, and all foods only have a limited lifetime until they spoil. In order to produce safe chilled foods with high-quality standards, minimal contamination is crucial during manufacture and low temperatures are essential during storage, handling, and distribution (Information Resources Management Association, 2020).

Temperature fluctuations in food supply chains cause food to spoil faster and accelerate microbial growth (i.e., quality risk). Again, such quality risks will increase the likelihood of the occurrence of foodborne diseases. Annually, approximately 300 million tons of food are wasted globally due to insufficient refrigeration. It is estimated that the food industry in the United States (US) wastes 35 billion US dollars in food goods due to spoilage. Therefore, the resources used to produce wasted food create an immense issue for the environment. (Estrada-Flores & Tanner, 2009)

According to United Nations Environment Programme (2022), households in the United Kingdom (UK) waste roughly 6.7 tons of food annually. Furthermore, it is estimated that consumers in Australia waste approximately 5.2 billion US dollars' worth of food yearly (Baker et al., 2009). The United Nations Environment Programme (2022) states that almost half of the fruit and vegetables produced worldwide are thrown away every year. Overall, it is estimated that one-third of all food produced worldwide, or about 1.3 billion tons, is lost or wasted (United Nations Environment Programme, 2022). Every ton of food that is wasted accounts for 4.5 tons of carbon dioxide (WRAP, 2008). Food waste sent to landfills creates a substantial environmental impact because it produces methane (WRAP, 2008). Methane is an immensely powerful greenhouse gas that is 20 times stronger than carbon dioxide (WRAP, 2008). Finally, food production requires a lot of water (Baker et al., 2009). Therefore, all water used for the production of food that is thrown away goes to waste (Baker et al., 2009).

Reflecting on the information above, it is becoming clear that environmental impacts caused by the food sector must decrease significantly to preserve the environment in the future. In general, efficient compliance management can help to ensure that high-quality standards are maintained during food production, processing, packaging, distribution, and retailing (Trienekens & Zuurbier, 2008). This can reduce the likelihood of food spoilage and waste through strict supplier approval and monitoring. In addition, compliance management can support sourcing for suppliers with responsible practices that promote environmental stewardship (e.g., proven by certification) (Porteous et al., 2015).

1.3. Occurrence of food scandals worldwide

On top of increasing environmental concerns caused by the food sector, Aung & Chang (2014) and Baker et al. (2018) argue that the credibility of the food industry has been affected heavily by several food scandals that occurred in the past couple of decades. Outbreaks of foodborne illnesses such as Escherichia coli O157:H7, salmonella, campylobacter, and food crises such as Dioxin in chicken feed, Foot-and-Mouth Disease (FMD), and Bovine Spongiform Encephalopathy (BSE), also known as mad cow disease have contributed to consumer concerns over safety and quality of food products (Aung & Chang, 2014). Also, cases of food fraud, such as the occurrence of illegal horse meat found in other meat products, have raised the concern of consumers but also of producers and distributors (Fiorino et al., 2018). According to Lynch et al. (2009), in many parts of the world, fresh produce, which relates to unprocessed

fruits and vegetables, has been increasingly linked to foodborne outbreaks. Australia, Europe, and the USA have been confronted by several foodborne outbreaks linked to the fresh produce sector (Lynch et al., 2009). In Australia and Denmark, the bacteria Shigella has been linked to imported baby corn (Lewis et al., 2007). In Finland, a widespread Yersinia pseudotuberculosis outbreak originated from lettuces affected 47 consumers and caused one to die from consumption (Nuorti et al., 2004). In Sweden, a norovirus outbreak was linked to the consumption of raspberries (Hjertqvist et al., 2006). In the USA, Escherichia coli O157:H7 infections originated from the consumption of baby spinach (Centers for Disease Control and Prevention, 2006). These multinational foodborne outbreaks underline the challenges of the fresh produce sector as fruits and vegetables are often unprocessed or freshly cut when consumed, which results in extreme limitations to eliminating contaminants (Kirezieva et al., 2013). This shows that especially the fresh produce sector should imply solutions that can help to prevent cases of foodborne illnesses.

Based on the information given above, with the aid of compliance management, fresh produce suppliers can be approved and monitored based on their certifications. As an example, certifications can ensure food safety, superior quality, or social standards, as well as responsible sourcing practices (Trienekens & Zuurbier, 2008). Supply chain stakeholders (e.g., producer, packer, trader, or wholesaler) that are audited frequently can be trusted through proper documentation proving compliance with certain standards (Jahn et al., 2005). This helps to decrease the likelihood of occurring food scandals such as foodborne illnesses and food fraud (Jahn et al., 2005).

1.4. Food scandals affecting social and economic factors

The worldwide occurrence of food scandals also has severe and far-reaching impacts on society and the economy. The Codex Alimentarius Commission (2003) states that food safety is a significant public health issue. It has become evident that "outbreaks of foodborne illnesses" have a fundamental impact on damaging "trade and tourism, and lead to loss of earnings, unemployment, and litigation" (Codex Alimentarius Commission, 2003). The FAO (2003) explains that the number of worldwide foodborne illnesses is increasing and that food safety and quality issues cause disruptions in the global food trade. The health of consumers is in danger once unsafe food has been consumed. According to the FAO (2003), the consumption of unsafe food can cause acute and life-long diseases such as diarrheal diseases or different forms of cancer.

According to a report by the World Health Organization (2010), 2.2 million people die from foodborne and waterborne diarrheal diseases annually. Each year, the percentage of the population in industrialized countries suffering from diseases caused by food was reported to be up to 30% (World Health Organization, 2010). It is estimated that 76 million foodborne illnesses occur annually in the U.S., causing almost 5,000 deaths and 325,000 hospitalizations (World Health Organization, 2010). The same report states that major food safety problems are highlighted by the high prevalence of diarrheal diseases in numerous developing countries.

In addition to negatively impacting the well-being and health of consumers, foodborne diseases can also have a harmful effect on the economy (World Health Organization, 2015). The World Health Organization (2015) states that foodborne diseases place a significant burden on health care systems and substantially reduce economic productivity affecting individuals, families, communities, businesses as well as countries.

According to a study conducted by the former U.S. Food and Drug Administration (FDA) economist Scharff (2010), the economic impact caused by outbreaks of foodborne diseases accounts for losses of roughly 152 billion US dollars annually. These losses are reported as increased health and job costs and other economic losses (Scharff, 2010). The study of Scharff (2010) suggests that approximately 39 billion US dollars, accounting for more than a quarter of the entire estimated annual costs, are associated with foodborne diseases linked to fresh, canned, and processed food products.

The European Food Safety Authority (2022) reports that, in the European Union (EU), more than 91.000 cases of salmonella infections occur yearly. It is estimated that the number of salmonella cases accounts for an economic impact of roughly 3 billion euros annually (European Food Safety Authority, 2022). In 1996, the medical costs of five foodborne outbreaks that occurred in England and Wales were estimated at 300 to 700 million Pound sterling (FAO & World Health Organization, 2002). Next, it is expected that 11.500 cases of food poisoning that arise daily in Australia account for roughly 2.6 billion Australian dollars every year (FAO & World Health Organization, 2002). Finally, research by McGrath et al. (2018) has found that food fraud costs the global food industry roughly 49 billion US dollars yearly.

Once more, this shows that there is an urgent need to fight the occurrence of food scandals to decrease annual social and economic losses worldwide. Flawless and responsible compliance management could be a crucial factor in decreasing the number of global food scandals significantly (Porteous et al., 2015). Also, this indicates that proper compliance management could allow immense cost savings (Wognum et al., 2011).

1.5. Changing consumer demands and future trends

The economic, environmental, and social aspects, as discussed in the sections above, are driving a shift in consumer demand. Several foodborne outbreaks have resulted in the increasing distrust of consumers towards the food industry. The research of Beulens et al. (2005) stresses that it is utterly important for the food industry to regain and sustain the confidence of consumers. This research also explains that consumers demand safe food that can always be trusted. According to Wu et al. (2021), consumer trust is the foundation of commitment, loyalty, and product acceptance and enables to maintain a good long-term relationship with brands.

Furthermore, consumers worldwide, especially Europeans, are increasingly concerned about food and its origin (Carcea et al., 2009). The research of Kelly et al. (2005) has found that consumers increasingly demand high-quality food with a well-defined regional identity. Consumers appear to be less confident about the quality and safety attributes of food produced outside of their local region, country, or EU (Kelly et al., 2005; Wang et al., 2017). Also, consumers pay more attention to animal welfare and sustainable production methods (Kelly et al., 2005).

These assumptions have also been confirmed by the research of Danezis et al. (2016). The research of Danezis et al. (2016) explains that consumers have become more concerned about food quality and safety in recent years. The same research clarifies that consumers developed a strong interest in knowing more about the authenticity of the food, and they became more sensitive to food fraud and scandals. This development results in consumers demanding more complete information about the food they buy and consume (Danezis et al., 2016).

Additionally, the global COVID-19 pandemic had increased consumer concern about food safety, accessibility, and affordability, as well as where, how, and when a food product was produced (Hassoun et al., 2020). Finally, research by Porteous et al. (2015) has found that consumers increasingly demand firms foster responsible practices in supplier management to ensure compliance throughout the entire supply chain. However, reducing the possibility of non-compliance and motivating all suppliers to do so becomes a great challenge for food companies (Porteous et al., 2015). This shows that new solutions that reduce the likelihood of non-compliance and help food companies in the fresh produce sector engage better with their suppliers to collect compliance data are becoming extremely important.

1.6. Importance of transparency, food authentication, compliance, and traceability

To meet changing consumer demands and regain their trust, transparency in the food supply chains is of paramount importance. Wognum et al. (2011) state that transparency can be seen as a critical component of modern food supply chains. According to Beulens et al. (2005), "transparency of a supply chain network is the extent to which all the network's stakeholders have a shared understanding of, and access to, product and process-related information that they request, without loss, noise, delay, and distortion." Therefore, all information provided needs to be timely, accurate, factual, relevant as well as accessible in a proper quantity (Hofstede et al., 2004). In addition, flawless information exchange is vital, and all information must be readable (Hofstede et al., 2004). According to Wognum et al. (2011), the given definition "poses strict requirements on systems that support communication towards consumers and stakeholders of a food supply chain."

The research from Astill et al. (2019) explains that transparency becomes vital to establishing food safety and gaining the trust of customers as well as consumers. According to David et al. (2022), Wu et al. (2021), and Singh and Sharma (2022), transparency is strongly connected to building and reinforcing trust by protecting the data of consumers, enabling production transparency, improving labor conditions, and social responsibility. Pettey (2018) explains that there is a great potential to implement modern technologies that allow food supply chains to become more transparent. This will allow food companies to regain consumer trust and to aid approval from regulatory bodies (Pettey, 2018). Research by Bilyea and McInnes (2016) found that food industry experts have determined that trust is one of the most important factors when it comes to food production. Moreover, a consumer study by Label Insight (2016) has discovered that 94% of consumers think it is important that food manufacturers must be transparent about how food is produced.

Overall, the research of Astill et al. (2019) examines that transparent food supply chains decrease the likelihood of food spoilage, foodborne disease outbreaks, and risk of food fraud scandals (e.g., cases of adding undeclared ingredients such as the horsemeat scandal). Furthermore, the same research has found that transparent food production systems are beneficial to stakeholders and consumers. Finally, the research also confirms that new technologies can improve data collection throughout the supply chain and that data management platforms are key to safeguarding high security and quality of data.

Next, as consumers are increasingly interested in food quality and the geographical origin of food products, quality assurance and methods used to validate a food product's authenticity are of great interest from commercial and legal perspectives (Danezis et al., 2016). According to Danezis et al. (2016), food authentication relates to the verification process, which ensures that

a food product is compliant with the description of its labeling. The research of Danezis et al. (2016) states that the label description of food may include, but is not limited to, "the origin (species, geographic or genetic), production method (conventional, organic, traditional, free-range) or processing technologies (irradiation, freezing, microwave heating)."

High-value food products that declare specific quality attributes on the labeling are often targets of food fraud since they create a particular interest for consumers (Danezis et al., 2016). Therefore, proof of provenance is essential for the assurance of food safety, food quality, and consumer protection (Danezis et al., 2016). Also, proof of provenance is crucial to ensure compliance with national legislation, international standards, and guidelines (Aung & Chang, 2014).

According to Sadiq et al. (2007), compliance has become increasingly important in multiple industry sectors. Compliance relates to "ensuring that business processes, operations, and practice are in accordance with a prescribed and/or agreed set of norms" (Sadiq et al., 2007). Abdullah et al. (2016) explain that compliance requirements are associated with regulations that can be implemented externally or internally and to which companies must adhere. Sadiq et al. (2007) outline that compliance requirements can be introduced by legislature and regulatory bodies such as the European Commission and U.S. Food and Drug Administration (FDA). In addition, compliance requirements can also originate from standards and codes of practice such as ISO9001, GLOBALG.A.P., HACCP, and BRC, as well as from organizational policies and business partner contracts (Beulens et al., 2005; Sadiq et al., 2007). Therefore, compliance requirements (i.e., standards such as ISO9001) support the assurance of quality.

Research by Behnke and Janssen (2020) discusses that companies that exchange quality assurance information with each other can increase the traceability of food products significantly. The same research explains that it would be ideal if quality assurance required full traceability of all ingredients included in the final product. Again, this results in the need for the exchange of quality information between all stakeholders to meet the increasing consumer demands for safety, quality, and sustainability (Behnke & Janssen, 2020). Bosona and Gebresenbet (2013) define food traceability as "part of logistics management which capture, store, and transmit adequate information about a food, feed, food-producing animal or substance at all stages in the food supply chain so that the product can be checked for safety and quality control, traced upward and tracked downward at any time required." The implementation of systems that enable food traceability help to manage safety risks, regain consumer trust, add value to marketing, endorse quality improvements in an organization and its supply chain, promote the well-being of animals as well as to attain precise agriculture (Lavelli, 2013). Therefore, new technology systems, such as software, can help companies to ensure traceability within supply chain networks.

According to McCullough et al. (2008), actors in fresh supply chains differ from very small to extremely large. Moreover, primary production, processing, and trade activities happen in various climates all around the world, and supply chain stakeholders operate in diverse administrative conditions and make use of traditional, structured, or industrialized food systems (McCullough et al., 2008). All actors that operate in fresh food supply chains are advised to make use of Food Safety Management Systems (FSMS) in order to control and prevent the occurrence of microbial, chemical, and physical hazards during the production of fresh fruits and vegetables (Codex Alimentarius, 2003; Kirezieva et al., 2013). FSMSs require the implementation of relevant quality assurance guidelines standards (i.e., Codex Alimentarius, GlobalG.A.P., BRC, and IFS) (Kirezieva et al., 2013). To receive the recognition

of a certification scheme such as GlobalG.A.P., Q&S, BRC, or IFS, neutral, independent, or third-party audits have to confirm that a farm or firm is compliant with certain quality assurance standards and guidelines (Gawron & Theuvsen, 2009; Karapetrovic & Willborn, 2000). Research by Jakubowska-Gawlik et al. (2021) outlines that food manufacturers are not only responsible for meeting their own food law requirements and quality standards but also for ensuring that their suppliers comply with their food safety standards. Today, companies that operate in the food business must comply with numerous food standards and specifications (Jakubowska-Gawlik et al., 2021). However, they often do not have the necessary expertise to assess and monitor their suppliers' compliance with these standards (Jakubowska-Gawlik et al., 2021). Therefore, it is still hard for food companies to establish flawless compliance management throughout their entire supply chain. The research of Porteous et al. (2015) makes clear that monitoring the compliance of suppliers becomes crucial to eliminating social and environmental non-compliances in supply chains that often lead to food scandals. Additionally, compliance management becomes utterly important to support social, environmental, and economic supply chain performance and as a response to increasing regulations, growing consumer demand, as well as to avoid possible supply chain disruptions (Porteous et al., 2015). David et al. (2022) explain that proper supply chain management is the backbone of any food company and that there is a need for technology that helps food companies to manage complex supply chains involving a large number of stakeholders such as suppliers. Ineffective supply chain monitoring "will lead to the addition of cost, lack of transparency, loss of efficiency, and other human-related problems" (David et al., 2022). Furthermore, David et al. (2022) stress that "too much human intervention leads to a lack of integrity, lack of proof to work, lack of authenticity, insecurity in ownership, and lack of trust." Therefore, abundant human interaction should be complemented by technology such as cloud computing to reduce errors in supply chains (David et al., 2022). Subsequently, the research of Wognum et al. (2011) has found that the integration of information databases can reduce costs and enable information sharing with a wider variety of stakeholders. The research by Wognum et al. (2011) also stresses that increasing legal requirements are sources of growing compliance costs. This demonstrates that there is an increasing demand for new technologies that allow reducing the growing challenges of compliance management in the fresh produce sector.

1.7. Knowledge gap and scope

All the facts outlined in the previous chapters prove that there is an urgent need for digital supply chain compliance management platforms in fresh produce supply chains. Hazell (2015) has found that the increasing amount of paperwork to prove compliance is a growing common concern in the fresh produce sector. Digital supply chain compliance management platforms can help actors in the fresh produce sector manage safe and transparent supply chains (Broersen, 2019). Modern technologies allow to map out supply chains and gather compliance data (i.e., certifications such as GLOBALG.A.P. or lab analyses) within one cloud platform (Broersen, 2019). The research of Hazell (2015) has found that managing quality assurance and compliance requirements is a costly and time-consuming exercise for supply chain actors. Especially for producers that supply to fresh, retail, and export markets, compliance management becomes absolutely crucial (Hazell, 2015). Until now, the compliance information from suppliers had to be managed manually in a combination of emails, Excel lists, and folders (Broersen, 2019). Also, it is often the quality manager's responsibility to remind suppliers, producers, and other intermediaries in the supply chain about expiring or missing certifications (i.e., GLOBALG.A.P., Q&S, IFS, etc.). As David et al. (2022) indicate, this degree of human interaction may lead to errors such as missing certifications which can result in increased risks such as food fraud and scandals in fresh produce supply chains. A new digital

supply chain compliance management platform called AgriPlace Chain is revolutionizing the way compliance data has been gathered and passed on in Business-to-Business (B2B) environments. B2B refers to the conduction of business between two companies, such as a producer and retailer (Chen, 2020). The AgriPlace Chain platform is able to facilitate the process of retrieving, managing, and sharing compliance information in the fresh produce sector (Broersen, 2019). Overall, digital supply chain compliance management platforms allow automatizing these processes by sending out automatic requests to suppliers to upload certifications, residue analysis, or supplier declarations to the platform (Broersen, 2019). Therefore, digital supply chain compliance management platforms enable accurate insights into the compliance status of each supply chain actor (Broersen, 2019). Supply chain actors have the opportunity to simply share documents in a secure portal they can access through a link (Broersen, 2019). This can increase the degree of cooperation due to simplification. On the one hand, digital supply chain compliance management platforms help quality managers to save time, and therefore, companies save costs (Broersen, 2019). On the other hand, they enable easy sharing of documents with other supply chain actors, which can benefit the transparency of fresh produce supply chains (Broersen, 2019). Previous research by Astill et al. (2019), David et al. (2022), Wu et al. (2021), and Singh and Sharma (2022) have shown that this degree of transparency is needed to regain the trust of consumers. Also, by exchanging quality assurance information and having an accurate and up-to-date overview of all suppliers and their compliance statuses, the traceability of food products can be increased significantly (Behnke and Janssen, 2020). Consequently, the platform allows companies to map and visualize their entire supply chain, which can help solve traceability issues.

Next, Everaert and Miotto (2015) explain that non-compliance can have serious and devastating commercial consequences. With increasing ethical expectations, as well as the financial and reputational consequences of corporate scandals, it becomes clear that faultless compliance management becomes vital for companies (Everaert & Miotto, 2015). Given the commercial importance of compliance, it is increasingly becoming a value-determining variable in fresh produce. This means that a platform that can help to ensure compliance is of great economic value for companies in the food business.

Overall, a digital supply chain compliance management platform can help to tackle the increasing complexity of supply chains due to globalization as companies can keep an accurate overview of their supply chain and eliminate a potential asymmetry of information flow. Next, labels on food products that require improved social standards (e.g., increased sustainability or labor conditions) become increasingly important due to changing consumer demands. A digital supply chain compliance management platform can help to ensure compliance with such labels and tackle challenges such as food spoilage. Furthermore, Chapter 1.3. has outlined that especially the fresh produce sector is affected by food scandals.

Such scandals have resulted in danger for consumers when consuming food and have led to new developments in food trends. These developments have made clear that consumers tend to purchase food that's label indicates increased quality and safety, a well-defined regional identity, and sustainable production methods. All these facts show that digital supply chain compliance management platforms can enable great improvements in current challenges, add value to companies, and regain the trust of consumers worldwide.

Nevertheless, it is still lacking research about what the most important requirements for digital supply chain compliance management platforms are in the fresh produce sector. No literature could be found about this topic. Generally, this can lead to digital supply chain compliance

management platforms failing as it is unknown which requirements a platform needs in order to satisfy the users and to ensure seamless compliance management throughout the entire supply chain.

This research outlines how a successful digital supply chain compliance management platform can benefit and add value to the fresh produce industry. Digital supply chain compliance management platform developers can make use of this research to make compliance management platforms more attractive to users and to make supply chains safer, more transparent, and sustainable. Therefore, consumers will benefit from the application of digital supply chain compliance management platforms due to increased food safety and quality. Moreover, this research will also benefit customers (e.g., quality managers) of digital supply chain compliance management platforms.

The scope of this qualitative research will focus on an internationally based organization from the Netherlands that offers a digital compliance management platform to clients of the fresh produce sector. The main objective and aim of this research are to identify and prioritize which requirements are key for a digital compliance management digital system in the fresh produce food sector. The prioritization of key requirements enables companies to be successful through customer contentment and allows them to eliminate needless requirements that could cause cost inefficiencies (Hudaib et al., 2018).

To reduce the knowledge gap and to provide insight into the requirements of a digital platform for compliance management in the fresh food industry, the main question of this research will answer:

What are the key requirements that should be included in digital supply chain compliance management platforms for the fresh produce sector?

To systematically answer the main question of this research, the sub-questions are as follows:

1. What requirements are already used by digital supply chain compliance management platforms in the fresh produce sector?

2. What new requirements or implications could add value to digital supply chain compliance management platforms in fresh produce?

3. Based on a stakeholder perspective, which requirements for a digital compliance management system tend to contribute to improved user experience?

The main objective of this research is to prioritize the requirements of a digital supply chain compliance management platform through a Delphi study to improve the overall user experience and increase the success of such platforms.

2. Proposed Material and Methods

2.1. Overall research approach

For this study, a qualitative research approach was chosen as it allows to analyze "data from direct fieldwork observations, in-depth, open-ended interviews, and written documents" (Patton, 2005). Moreover, qualitative research is ideal for inductively examining real-world situations and constructing case studies (Patton, 2005). Therefore, inductive analysis through cases reveals patterns and themes that are the result of qualitative research (Patton, 2005).

Figure 1. illustrates the steps taken to conduct this case study. These steps are discussed in detail in Chapter 2.2. Overall, a three-round Delphi study is applied involving the same international group of experts. A three-round Delphi study was chosen because research by Grime and Wright (2016) indicates that three rounds are sufficient using the Delphi method. The Delphi method enables a degree of interactivity and dialogue (e.g., feedback from experts and the opportunity to reconsider own opinion), as it is common in group meetings, combined with the practicability of a survey, which leads to advantages in terms of cost efficiency and potential access to a wider range of expertise than it would otherwise be possible (Landeta, 2006; Linstone & Turoff, 1975). Furthermore, the Delphi method is widely used to find consensus on many different topics, often among experts, especially when they are located distantly (Adler & Ziglio, 1996).
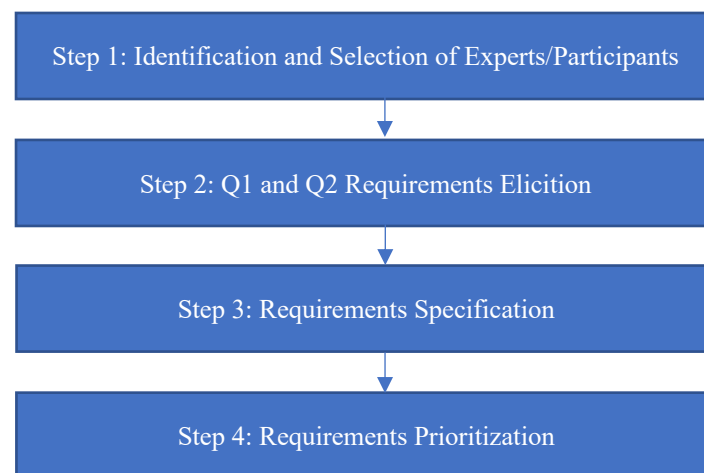
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│          Step 2: Q1 and Q2 Requirements Elicition        │
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┌─────────────────────────────────────────────────────────┐
│            Step 3: Requirements Specification            │
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┌─────────────────────────────────────────────────────────┐
│            Step 4: Requirements Prioritization           │
└─────────────────────────────────────────────────────────┘
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Figure 1
Research conduction steps

2.2. Data collection and data analysis

Firstly, stakeholders (e.g., employees and customers) of the case study company (AgriPlace) that have knowledge about requirements used in digital supply chain compliance management platforms have been approached with the request to participate in this study. The ones that have given their consent to participate in this study were selected. The stakeholders of AgriPlace were contacted via email or in person (if possible) with the request to participate in this Delphi study. The email contained a brief explanation of the study objectives, the Delphi method, the MoSCoW prioritization process, and a request for consent. For experts that were approached in person, the same information was passed on to them in a face-to-face environment.

Generally, research by Grime and Wright (2016) recommends including five to 20 experts in a Delphi study that involves expert opinions. Hence, the aim was that up to 15, and a threshold of five experts would participate in this study.

Secondly, to elicit current platform requirements, archival records of AgriPlace were observed. Welch (2000) states that archival research is an important but often overlooked tool in case study research. The same research suggests that archival research allows access to data that can help to improve the validity and reliability of findings. Observation of archival records helps to generate new data and to enable verification of existing data from other sources (Welch, 2000). Therefore, access to the system of AgriPlace Chain was granted for this observation to extract current requirements used in the digital compliance management platform. This allowed answer the first sub-question of this research by the determination of which requirements are already used by digital supply chain compliance management platforms in the fresh produce sector. A list with all currently used requirements was created based on the findings of the archival observation.

Following the collection of current requirements used in AgriPlace Chain, five to 15 experts dealing with requirements in digital supply chain compliance management platforms that consented to participate in the study were interviewed. To collect the qualitative data throughout the first round, face-to-face interviews with stakeholders of AgriPlace were conducted in the meeting room at the AgriPlace office in Amsterdam, the Netherlands. The meeting room was used to avoid external distractions, and the interviews were conducted in English. In case restrictions caused by the COVID-19 pandemic would not have allowed face-to-face interviews at the office of AgriPlace, then the interviews were conducted in a videoconference via Microsoft Teams. The same would have applied if experts preferred to conduct the interview through a videoconference instead of in a face-to-face meeting. A semi-structured interview technique was applied in order to conduct the interviews. This technique was chosen because it is versatile and flexible and allows the interviewer to follow up with questions based on the participant's responses (Kallio et al., 2016). Furthermore, the use of semi-structured interviews demands a certain degree of prior knowledge in the field of the research topic, as the interview questions are based on prior knowledge (Kallio et al., 2016). This prior knowledge was collected through the observation of archival records. The interviewer presented a list of requirements to the experts that was gathered through archival observation. Then, the experts were asked to elaborate on which of the listed requirements they agreed with or did not. In case the experts did not agree with certain requirements listed, requirements were removed, and the list was adapted. Besides this, experts were asked to indicate what requirements or implications that are not on the list yet could add value to the digital supply chain compliance management platform. Therefore, the outcome of the semi-structured interviews enabled to answer the second sub-question of this research. Additionally, the experts were asked for consent to record the interviews to create a transcript. This step of the study allowed completing the first round of the Delphi study.

Thirdly, inductive content analysis was used to organize the qualitative data collected through the observation of archival records and semi-structured interview techniques. According to Elo and Kyngäs (2008), "this process includes open coding, creating categories and abstraction." The inductive content analysis aims to utilize the process of abstraction in order to group data to answer the study questions by using concepts, categories, or themes (Elo & Kyngäs, 2008; Kyngäs, 2019). After all the data that was collected through observation and semi-structured interviews, the requirements gathered were grouped and categorized into various requirement need categories. This completed the step "Requirements Specification".

Finally, the second and third round of the Delphi study was arranged to prioritize requirements and to gain consensus. In the second round of this Delphi study, the stakeholders used their experience to prioritize all requirements listed in an assessment form. Based on the outcome of the inductive content analysis, a consolidated list of requirements was created, including grouping and categorization. Therefore, a Google Forms document presenting the consolidated list of requirements was sent as an assessment form to all experts participating in the study. This served as a base for the final semi-structured interviews in round three of the Delphi study. The assessment form was distributed through Google Forms because it is convenient and was fillable for experts outside the company. The questions included in the form asked the experts to prioritize the requirements that were drawn forth. Therefore, the MoSCoW method was used to prioritize the requirements listed in the assessment form. This technique allows for prioritizing requirements in a collaborative manner and is often used by analysts and stakeholders (Hudaib et al., 2018). Participants were asked to prioritize the requirements whether as "4) Must have (Mo)" (first place on the priority list), "3) Should have (S)" (second place on the priority list), "2) Could have (Co)" (third place on the priority list), or "1) Will not have (W)" (last place on the priority list) (Hudaib et al., 2018). "Mo" indicates that requirements are vitally important in the system and that failure to deliver these may indicate that the project could fail (Hudaib et al., 2018). Ahmad et al. (2017) state requirements prioritized as "Mo" must be included in a final software product. Additionally, Burgess and Sunmola (2021) outline that "Mo" requirements are crucial to be included in the first version of software developed. Next, requirements that have been prioritized as "S" are high-priority features that are not crucial to launching but would add high value to users (Hudaib et al., 2018). Furthermore, Ahmad et al. (2017) have found that requirements defined as "S" should be implemented in the software if feasible. An allocated "Co" will suggest that a requirement may be desirable, but it is not necessary to be included in the system (Hudaib et al., 2018). Moreover, Ahmad et al. (2017) stress that "Co" requirements are considered nice to have and could be implemented if it does not require too many resources. According to Burgess and Sunmola (2021), requirements classified as "S" or "Co" can be introduced during later stages of software development. Lastly, a requirement prioritized as "W" will not be implemented in current developments as it will add little to no value to the system (Hudaib et al., 2018). Once all experts had responded to the assessment form, a final overview of the prioritized requirements was created, and individual requirements were labeled whether as "Mo, S, Co, or W". The results of this round are displayed in a MoSCoW matrix, as illustrated in Figure 2. A MoSCoW matrix consists of four quadrants. These quadrants are used to display the allocated prioritized requirements. The outcome of this round allowed answering the third sub-question as customers and company employees are stakeholders that adopt the system. This gave clarity over which requirements for a digital compliance management platform tend to contribute to an improved user experience.
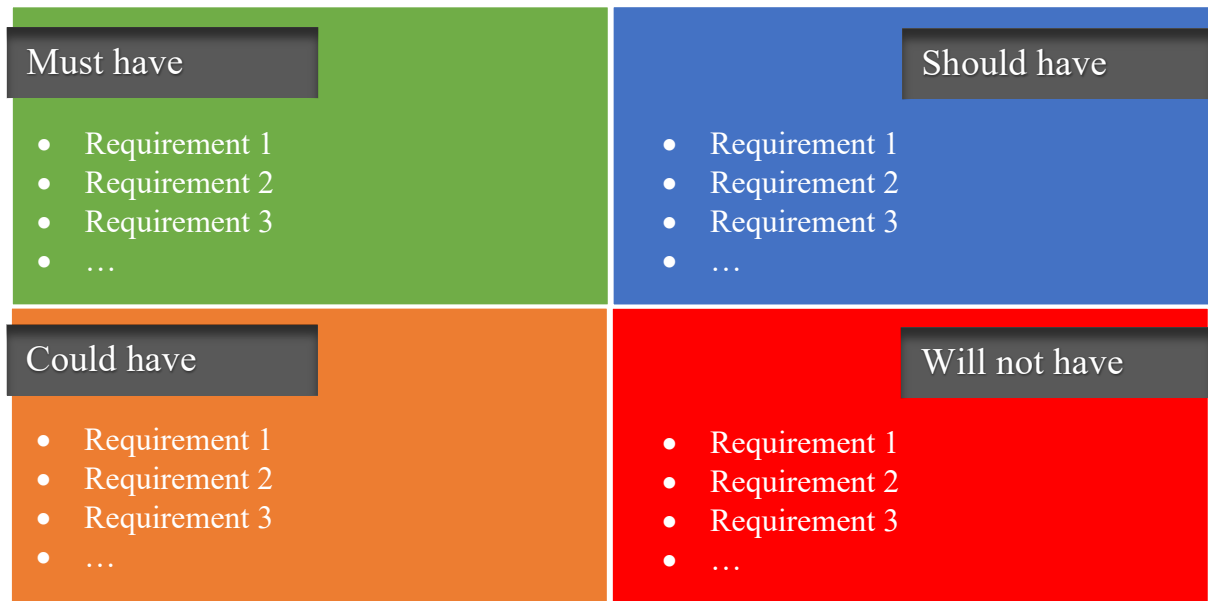
Must have	Should have
• Requirement 1 • Requirement 2 • Requirement 3 • …	• Requirement 1 • Requirement 2 • Requirement 3 • …
Could have	Will not have
• Requirement 1 • Requirement 2 • Requirement 3 • …	• Requirement 1 • Requirement 2 • Requirement 3 • …

Figure 2
MoSCoW matrix

Following, once more, a semi-structured interview technique (as described previously in this Chapter covering round one of the Delphi study) was applied for the third round of this Delphi study. The result of round two (i.e., MoSCoW matrix displaying prioritized consolidated requirements) was shown to the experts. Experts were asked to elaborate on the results of the second round. Consequently, they were asked whether they agreed with the list shown to them. In case they did not agree, they were asked why and with what they did not agree. This process allowed to gain consensus and complete the Delphi study. The feedback collected from the experts about the outcome of the requirement prioritization was discussed thoroughly once the study was conducted.

An electronic device was used to collect all data. Microsoft Excel was used to manage the data and analyze the assessment forms distributed through Google Forms. No personal data of the participants were collected, and any personal information extracted from semi-structured interviews was anonymized prior to data storage.

A foreseen limitation to the research was that the study focuses exclusively on a fresh produce digital supply chain compliance management platform. Therefore, requirements and their importance might vary for other types of food products (e.g., meat or dairy).

The feasibility of this research project in the allocated time frame has been carefully considered. It was recognized that the research approach could be seen as ambitious to be completed within the given time frame. However, it was predicted that this research would be completed in the allocated time frame due to the adoption of a case study approach focused on AgriPlace Chain. Also, a strict schedule was developed to finish this research in time. Furthermore, there was a level of certainty that there would be no foreseen dropouts of participants within the course of this Delphi study. Additionally, the feasibility was also related to the size of the researcher's network of experts in the field of digital supply chain compliance management platforms.

3. Results

In order to systematically answer the main research question of this study, three sub-questions have been answered. This chapter presents the results of the three sub-questions gathered through observation, semi-structured interviews, inductive content analysis as well as the MoSCoW method implemented through an assessment form that has been sent to 17 experts that attended this Delphi study. The assessment form distributed to all experts can be found in Appendix 1. The results of the first and second rounds of the Delphi study are presented per sub-question, including the final prioritization.

Firstly, the outcomes about requirements already used by digital supply chain compliance management platforms in the fresh produce sector are given. Secondly, the results about what new requirements or implications could add value to digital supply chain compliance management platforms in the fresh produce sector are presented. Thirdly, the findings of which requirements of a digital compliance management system tend to contribute to improved user experience based on a stakeholder perspective are given.

3.1. What requirements are already used by digital supply chain compliance management platforms in the fresh produce sector?

In order to answer the first sub-question of this research, access to the AgriPlace Chain System has been granted, and an archival observation has been executed. Hence, during the first round of this Delphi study, an observation technique was used to identify requirements already implemented in the system. Once the list of requirements already used by digital supply chain compliance management platforms in the fresh produce sector was completed, semi-structured interviews with five experts in managerial positions were performed for further clarification. These semi-structured interviews have taken place in the AgriPlace office in Amsterdam and have been conducted in a face-to-face environment. The five experts were asked to evaluate the list of requirements currently implemented in the system and to provide feedback. Four requirements previously listed have been removed from the list as the experts disagreed with them or identified these as irrelevant. Besides this, the list shown to the experts with all currently implemented requirements was perceived as complete by all interviewed experts after it had been adapted. This enabled the finalization of the list of already used requirements.

The results of the requirements elicitation that answers this sub-question are represented in Table 1. Table 1 shows three columns representing a linguistic variable of each requirement, a short description of the requirement, and an explanation for further clarification. In total, 29 requirements were extracted and summarized in Table 1.

Table 1
Requirements already used by digital supply chain compliance management platforms

Linguistic Variable	Requirement	Explanation
R1	Document monitoring and handling capabilities	Enable users (e.g., quality managers) to maintain an overview of the due diligence status of their suppliers and to so see what due diligence documentation (i.e., GLOBALG.A.P., Q&S, IFS, etc.) is complete,

		missing, or expired. This enables quality managers to get a detailed insight into the status of due diligence documentation of individual suppliers.
R2	Document preview	Users can preview all document types in the platform and can immediately access the file's contents (e.g., PDF, JPEG, and Word).
R3	Manual document requests	Enable users to act on the status of their supplier's due diligence documentation. If documentation is expired or missing, the platform allows users to send manual requests to suppliers via the platform with the request to share the missing documentation and to directly upload it to the platform.
R4	Document review	Users can accept and reject documents from answered requests in the platform.
R5	Creation bulk request rules	The platform allows users to compose what they require so they can set up requirements in a bulk action to define what sets of documentation they require from different suppliers.
R6	Single and bulk document imports	The platform allows users to add support documents (e.g., supplier declarations) or other valid documents and certificates to the platform.
R7	Automatic document collection	The platform allows users to automatically request documents from suppliers based on expiry dates and set requirements. Users can request documents from suppliers, individually or in bulk, based on filters.
R8	Customizable compliance overview	Enable users to customize the table overview of available, missing, or expired documents and certifications.
R9	Customizable default user settings	Allow different users to customize the appearance of the platform. A user can save preferences such as a specific table overview without making changes to the preferences of other users within the same company.
R10	Complete record of supply chain	Enable users to have a complete record of all their suppliers and sub-suppliers as well as their relations.
R11	Retrieve supplier information	Enable users to display and retrieve organizational characteristics and contact details of suppliers and customers.
R12	Search suppliers	The platform permits users to search for a different supplier with a search bar.
R13	Filter suppliers	Users can easily filter suppliers based on company details.
R14	Document filtering	Different filtering options allow the user to search for metadata in order to easily identify and find the documents that have been saved.
R15	Supplier categorization	Users can categorize suppliers along with various dimensions.
R16	Automatic and real-time updates on the	The platform integrates and leverages information that is available on other certifications databases (i.e.,

		Global G.A.P. and BRC) and displays it within the platform. This means the user does not have to visit multiple websites to gain the insight they require.
R17	Request sub-supplier intake	The platform enables users to request a sub-supplier intake from their suppliers.
R18	Single channel for all due diligence communication	Enable users to manage all communication on due diligence with suppliers via the platform to reduce the usage of email and to make communication on due diligence manageable.
R19	Document saving	Allow users to have control over what documentation is being saved in the platform and allow them to review documents that they receive within the platform.
R20	Document indexing	The platform allows for minimizing the workload required to organize due diligence documentation. The platform enables users to process, organize, and structure documents efficiently.
R21	Document sharing	Users can easily share documents with suppliers and customers.
R22	Default role-based access control	Several users with different roles can always access the information in the platform. The different roles have different rights to interact with the platform (e.g., quality assurance has more rights than sales & procurement).
R23	Preparation for auditing	The platform enables users to prepare their organization for company audits and to attain certifications more easily by always having proof of compliance.
R24	Integration with internal systems	The user can connect the platform to other internal systems such as ERP systems to synchronize data.
R25	Due diligence reporting on sustainability and social risks	The platform offers users a tool for due diligence reporting on sustainability and social risks within their supply chain.
R26	Automatic retrieval of laboratory analyses	The platform has a direct connection with laboratories to retrieve all test results directly within the platform.
R27	Document and data security	The platform makes use of cloud-based encrypted document storage.
R28	Default email notifications and reminders	Enable users to receive notifications on key actions to take if documents are expiring according to the established individually desired frequency.
R29	Single document download	Users can download documents and certificates that were uploaded to the platform.

3.2. What new requirements or implications could add value to digital supply chain compliance management platforms in fresh produce?

With the aid of the first round of this Delphi study using a semi-structured interview technique, the list of requirements that are already used by digital supply chain compliance management platforms could be altered and finalized. Once this step was completed, experts in managerial positions were asked to indicate what requirements or implications that are not on the list yet could add value to the digital supply chain compliance management platform. All five experts interviewed have referred the researcher to an internal database with records of requirements that could add value to digital supply chain compliance management platforms from a user perspective. This internal database was analyzed carefully and summarized in Table 2, outlining requirements that could add value to digital supply chain compliance management platforms in the fresh produce sector. Consequently, the list of requirements that could add value to digital supply chain compliance management platforms in fresh produce, represented in Table 2, has been confirmed as complete and perceived as correct by all five experts. Table 2 shows three columns representing a linguistic variable of each requirement, a short description of the requirement, and an explanation for further clarification. Overall, 36 requirements were extracted and summarized in Table 2.

Table 2
New requirements or implications that could add value to digital supply chain compliance management platforms in fresh produce

Linguistic Variable	Requirement	Explanation
R30	Automatic document reviewing	The platform processes information automatically in the system and extracts data from PDF documents and translates it into metadata.
R31	Centrally manage organizational divisions	The platform enables users to have separate accounts for different companies within organizational divisions (e.g., connect these via one master account).
R32	Automatic information sharing to retailers	The platform automatically shares relevant information and documents with retailer systems.
R33	Smart analytics on producer product customer fit	The platform allows users to automatically see what producer and product are suitable for which customer.
R34	Supplier evaluation and rating	Users can rate their suppliers on different aspects and execute supplier evaluations and ratings within the system.
R35	Online fillable and signable forms	Users can create online fillable forms within the platform and suppliers can directly fill them out in the request portal.
R36	Request documents based on frequency	Users can collect certain documents that do not expire but that they collect within a certain frequency.
R37	Information sharing among all AgriPlace Chain users	Users can easily share their certificates with all users within the AgriPlace Chain network.

R38	Contract management tool (e.g., finance department)	The platform has an integrated contract management tool that helps to collect and manage contracts in a more structured manner.
R39	From certificate to audit report	Users are able to track and access the data of the social and environmental certificates, e.g., assessment results in the platform. Users can access full audit reports of suppliers directly on the platform.
R40	Notify about blacklisted pesticide use	Enable users to automatically get informed which pesticides are not allowed and are on the pesticide blacklist of certain clients and certification bodies.
R41	Generate approved supplier list overview	The user has the ability to assess retailer-fit manually and generate a quick 'approved supplier list overview' based on that to share with other departments within the organization.
R42	Draft document request set-up	The platform allows users to set up draft document requests and save them (e.g., applicable to new suppliers or during the start of the season)
R43	Include quality control parameters	Users can do product inspections, take pictures and define some quality aspects within the platform.
R44	Open requests	The platform enables to send open requests to new suppliers asking for certificates. Based on what comes back, apply requirements to update the existing certificates when needed.
R45	Chat messenger within the platform	The platform has a chat function that users can use to continuously communicate with suppliers in the platform.
R46	Automatic season-based supplier archival	The platform allows users to define when certain suppliers are archived during different seasons.
R47	Request information per product	The platform enables users to request information per product.
R48	Customizable notifications and reminders	The platform offers the user the opportunity to adjust and customize notifications and reminders and to choose between different communication channels (e.g., users receive a notification via SMS if a supplier on the GlobalG.A.P. database gets suspended)
R49	Customizable messages send with automatic document requests	The platform enables users to add customized messages to automatic document requests.
R50	Non-delivery notification	Users can get insight if a supplier request could not be delivered via email.
R51	Standard message templates	The platform allows users to save standard templates for messages to suppliers, thereby being able to save time.
R52	Bulk document download	Users are able to download a set of selected documents and certificates at once that were uploaded to the platform.

R53	Customizable role-based access control	The admin user can assign per role what other users are allowed to access in the platform.
R54	Create quality rules templates	The platform provides users with an "add as a template function" for the creation of quality rules. Then, users can save the template of selected filters and apply it to other quality rules that are created.
R55	Document archival	The platform enables users to archive expired documents to avoid cluttering but have them as an archive for audits.
R56	User company logo email display	The platform allows users to add their company logo to the email when they share documents with a customer.
R57	Supplier response timing analytics	Users can get insight into when a supplier responded to a request in order to rate suppliers.
R58	Mobile application	The platform offers users a mobile application to allow them to execute tasks such as sending and viewing organizations/documents on the go.
R59	Personalized outgoing document requests	Users have the possibility to make outgoing document requests more personalized by adding signatures.
R60	PDF document search function	Users can use a search function in a PDF document.
R61	Retailer requirement modification in lab analyses module	The user can set up specific requirements in the lab analyses module (e.g., in case a certain value surpasses a set amount, the product will not be compliant to sell to specific retailers).
R62	Network graph	Allow users to visualize their supply chain in a network graph within the platform.
R63	Bulk update sub-supplier status	Enable users to manage sub-suppliers and update whether they are active, inactive or whether they are spot buy suppliers users buy from occasionally.
R64	Sustainability reporting	The platform supports users in increasing sustainability in their supply chain by ensuring that suppliers are in line with the sustainability requirements of retailers.
R65	Delete suppliers	The user has the ability to delete suppliers that have been added to the platform.

Consequently, an inductive content analysis was used to organize the qualitative data outlined in Tables 1 and 2. Therefore, all requirements collected through the semi-structured interviews and observation techniques have been grouped and categorized in Figure 3. Figure 3 represents the specification of the requirements collected during this study. Figure 3 shows a diagram with all specific requirements collected during the first round of this Delphi study, answering sub-questions one and two. In total, 65 requirements were gathered in the first round of the Delphi study. These specific requirements have been grouped and categorized into different requirement needs that lead to the main category of this study. As an example, the specific requirements "Request information per product (R47)" and Smart analytics on producer product customer fit (R33)" were grouped and assigned to the requirement need category "Product management" (see Figure 3). Then, the five experts were asked to provide feedback on the diagram created to confirm if the grouping and categorization of all requirements were executed correctly. All experts have confirmed the outcome of the inductive content analysis.
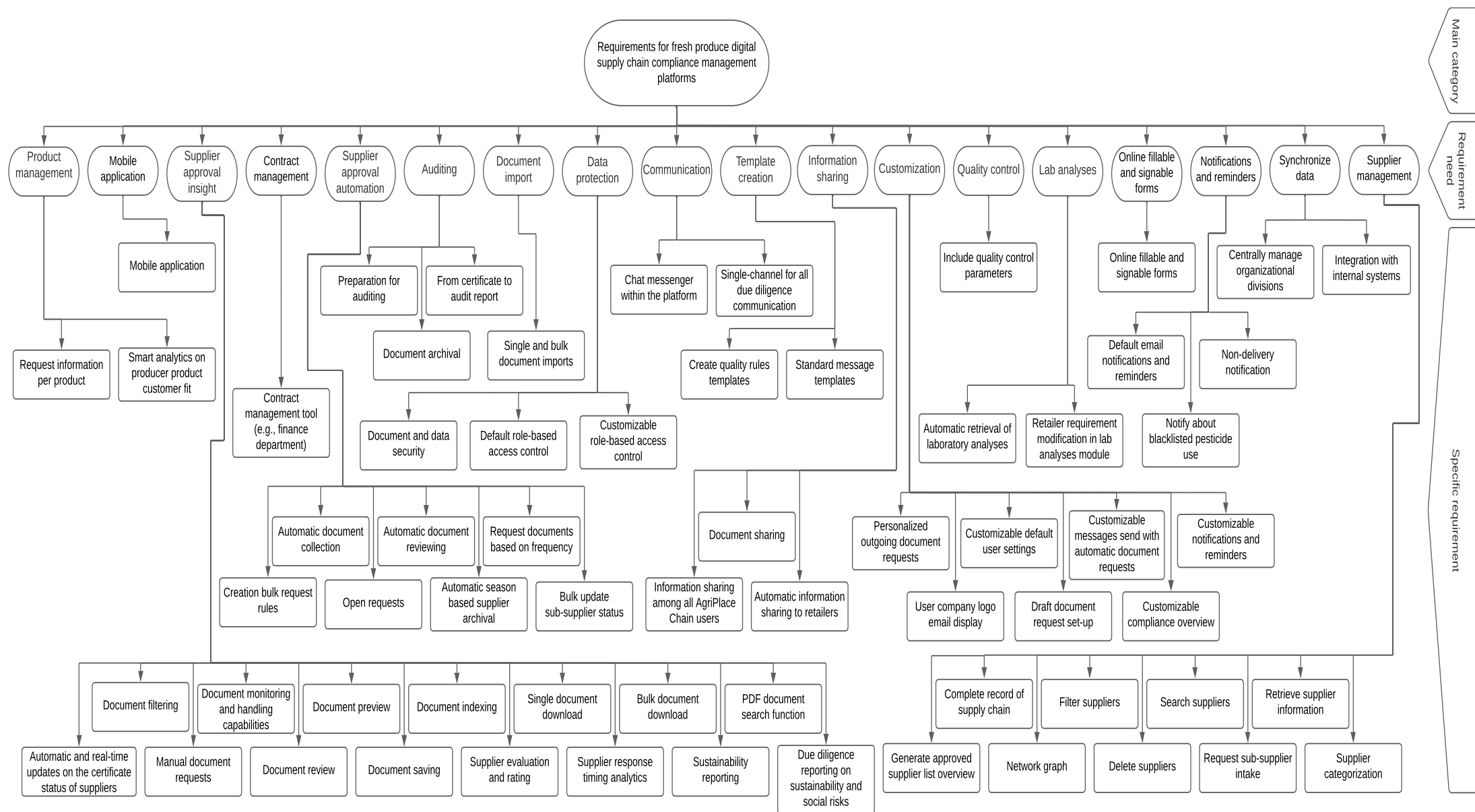
Figure 3
Inductive content analysis of requirements gathered in Tables 1 and 2

3.3. Based on a stakeholder perspective, which requirements for a digital compliance management system tend to contribute to improved user experience?

The results shown in Figure 3 were used to develop a consolidated list of requirements, including the grouping and categorization. The consolidated list was used to develop an assessment form that was distributed through Google Forms to all experts attending this Delphi study. The experts were asked to prioritize requirements according to the MoSCoW method as described in Chapter 2.2. The assessment form distributed to all experts can be found in Appendix 1. Appendix 2 contains detailed results of each requirement prioritized by the experts illustrated in pie charts. Overall, 17 experts have responded to the assessment form. Based on the results collected through Google Forms, a summary table of the requirement prioritization and inductive content analysis was created. Table 3 shows 65 requirements extracted with the aid of this Delphi study. Column 1 of Table 3 provides an importance rank and a short description of the requirement indicating its linguistic variable. Columns 2 to 5 of Table 3 indicate how many experts of the 17 experts prioritized each of the requirements, whether as "4) Must have (Mo)", "3) Should have (S)", "2) Could have (Co)", or "1) Will not have (W)". Consequently, columns 6 to 9 represent the percentages of the MoSCoW prioritization, as shown in Appendix 2. Following, column 10 indicates the outcome of the MoSCoW prioritization for each of the requirements. Therefore, it is determined in which prioritization category each requirement falls, which represents the consensus of the experts. Finally, column 11 specifies to which requirement need category each specific requirement belongs.

Overall, it can be seen that the following requirements have been classified as most important due to the "Must have (Mo)" prioritization: "Automatic document collection (R7), Search suppliers (R12), Document monitoring and handling capabilities (R1), Document review (R4), Single and bulk document imports (R6), Filter suppliers (R13), Document saving (R19), Document sharing (R21), Document and data security (R27), Complete record of supply chain (R10) ,Document preview (R2), Creation bulk request rules (R5), Retrieve supplier information (R11), Document filtering (R14), Automatic and real-time updates on the certificate status of suppliers (R16), Default role-based access control (R22), Request sub-supplier intake (R17), Single document download (R29), Customizable compliance overview (R8), Document indexing (R20), Integration with internal systems (R24), Default email notifications and reminders (R28), Request information per product (R47), Manual document requests (R3), Non-delivery notification (R50), Bulk update sub-supplier status (R63), Delete suppliers (R65), Preparation for auditing (R23), Automatic retrieval of laboratory analyses (R26), User company logo email display (R56), Smart analytics on producer product customer fit (R33) and Bulk document download (R52)".

Firstly, Table 3 outlines that 94.1% of 17 experts rated "R7 and R12" as "Must have (Mo)". Secondly, it shows that 88.2% of the 17 experts rated "R1, R4, R6, R13, R19, R21, and R27" as "Must have (Mo)". Thirdly, 76.5% of the 17 experts rated "R10" as a "Must have (Mo)". Following, 70.6% of the 17 experts rated "R2, R5, R11, R14, R16, and R22" as "Must have (Mo)". Subsequently, 64.7% of the 17 experts have prioritized "R17 and R29" as "Must have (Mo)". Afterward, 58.8% of the 17 experts rated the requirements "R8, R20, R24, R28 an,d R47" as "Must have (Mo)". Next, 52.9% of the 17 experts rated the requirements "R3, R50, R62, and R65" as "Must have (Mo)". Then, 47.1% of the 17 experts rated the requirements "R23, R26, and R56" as "Must have (Mo)". Finally, 41.2% of the 17 experts rated the requirements "R32 and R52" as "Must have (Mo).

Table 3

Summary table of requirement prioritization and inductive content analysis (sorted from most to least important)

Requirement (Linguistic Variable)	Mo	S	Co	W	%Mo	%S	%Co	%W	Prioritization category	Requirement need category
1. Automatic document collection (R7)*	16	1	0	0	94.1	5.9	0	0	Mo	Supplier approval automation
2. Search suppliers (R12)*	16	1	0	0	94.1	5.9	0	0	Mo	Supplier management
3. Document monitoring and handling capabilities (R1)*	15	2	0	0	88.2	11.8	0	0	Mo	Supplier approval insight
4. Document review (R4)*	15	2	0	0	88.2	11.8	0	0	Mo	Supplier approval insight
5. Single and bulk document imports (R6)*	15	2	0	0	88.2	11.8	0	0	Mo	Document import
6. Filter suppliers (R13)*	15	2	0	0	88.2	11.8	0	0	Mo	Supplier management
7. Document saving (R19)*	15	2	0	0	88.2	11.8	0	0	Mo	Supplier approval insight
8. Document sharing (R21)*	15	2	0	0	88.2	11.8	0	0		Information sharing
9. Document and data security (R27)*	15	1	1	0	88.2	5.9	5.9	0	Mo	Data protection
10. Complete record of supply chain (R10)*	13	3	1	0	76.5	17.6	5.9	0	Mo	Supplier management
11. Document preview (R2)*	12	5	0	0	70.6	29.4	0	0	Mo	Supplier approval insight
12. Creation bulk request rules (R5)*	12	4	1	0	70.6	23.5	5.9	0	Mo	Supplier approval automation
13. Retrieve supplier information (R11)*	12	5	0	0	70.6	29.4	0	0	Mo	Supplier management
14. Document filtering (R14)*	12	3	2	0	70.6	17.6	11.8	0	Mo	Supplier approval insight
15. Automatic and real-time updates on the certificate status of suppliers (R16)*	12	4	1	0	70.6	23.5	5.9	0	Mo	Supplier approval insight
16. Default role-based access control (R22)*	12	5	0	0	70.6	29.4	0	0	Mo	Data protection
17. Request sub-supplier intake (R17)*	11	5	1	0	64.7	29.4	5.9	0	Mo	Supplier management
18. Single document download (R29)*	11	4	2	0	64.7	23.5	11.8	0	Mo	Supplier approval insight
19. Customizable compliance overview (R8)*	10	4	3	0	58.8	23.5	17.6	0	Mo	Customization
20. Document indexing (R20)*	10	7	0	0	58.8	41.2	0	0	Mo	Supplier approval insight
21. Integration with internal systems (R24)*	10	4	3	0	58.8	23.5	17.6	0	Mo	Synchronize data
22. Default email notifications and reminders (R28)*	10	5	2	0	58.8	29.4	11.8	0	Mo	Notifications and reminders
23. Request information per product (R47)	10	6	1	0	58.8	35.3	5.9	0	Mo	Product management

24. Manual document requests (R3)*	9	6	2	0	52.9	35.3	11.8	0	Mo	Supplier approval insight
25. Non-delivery notification (R50)	9	7	1	0	52.9	41.2	5.9	0	Mo	Notifications and reminders
26. Bulk update sub-supplier status (R63)	9	7	1	0	52.9	41.2	5.9	0	Mo	Supplier approval automation
27. Delete suppliers (R65)	9	6	2	0	52.9	35.3	11.8	0	Mo	Supplier management
28. Preparation for auditing (R23)*	8	3	5	1	47.1	17.6	29.4	5.9	Mo	Auditing
29. Automatic retrieval of laboratory analyses (R26)*	8	6	3	0	47.1	35.3	17.6	0	Mo	Lab analyses
30. User company logo email display (R56)	8	5	4	0	47.1	29.4	23.5	0	Mo	Customization
31. Smart analytics on producer product customer fit (R33)	7	5	5	0	41.2	29.4	29.4	0	Mo	Product management
32. Bulk document download (R52)	7	6	4	0	41.2	35.3	23.5	0	Mo	Supplier approval insight
33. Single channel for all due diligence communication (R18)*	3	13	1	0	17.6	76.5	5.9	0	S	Communication
34. Document archival (R55)	6	11	0	0	35.3	64.7	0	0	S	Auditing
35. Draft document request set-up (R42)	1	11	5	0	5.9	64.7	29.4	0	S	Customization
36. Generate approved supplier list overview (R41)	5	10	2	0	29.4	58.8	11.8	0	S	Supplier management
37. Retailer requirement modification in lab analyses module (R61)	5	10	2	0	29.4	58.8	11.8	0	S	Lab analyses
38. Standard message templates (R51)	3	10	4	0	17.6	58.8	23.5	0	S	Template creation
39. Supplier categorization (R15)*	6	9	2	0	35.3	52.9	11.8	0	S	Supplier management
40. Sustainability reporting (R64)	4	9	4	0	23.5	52.9	23.5	0	S	Supplier approval insight
41. From certificate to audit report (R39)	3	9	5	0	17.6	52.9	29.4	0	S	Auditing
42. Personalized outgoing document requests (R59)	3	9	5	0	17.6	52.9	29.4	0	S	Customization
43. Information sharing among all AgriPlace Chain users (R37)	6	8	3	0	35.3	47.1	17.6	0	S	Information sharing
44. Centrally manage organizational divisions (R31)	5	8	4	0	29.4	47.1	23.5	0	S	Synchronize data
45. Request documents based on frequency (R36)	5	8	4	0	29.4	47.1	23.5	0	S	Supplier approval automation

Requirement									Category	Theme
46. Customizable messages send with automatic document requests (R49)	4	8	5	0	23.5	47.1	29.4	0	S	Customization
47. Open requests (R44)	2	8	7	0	11.8	47.1	41.2	0	S	Supplier approval automation
48. Automatic season-based supplier archival (R46)	7	7	3	0	41.2	41.2	17.6	0	S	Supplier approval automation
49. Customizable role-based access control (R53)	7	7	3	0	41.2	41.2	17.6	0	S	Data protection
50. Due diligence reporting on sustainability and social risks (R25)*	6	7	4	0	35.3	41.2	23.5	0	S	Supplier approval insight
51. Online fillable and signable forms (R35)	5	7	5	0	29.4	41.2	29.4	0	S	Online fillable and signable forms
52. Chat messenger within the platform (R45)	2	7	7	1	11.8	41.2	41.2	5.9	S	Communication
53. Automatic information sharing to retailers (R32)	4	6	4	2	23.5	35.3	23.5	17.6	S	Information sharing
54. Notify about blacklisted pesticide use (R40)	6	5	6	0	35.3	29.4	35.3	0	S	Notifications and reminders
55. Supplier response timing analytics (R57)	1	3	13	0	5.9	17.6	76.5	0	Co	Supplier approval insight
56. Network graph (R62)	0	5	11	1	0	29.4	64.7	5.9	Co	Supplier management
57. Include quality control parameters (R43)	2	2	11	2	11.8	11.8	64.7	11.8	Co	Quality control
58. Supplier evaluation and rating (R34)	1	6	10	0	5.9	35.3	58.8	0	Co	Supplier approval insight
59. Mobile application (R58)	0	5	10	2	0	29.4	58.8	11.8	Co	Mobile application
60. Contract management tool (e.g., finance department) (R38)	1	4	10	2	5.9	23.5	58.8	11.8	Co	Contract management
61. Create quality rules templates (R54)	1	7	9	0	5.9	41.2	52.9	0	Co	Template creation
62. PDF document search function (R60)	2	6	9	0	11.8	35.3	52.9	0	Co	Supplier approval insight
63. Customizable notifications and reminders (R48)	4	3	9	1	23.5	17.6	52.9	5.9	Co	Customization
64. Automatic document reviewing (R30)	2	7	8	0	11.8	41.2	47.1	0	Co	Supplier approval automation
65. Customizable default user settings (R9)*	4	5	8	0	25.5	29.4	47.1	0	Co	Customization

* Requirements already used by digital supply chain compliance management platforms

A MoSCoW matrix, shown in Figure 4, was created representing all 65 prioritized requirements in an overview. The requirements are presented in a sequential order based on their importance as prioritized by the experts in each of the quadrants. As a lot of data was collected throughout this study and the assessment form, the MoSCoW matrix illustrated in Figure 4 allows representing the results of this Delphi study concisely. After all prioritized requirements had been added to the MoSCoW matrix, it was determined which of the requirements divided into the four different quadrants are already used by the digital supply chain compliance management platform involved in this case study. Consequently, the requirements already implied in the AgriPlace Chain platform have been highlighted with a symbol to give a better insight into what requirements should still be implemented to improve user experience. Moreover, this enables to discuss whether the platform suits the fresh produce sector as it currently is.

Figure 4 illustrates that the majority of the requirements have been rated as a "Must have (Mo)" by the experts. Firstly, about half of all requirements that were extracted through the semi-structured interviews and the archival observation can be found in the first quadrant of the MoSCoW matrix, indicating these requirements to be most important based on a stakeholder perspective as they were rated as first place on the priority list. Secondly, approximately one-third of all requirements were prioritized as "Should have (S)" by the stakeholders. These requirements are shown in the second quadrant of the MoSCoW matrix in Figure 4. Thirdly, roughly one-sixth of all requirements collected during this study have been prioritized as "Could have (Co)" and can therefore be found in the third quadrant of the matrix. Finally, none of the requirements have been prioritized as "Will not have (W)" representing the fourth quadrant of the matrix.

Must have

1. Automatic document collection (R7)*
2. Search suppliers (R12)*
3. Document monitoring and handling capabilities (R1)*
4. Document review (R4)*
5. Single and bulk document imports (R6)*
6. Filter suppliers (R13)*
7. Document saving (R19)*
8. Document sharing (R21)*
9. Document and data security (R27)*
10. Complete record of supply chain (R10)*
11. Document preview (R2)*
12. Creation bulk request rules (R5)*
13. Retrieve supplier information (R11)*
14. Document filtering (R14)*
15. Automatic and real-time updates on the certificate status of suppliers (R16)*
16. Default role-based access control (R22)*
17. Request sub-supplier intake (R17)*
18. Single document download (R29)*
19. Customizable compliance overview (R8)*
20. Document indexing (R20)*
21. Integration with internal systems (R24)*
22. Default email notifications and reminders (R28)*
23. Request information per product (R47)
24. Manual document requests (R3)*
25. Non-delivery notification (R50)
26. Bulk update sub-supplier status (R63)
27. Delete suppliers (R65)
28. Preparation for auditing (R23)*
29. Automatic retrieval of laboratory analyses (R26)*
30. User company logo email display (R56)
31. Smart analytics on producer product customer fit (R33)
32. Bulk document download (R52)

Should have

1. Single channel for all due diligence communication (R18)*
2. Document archival (R55)
3. Draft document request set-up (R42)
4. Generate approved supplier list overview (R41)
5. Retailer requirement modification in lab analyses module (R61)
6. Standard message templates (R51)
7. Supplier categorization (R15)*
8. Sustainability reporting (R64)
9. From certificate to audit report (R39)
10. Personalized outgoing document requests (R59)
11. Information sharing among all AgriPlace Chain users (R37)
12. Centrally manage organizational divisions (R31)
13. Request documents based on frequency (R36)
14. Customizable messages send with automatic document requests (R49)
15. Open requests (R44)
16. Automatic season-based supplier archival (R46)
17. Customizable role-based access control (R53)
18. Due diligence reporting on sustainability and social risks (R25)*
19. Online fillable and signable forms (R35)
20. Chat messenger within the platform (R45)
21. Automatic information sharing to retailers (R32)
22. Notify about blacklisted pesticide use (R40)

Could have

1. Supplier response timing analytics (R57)
2. Network graph (R62)
3. Include quality control parameters (R43)
4. Supplier evaluation and rating (R34)
5. Mobile application (R58)
6. Contract management tool (e.g., finance department) (R38)
7. Create quality rules templates (R54)
8. PDF document search function (R60)
9. Customizable notifications and reminders (R48)
10. Automatic document reviewing (R30)
11. Customizable default user settings (R9)*

Will not have

Figure 4
MoSCoW matrix of prioritized requirements

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4. Discussion of Results

The main aim of this research was a requirement prioritization of a digital supply chain compliance management platform through a Delphi study to improve the overall user experience and increase the success of such platforms. With the aid of the qualitative research method chosen for this study, three sub-questions were answered. This led to insights into the requirements of a fresh produce digital supply chain compliance management platform and their prioritization through experts. Therefore, based on the findings of answering the three sub-questions, an answer to the following main question can be provided: "What are the key requirements that should be included in digital supply chain compliance management platforms for the fresh produce sector?"

The following sections of this chapter include a discussion of all results mentioned previously. Therefore, the first two sub-questions that cover requirements currently used by a fresh produce digital supply chain compliance management platform, as well as the ones that could add value, are discussed in Chapter 4.1. Next, sub-question three covering the requirement prioritization is discussed in detail in Chapter 4.2. Finally, the limitations of this research are discussed. Overall, this chapter will provide a critical reflection of the conducted research.

4.1. Requirements of a fresh produce digital supply chain compliance management platform

Sub-questions one and two could be answered with the aid of the first round of this Delphi study. In total, 65 requirements that are currently implemented and could add value to a fresh produce digital supply chain compliance management platform were extracted through granted access to the AgriPlace Chain system, archival observation, and semi-structured interviews conducted with five experts in managerial positions dealing with requirements.

The findings of sub-question one resulted in the extraction of 29 requirements already used by a digital supply chain compliance management platform. Therefore, the researcher was granted access to the AgriPlace Chain system. The requirements extracted through observation have been discussed thoroughly with the interviewed experts. The five experts involved in the semi-structured interviews have provided feedback on the list of requirements shown to them. Once the list was slightly altered and four requirements had been removed, all experts confirmed the correctness and completeness of the list represented in Table 1. This enabled the researcher to finalize the results for sub-question one.

Next, the findings of sub-question two resulted in the extraction of 36 requirements that could add value to fresh produce digital supply chain compliance management platforms. During the semi-structured interviews with the five experts, all experts referred the research to an internal database with records of requirements that could add value to digital supply chain compliance management platforms from a user perspective. The researcher has been granted access to this database to analyze the data and summarize all extracted requirements, as shown in Table 2 given in Chapter 3.2. Once the list was completed, it was shown to the experts to confirm. After the researcher had received confirmation from the experts, the results of this sub-question were finalized.

Finally, an inductive content analysis was executed. Therefore, all requirements were grouped and categorized in a diagram, as shown in Figure 3. The inductive content analysis permitted creating an illustrative overview by dividing groups of requirements into different requirement need categories. With the aid of the inductive content analysis, the five experts interviewed earlier were asked if they agreed with the content of Figure 3 as well as the way the requirements have been structured, grouped, and categorized. All five experts in managerial positions have given confirmation and therefore, the inductive content analysis was completed. The way the requirements have been structured in the diagram enabled to draw lines between the importance of the different requirement need categories. This will be discussed further in the following chapter.

The collection of results for sub-question one and two went according to plan, and enough reliable data was collected to answer both sub-questions. The initial aim was to include five to 15 experts in the round of this Delphi study. Generally, more than five experts could have been included in the semi-structured interviews during the first round of this Delphi study but were not due to time efficiency and as the focus on archival observation turned out to be more important. Before the conduction of this research, it was unknown that there was an existing database of requirements that could add value to digital supply chain compliance management platforms. Overall, the archival observation and semi-structured expert interviews went well, and the cooperation of the experts was outstanding. The researcher's large network of experts in the field of digital supply chain compliance management platforms has influenced the process of this study beneficially and supported rapid data collection. Nevertheless, if there were no time limitations, it could be beneficial to include a larger set of experts in order to increase the reliability of data even further. Lastly, during this research, no non-influential circumstances appeared, and there were no dropouts in the expert panel involved.

It can be said that enough reliable data was collected during the first round of this Delphi study. Additionally, the feedback of the experts in the field has confirmed this. Furthermore, this study and its findings support the research of Hazell (2015). Besides the research of Hazell (2015), no literature could be found on key requirements of digital supply chain compliance management platforms. Based on the results of this study, many other factors have been identified that will contribute to favorable requirement implementation in digital supply chain compliance management platforms. Most of the specific requirements found during this study are new or different from the ones that can be found in the literature. To undermine the reliability of the data collected during this study, Hazell's (2015) research states that innovative cloud-based platforms should include requirements such as "Quality Assurance Principles, Control of Product (Quality Control), Document & Record Management, Good Agricultural Practices (GAP), Identification & Traceability, Control of Non-conforming Product, Regulatory Requirements as well as Supplier Management." The requirements listed in the research of Hazell (2015) have similarities to some of the specific requirements extracted during this study, as well as to requirement need categories developed during the inductive content analysis.

It was unexpected that more requirements that are currently not implemented in the AgriPlace Chain platform were found. This may be because digital supply chain compliance management platforms are not very established and may still have to implement more development work to make them wholesome and perfectly holistic. However, compliance management can be seen as a far-reaching topic that is highly complex. It seems that the implementation of all value-adding requirements and further development of a digital supply chain compliance management platform such as AgriPlace Chain requires important resources such as

experienced professionals in the field, a large monetary budget as well as time. However, the findings of this research may support a more rapid development of the platform due to the requirement prioritization discussed in the following chapter.

4.2. Requirements prioritization

Sub-question three could be answered with the aid of the second round of this Delphi study. With the aid of the inductive content analysis executed after the first round of this Delphi study, an assessment form could be developed that was distributed to all experts. Hereby, 17 experts attended this round of the Delphi study. The importance of including many experts in the prioritization was a preference to make the data more reliable. The inductive content analysis allowed to group the specific requirements under different requirement need categories to structure the assessment form systematically. This may have benefitted the positive outcome of this study as experts were provided with a clear and structured assessment form. The 17 experts were asked to prioritize all requirements according to the MoSCoW method. A prioritization rating of whether "4) Must have (Mo)", "3) Should have (S)", "2) Could have (Co)", or "1) Will not have (W)" was given to each requirement by the experts. The outcome of the assessment form resulted in the creation of a summary table, as shown in Table 3 in Chapter 3.3. The table summarizes the statistical outcome of this study, indicating clearly how each of the requirements was prioritized by the experts. Considering the prioritization outcome, 32 of the 65 requirements gathered in this study can be seen as most important as experts rated them as "Must have (Mo)". Therefore, the key requirements can be considered "Automatic document collection (R7), Search suppliers (R12), Document monitoring and handling capabilities (R1), Document review (R4), Single and bulk document imports (R6), Filter suppliers (R13), Document saving (R19), Document sharing (R21), Document and data security (R27), Complete record of supply chain (R10), Document preview (R2), Creation bulk request rules (R5), Retrieve supplier information (R11), Document filtering (R14), Automatic and real-time updates on the certificate status of suppliers (R16), Default role-based access control (R22), Request sub-supplier intake (R17), Single document download (R29), Customizable compliance overview (R8), Document indexing (R20), Integration with internal systems (R24), Default email notifications and reminders (R28), Request information per product (R47), Manual document requests (R3), Non-delivery notification (R50), Bulk update sub-supplier status (R63), Delete suppliers (R65), Preparation for auditing (R23), Automatic retrieval of laboratory analyses (R26), User company logo email display (R56), Smart analytics on producer product customer fit (R33), and Bulk document download (R52)".

The outcome of the assessment form highlights that the following requirement need categories can be considered most important as some appeared repetitively with the specific key requirements prioritized as "Must have (Mo)". Therefore, it seems that the requirement need categories "Supplier approval automation, Supplier management, Supplier approval insight, Document import, Information sharing, Data protection, Customization, Synchronize data, Notifications and reminders, Product management, Auditing, and Lab analyses" can be considered most important. Again, there are similarities to the study of Hazell (2015) when comparing the requirement needs of both studies as elaborated in the previous chapter. It is noticeable that the requirements found in the research of Hazell (2015), such as "Document & Record Management and Supplier Management Supplier Management", are very similar to the requirement need categories found in this study. This may indicate the reliability of the data collected during this study. Additionally, this study gives a holistic insight into the specific requirements falling under different requirement need categories with the aid of prioritization.

No other literature could be found covering these topics about fresh produce digital supply chain compliance management platforms.

Consequently, based on the development of the summary table, a MoSCoW matrix of the prioritized requirements, as shown in Figure 4, was developed. The matrix allows to visualize all requirements within four quadrants consisting of "Must have (Mo), Should have (S), Could have (Co), and Will not have (W)". The matrix illustrates that 32 of the requirements were prioritized as "Must have (Mo)", 22 as "Should have (S)", 11 as "Could have", and none as "Will not have (W)". All requirements in each of the quadrants are listed in the same order as in Table 3, in descending order of importance. As previously mentioned, there is a remarkable trend reflected in the "Must have (Mo)" quadrant of the Matrix. It is noticeable that 25 of the 32 requirements in this quadrant are already implemented in the AgriPlace Chain platform. This also means that nearly all of the 29 requirements already used by the digital supply chain compliance management platform are considered a "Must have (Mo)". This may justify the quality and success of the platform as the most important key requirements are already implemented. This may also indicate that the requirements already used in the platform fit the fresh food agribusiness sector and can add value to the sector. Furthermore, this would result in the assumption that there is a level of good user experience as most requirements that are already implemented by the platform were prioritized as "Must have (Mo)". Next, none of the requirements extracted during this study have been prioritized as "Will not have (W)", which supports the justification of the relevance of the requirements that have been collected. However, this may also indicate biased opinions as stakeholders that work closely with the platform have been in the expert panel. To justify this further, a quantitative research approach could be applied with the inclusion of a larger range of stakeholders.

It can be said that the success of the platform and its users will directly benefit from the implementation of the "Must have (Mo)" requirements that are not yet used. However, it is important to stress that, as elaborated on in Chapter 2.2., "Must have (Mo)" requirements must be implemented in the early stages of the software development (Burgess & Sunmola, 2021). Furthermore, "Must have (Mo)" requirements are vitally important and failing to implement these may lead to project failure (Hudaib et al., 2018). Therefore, the following requirements shall still be implemented as soon as possible: "Request information per product (R47), Non-delivery notification (R50), Bulk update sub-supplier status (R63), Delete suppliers (R65), User company logo email display (R56), Smart analytics on producer product customer fit (R33), Bulk document download (R52)". These requirements may have been missed during the early stages of software development. Besides this, the platform and its users will also benefit from the implementation of all requirements classified as "Should have (S) and Could have (Co)" that are not yet implemented. Hereby, it is interesting to observe that three of the requirements (R18, R15, and R25) were prioritized as "Should have (S)" but are currently already implemented. The same applies to the requirement "Customizable default user settings (R9)" prioritized as "Could have (Co)". It may be that development resources have not been allocated effectively as the company should have focused on the implementation of requirements with higher priority. This demonstrates the relevance and importance of the key prioritization executed in this study.

Generally, the findings of this study can support sustainability and the creation of safe and transparent supply chains in the fresh produce sector. Next, developers of digital supply chain compliance management platforms use the findings of this study to efficiently improve compliance management platforms rapidly, which will attract more users due to improved user experience. Ultimately, this will determine the success of digital supply chain compliance

management platforms. Additionally, consumers will benefit from food companies adopting the application of compliance management platforms due to increased food safety and quality.

The research approach was slightly altered due to the sake of time efficiency. The third round of this Delphi study became obsolete as consensus was found through the outcome of the assessment form. Therefore, the researcher decided to alter the research process slightly and to focus on careful evaluation of the collected data. If there would not have been any time limitations, it may be beneficial to include a third round of semi-structured experts to increase the reliability of the data even further. Nevertheless, in this case, it has been decided that there would not have been a great benefit for this study also since a large panel was willing to answer the assessment form. Besides this, the research process went according to plan as all experts involved were willing to cooperate closely when participating in this study. This allowed the researcher to gather all qualitative data rapidly. Overall, it can be said that enough reliable and valuable data was collected to answer all sub-questions and the main question of this research accordingly. Also, the literature review of the limited literature available on this topic has indicated the reliability of the findings in this study. It can be said that the outcome of this research can benefit the development of fresh produce digital supply chain compliance management platforms greatly.

4.3. Limitations

The first limitation of this research that must be considered is the case study approach. As discussed already in Chapter 2.2., the research's limitation of focusing specifically on the fresh produce sector may lead to the need for further research and justification to apply the findings to other sectors such as meat or dairy. Next, the application of a case study may have led to researcher bias since stakeholders that work closely with the platform have been in the expert panel. This may have resulted in many of the requirements already used by the digital supply chain compliance management platform being prioritized as most important. Another limitation of this research was the decision to focus rather on archival observation instead of semi-structured interviews during the first round of this Delphi study, as the interviews revealed that there was an existing internal database outlining requirements that could add value to the platform. Nevertheless, this did not affect the quality of the data collected, as the experts were asked to confirm the findings. Next, due to the confidentially of this case study, it was not possible to transcribe all the semi-structured interviews. Another limitation of this study may have been the availability of literature on this topic. As mentioned previously, only one source could be identified that indicated general requirements being used for compliance management platforms. This resulted in a limitation in the literature review and in the ability to compare all data to findings of similar studies. Finally, it is worth mentioning that the MoSCoW method is a favorable tool for prioritizing requirements efficiently. However, the weaknesses of the MoSCoW method should not be overlooked. Critically seen, the MoSCoW method can result in non-consensus. Burgess and Sunmola (2021) discuss that a critique of MoSCoW method can be a high number of ties as it can be complicated to rank requirements on perceptions. Nevertheless, this did not affect the outcome of this study. Though another tool such as the Kano or RICE scoring model could be used to conduct a deeper analysis of the data.

5. Conclusions and Recommendations

5.1. Conclusions

The research presented in this paper aims to outline how digital supply chain compliance management platforms can benefit and add value to the fresh produce industry. Moreover, it was discussed how the use of such innovative technologies could lead to making supply chains safer, more transparent, and sustainable. The main objective of this research was to prioritize the requirements of a digital supply chain compliance management platform through a Delphi study to improve the overall user experience and increase the success of such platforms. Three sub-questions were answered using a qualitative research method. This facilitated the extraction and prioritization of vital requirements of a fresh produce digital supply chain compliance management platform. Consequently, all results collected throughout this study allow determining the key requirements that should be included in digital supply chain compliance management platforms for the fresh produce sector.

Firstly, to answer sub-question one, archival observation and semi-structured interviews were used. The findings of the sub-question resulted in the extraction of 29 requirements already used by digital supply chain compliance management platforms. Table 1 presented in Chapter 3.1. lists and explains the requirements in further detail.

Secondly, semi-structured interviews and archival observation with the aid of access to an internal database enabled to answer sub-question two. In total, 36 requirements that could add value to fresh produce digital supply chain compliance management platforms have been found. The value-adding requirements are represented in Table 2 given in Chapter 3.2. Both sub-questions have been answered within the first round of this Delphi study, including an expert panel of five stakeholders in managerial positions. The outcome of this round resulted in the extraction of 65 requirements. Following, an inductive content analysis was executed, and a complete visualized overview of all extracted requirements was created. Therefore, requirements were grouped and categorized into requirement needs. All experts have confirmed the outcome of the inductive content analysis that can be found in Figure 3 in Chapter 3.2.

Thirdly, based on the outcome of the inductive content analysis, an assessment form was developed and distributed to an expert panel consisting of 17 stakeholders. This step allowed to complete the second round of this Delphi study and to prioritize all requirements, whether as "Must have (Mo), Should have (S), Could have (Co), or Will not have (W)". This enabled to answer sub-question three about which requirements for a digital compliance management system tend to contribute to improved user experience. 32 requirements have been prioritized as "Must have (Mo)", 22 as "Should have (S)", 11 as "Could have (Co)" and none as "Will not have (W)" and are represented in MoSCoW matrix as shown in Figure 4 as well as in Table 3 in Chapter 3.3.

Finally, based on the results gathered in Table 3 given in Chapter 3.3., the main question could be answered. Considering the percentages of how many the experts prioritized a requirement as "Must have (Mo)", 32 key requirements that should be included in digital supply chain compliance management platforms for the fresh produce sector are: "Automatic document collection (R7), Search suppliers (R12), Document monitoring and handling capabilities (R1), Document review (R4), Single and bulk document imports (R6), Filter suppliers (R13),

Document saving (R19), Document sharing (R21), Document and data security (R27), Complete record of supply chain (R10), Document preview (R2), Creation bulk request rules (R5), Retrieve supplier information (R11), Document filtering (R14), Automatic and real-time updates on the certificate status of suppliers (R16), Default role-based access control (R22), Request sub-supplier intake (R17), Single document download (R29), Customizable compliance overview (R8), Document indexing (R20), Integration with internal systems (R24), Default email notifications and reminders (R28), Request information per product (R47), Manual document requests (R3), Non-delivery notification (R50), Bulk update sub-supplier status (R63), Delete suppliers (R65), Preparation for auditing (R23), Automatic retrieval of laboratory analyses (R26), User company logo email display (R56), Smart analytics on producer product customer fit (R33) and Bulk document download (R52)". Therefore, it is a must that fresh produce digital supply chain compliance management platforms have the mentioned above requirements implemented in order to launch such a platform successfully and to ensure a good user experience. Once all "Must have (Mo)" have been included, all "Should have (S) and Could have (Co)" requirements found in this research shall be implemented.

Ultimately, it appears that the requirement need categories "Supplier approval automation, Supplier management, Supplier approval insight, Document import, Information sharing, Data protection, Customization, Synchronize data, Notifications and reminders, Product management, Auditing, and Lab analyses" can be seen as most important as they appeared repetitively with the specific key requirements prioritized as "Must have (Mo)".

Overall, the development of fresh produce digital supply chain compliance management platforms can be accelerated by the findings of this study which can support sustainability improvements, more transparency as well as the creation of safe supply chains in the food industry. Moreover, developers of digital supply chain compliance management platforms can make use of this study to make compliance management platforms more attractive to users. Also, consumers will benefit from the application of compliance management platforms due to increased food safety and quality. Moreover, this research will also benefit the users of digital supply chain compliance management platforms as the user experience can be improved based on the findings of this research.

To conclude, a lot of the requirements already implied in AgriPlace Chain are prioritized as "Must have (Mo)". This indicates that the requirements already used in the platform fit the fresh food agribusiness sector and can add value to the sector. Also, this may mean that the platform has a high degree of good user experience as many of the requirements are already implemented. However, the implementation of the "Must have (Mo), Should have (S), and Could have (Co)" requirements would benefit the success of the platform as well as the user experience.

5.2. Recommendations

It can be recommended that the AgriPlace Chain platform and its users will benefit from the implementation of the "Must have (Mo)" requirements not yet used. Therefore, the company should consider implementing the following requirements as soon as possible: "Request information per product (R47), Non-delivery notification (R50), Bulk update sub-supplier status (R63), Delete suppliers (R65), User company logo email display (R56), Smart analytics on producer product customer fit (R33), Bulk document download (R52)". Moreover, it is recommended that all requirements classified as "Should have (S) and Could have (Co)" that

are not yet implemented will be implemented. This may boost the platform's success and improve the overall user experience.

Besides the AgriPlace Chain platform, any other fresh produce digital supply chain compliance management platform should focus on the implementation of the 32 "Must have (Mo)" requirements that have been found in this study. Afterward, it would be beneficial to implement the 22 "Should have (S)" and then the 11 "Could have (Co)" requirements found during this research. This will allow a rapid development of such a platform considering a good user experience.

To justify that researcher bias have not influenced this study, a quantitative research approach could be applied, including a more extensive range of stakeholders. This would allow determining if the requirements would have been prioritized differently and to justify the findings of this study further. Furthermore, this case study explicitly focused on the fresh produce sector. Therefore, it may be favorable that further research is applied to evaluate if the findings of this study are applicable to other sectors than the fresh produce. Next, the use of a Delphi study and case study approach has resulted in time limitations. The execution of this study was very time intensive. Therefore, it can be recommended that a extensive time window will be allocated to similar research approaches. Also, it could have been beneficial to include a larger set of experts in order to increase the reliability of data even further. Finally, it can be said that the MoSCoW method is a constructive tool to prioritize requirements but can lead to non-consensus in specific cases. Therefore, it can be recommended that another tool such as the Kano or RICE scoring model could be used to conduct a deeper analysis of the data for further research.

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Appendices

Appendix 1: Expert assessment form

AgriPlace Chain key requirement prioritization

* Required

Your Name: *

Your answer

Supplier approval insight

Please prioritize according to the MoSCoW method:
"4) Must have (Mo)" (first place on the priority list), "3) Should have (S)" (second place on the priority list),
"2) Could have (Co)" (third place on the priority list), or "1) Will not have (W)" (last place on the priority list)

Manual document requests *

Enable users to act on the status of their supplier's due diligence documentation. If documentation is expired or missing, the platform allows users to send manual requests to suppliers via the platform with the request to share the missing documentation and to directly upload it to the platform.

Choose

Document monitoring and handling capabilities *

Enable users (e.g., quality managers) to maintain an overview of the due diligence status of their suppliers and to so see what due diligence documentation (i.e., GLOBALG.A.P., Q&S, IFS, etc.) is complete, missing, or expired. This enables quality managers to get a detailed insight into the status of due diligence documentation of individual suppliers.

Choose

Document preview *

Users can preview all document types in the platform and can immediately access the file's contents (e.g., PDF, JPEG, and Word).

Choose

Document indexing *

The platform allows for minimizing the workload required on organizing due diligence documentation. The platform enables users to process, organize, and structure documents efficiently.

Choose

Single document download *

Users can download documents and certificates that were uploaded to the platform.

Choose

Bulk document download *

Users are able to download a set of selected documents and certificates at once that were uploaded to the platform.

Choose

PDF document search function *

Users can use a search function in a PDF document.

Choose

Automatic and real-time updates on the certificate status of suppliers *

The platform integrates and leverages information that is available on other certifications databases (i.e., Global G.A.P. and BRC) and displays it within the platform. This means the user does not have to visit multiple websites to gain the insight they require.

Choose

Document filtering *

Different filtering options allow the user to search for metadata in order to easily identify and find the documents that have been saved.

Choose

Document review *

Users can accept and reject documents from answered requests in the platform.

Choose

Document saving *

Allow users to have control over what documentation is being saved in the platform and allow them to review documents that they receive within the platform.

Choose

Supplier evaluation and rating *

Users can rate their suppliers on different aspects and execute supplier evaluations and ratings within the system.

Choose

Supplier response timing analytics *

Users can get insight into when a supplier responded to a request in order to rate suppliers.

Choose

Sustainability reporting *

The platform supports users in increasing sustainability in their supply chain by ensuring that suppliers are in line with the sustainability requirements of retailers.

Choose

Due diligence reporting on sustainability and social risks *

The platform offers users a tool for due diligence reporting on sustainability and social risks within their supply chain.

Choose

Supplier approval automation

Please prioritize according to the MoSCoW method:
"Must have (Mo)" (first place on the priority list), "Should have (S)" (second place on the priority list),
"Could have (Co)" (third place on the priority list), or "Will not have (W)" (last place on the priority list)

Automatic document collection *

The platform allows users to automatically request documents from suppliers based on expiry dates and set requirements. Users can request documents from suppliers, individually or in bulk, based on filters.

Choose ▾

Automatic document reviewing *

The platform processes information automatically in the system and extracts data from PDF documents and translates it into metadata.

Choose ▾

Request documents based on frequency *

Users can collect certain documents that do not expire but that they collect within a certain frequency.

Choose ▾

Creation bulk request rules *

The platform allows users to compose what they require so they can set up requirements in a bulk action to define what sets of documentation they require from different suppliers.

Choose ▾

Open requests *

The platform enables to send open requests to new suppliers asking for certificates. Based on what comes back, apply requirements to update the existing certificates when needed.

Choose ▾

Automatic season based supplier archival *

The platform allows users to define when certain suppliers will be archived during different seasons.

Choose ▾

Bulk update sub-supplier status *

Enable users to manage sub-suppliers and update whether they are active, inactive or whether they are spot buy suppliers, users buy from occasionally.

Choose ▾

Supplier management

Please prioritize according to the MoSCoW method:
"Must have (Mo)" (first place on the priority list), "Should have (S)" (second place on the priority list),
"Could have (Co)" (third place on the priority list), or "Will not have (W)" (last place on the priority list)

Complete record of supply chain *

Enable users to have a complete record of all their suppliers and sub-suppliers as well as their relations.

Choose ▾

Filter suppliers *

Users can easily filter suppliers based on company details.

Choose ▾

Search suppliers *

The platform permits users to search for a different supplier with a search bar.

Choose ▾

Retrieve supplier information *

Enable users to display and retrieve organizational characteristics and contact details of suppliers and customers.

Choose ▾

Network graph *

Allow users to visualize their supply chain in a network graph within the platform.

Choose ▾

Delete suppliers *

The user has the ability to delete suppliers that have been added to the platform.

Choose ▾

Request sub-supplier intake *

The platform enables users to request a sub-supplier intake from their suppliers.

Choose ▾

Supplier categorization *

Users can categorize suppliers along with various dimensions.

Choose ▾

Generate approved supplier list overview *

Users can categorize suppliers along with various dimensions.

Choose ▾

Communication

Please prioritize according to the MoSCoW method:
"Must have (Mo)" (first place on the priority list), "Should have (S)" (second place on the priority list),
"Could have (Co)" (third place on the priority list), or "Will not have (W)" (last place on the priority list)

Chat messenger within the platform *
The platform has a chat function that users can use to continuously communicate with suppliers in the platform.

Choose ▾

Single-channel for all due diligence communication *
Enable users to manage all communication on due diligence with suppliers via the platform to reduce the usage of email and to make communication on due diligence manageable.

Choose ▾

Synchronize data

Please prioritize according to the MoSCoW method:
"Must have (Mo)" (first place on the priority list), "Should have (S)" (second place on the priority list),
"Could have (Co)" (third place on the priority list), or "Will not have (W)" (last place on the priority list)

Centrally manage organizational divisions *
The platform enables users to have separate accounts for different companies within organizational divisions (e.g., connect these via one master account).

Choose ▾

Integration with internal systems *
The user can connect the platform to other internal systems such as ERP systems to synchronize data.

Choose ▾

Notifications and reminders

Please prioritize according to the MoSCoW method:
"Must have (Mo)" (first place on the priority list), "Should have (S)" (second place on the priority list),
"Could have (Co)" (third place on the priority list), or "Will not have (W)" (last place on the priority list)

Non-delivery notification *
Users can get insight if a supplier request could not be delivered via email.

Choose ▾

Default email notifications and reminders *
Enable users to receive notifications on key actions to take if documents are expiring according to the established individually desired frequency.

Choose ▾

Notify about blacklisted pesticide use *
Enable users to automatically get informed which pesticides are not allowed and are on the pesticide blacklist of certain clients and certification bodies.

Choose ▾

Document import

Please prioritize according to the MoSCoW method:
"Must have (Mo)" (first place on the priority list), "Should have (S)" (second place on the priority list),
"Could have (Co)" (third place on the priority list), or "Will not have (W)" (last place on the priority list)

Single and bulk document imports *
The platform allows users to add support documents (e.g., supplier declarations) or other valid documents and certificates to the platform.

Choose ▾

Data protection

Please prioritize according to the MoSCoW method:
"Must have (Mo)" (first place on the priority list), "Should have (S)" (second place on the priority list),
"Could have (Co)" (third place on the priority list), or "Will not have (W)" (last place on the priority list)

Document and data security *
The platform makes use of cloud-based encrypted document storage.

Choose ▾

Default role-based access control *
Several users with different roles can always access the information in the platform. The different roles have different rights to interact with the platform (e.g., quality assurance has more rights than sales & procurement).

Choose ▾

Customizable role-based access control *
The admin user can assign per role what other users are allowed to access in the platform.

Choose ▾

Template creation

Please prioritize according to the MoSCoW method:
"Must have (Mo)" (first place on the priority list), "Should have (S)" (second place on the priority list),
"Could have (Co)" (third place on the priority list), or "Will not have (W)" (last place on the priority list)

Create quality rules templates *
The platform provides users with an "add as a template function" for the creation of quality rules. Then, users can save the template of selected filters and apply it to other quality rules that are created.

Choose ▾

Standard message templates *

The platform allows users to save standard templates for messages to suppliers, thereby being able to save time.

Choose ▼

Auditing

Preparation for auditing *

The platform enables users to prepare their organization for company audits and to attain certifications more easily by always having proof of compliance.

Choose ▼

From certificate to audit report *

Users are able to track and access the data of the social and environmental certificates e.g., assessment results in the platform. Users can access full audit reports of suppliers directly on the platform.

Choose ▼

Document archival *

The platform enables users to archive expired documents to avoid cluttering but have them as archive for audits.

Choose ▼

Information sharing

Document sharing *

Users can easily share documents with suppliers and customers.

Choose ▼

Automatic information sharing to retailers *

The platform automatically shares relevant information and documents with retailer systems.

Choose ▼

Information sharing among all AgriPlace Chain users *

Users can easily share their certificates with all users within the AgriPlace Chain network.

Choose ▼

Customization

Personalized outgoing document requests *

Users have the possibility to make outgoing document requests more personalized by adding signatures.

Choose ▼

Customizable default user settings *

Allow different users to customize the appearance of the platform. A user can save preferences such as a specific table overview without making changes to the preferences of other users within the same company.

Choose ▼

Customizable messages send with automatic document requests *

The platform enables users to add customized messages to automatic document requests.

Choose ▼

Customizable notifications and reminders *

The platform offers the user the opportunity to adjust and customize notifications and reminders and to choose between different communication channels (e.g., users receive a notification via SMS if a supplier on the GlobalG.A.P. database gets suspended)

Choose ▼

User company logo email display *

The platform allows users to add their company logo to the email when they share documents with a customer.

Choose ▼

Draft document request set-up *

The platform allows users to set up draft document requests and save them (e.g., applicable to new suppliers or during the start of the season)

Choose ▼

Customizable compliance overview *

Enable users to customize the table overview of available, missing, or expired documents and certifications.

Choose ▼

Quality control

Please prioritize according to the MoSCoW method:
"Must have (Mo)" (first place on the priority list), "Should have (S)" (second place on the priority list),
"Could have (Co)" (third place on the priority list), or "Will not have (W)" (last place on the priority list)

Include quality control parameters *
Users can do product inspections, make pictures and define some quality aspects within the platform.

Choose ▾

Product management

Please prioritize according to the MoSCoW method:
"Must have (Mo)" (first place on the priority list), "Should have (S)" (second place on the priority list),
"Could have (Co)" (third place on the priority list), or "Will not have (W)" (last place on the priority list)

Request information per product *
The platform enables users to request information per product.

Choose ▾

Smart analytics on producer product customer fit *
The platform allows users to automatically see what producer and product are suitable for which customer.

Choose ▾

Mobile application

Please prioritize according to the MoSCoW method:
"Must have (Mo)" (first place on the priority list), "Should have (S)" (second place on the priority list),
"Could have (Co)" (third place on the priority list), or "Will not have (W)" (last place on the priority list)

Mobile application *
The platform offers users a mobile application to allow them to execute tasks such as sending and viewing organizations/documents on the go.

Choose ▾

Lab analyses

Please prioritize according to the MoSCoW method:
"Must have (Mo)" (first place on the priority list), "Should have (S)" (second place on the priority list),
"Could have (Co)" (third place on the priority list), or "Will not have (W)" (last place on the priority list)

Automatic retrieval of laboratory analyses *
The platform has a direct connection with laboratories to retrieve all test results directly within the platform.

Choose ▾

Retailer requirement modification in lab analyses module *
The user can set up specific requirement in the lab analyses module (e.g., in case a certain value surpasses a set amount the product will not be compliant to sell to a specific retailers).

Choose ▾

Online fillable and signable dataforms

Please prioritize according to the MoSCoW method:
"Must have (Mo)" (first place on the priority list), "Should have (S)" (second place on the priority list),
"Could have (Co)" (third place on the priority list), or "Will not have (W)" (last place on the priority list)

Online fillable and signable forms *
Users can create online fillable forms within the platform and suppliers can directly fill them out in the request portal.

Choose ▾

Contract management

Please prioritize according to the MoSCoW method:
"Must have (Mo)" (first place on the priority list), "Should have (S)" (second place on the priority list),
"Could have (Co)" (third place on the priority list), or "Will not have (W)" (last place on the priority list)

Contract management tool (e.g., finance department) *
The platform has an integrated contract management tool that helps to collect and manage contracts in a more structured manner.

Choose ▾

Appendix 2: Detailed results of requirement prioritization (assessment form distributed through Google Forms)

Manual document requests

17 responses

- ● 4) Must have
- ● 3) Should have
- ● 2) Could have
- ● 1) Will not have
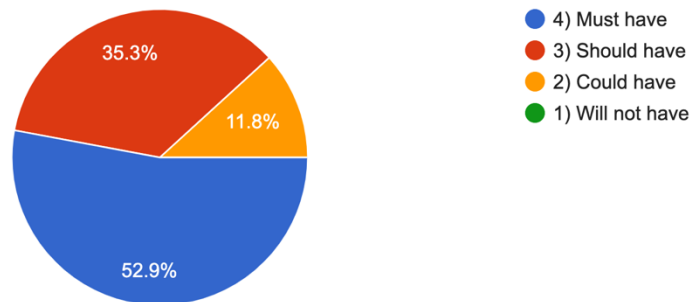
Document monitoring and handling capabilities

17 responses

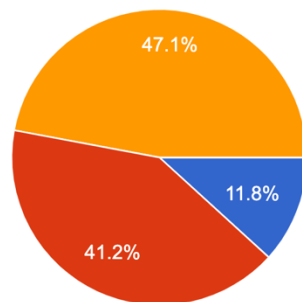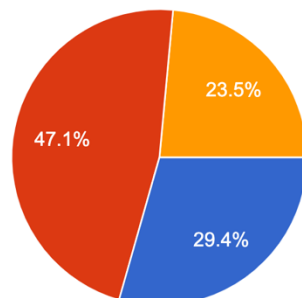- ● 4) Must have
- ● 3) Should have
- ● 2) Could have
- ● 1) Will not have
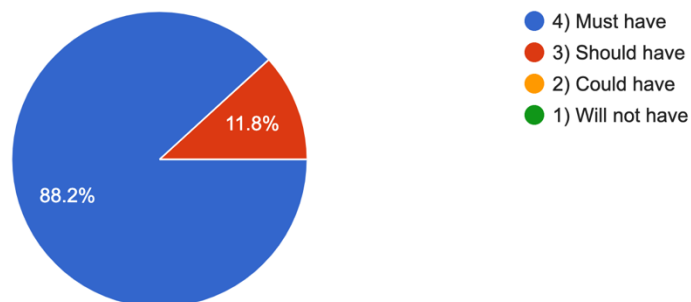
Document preview

17 responses

- ● 4) Must have
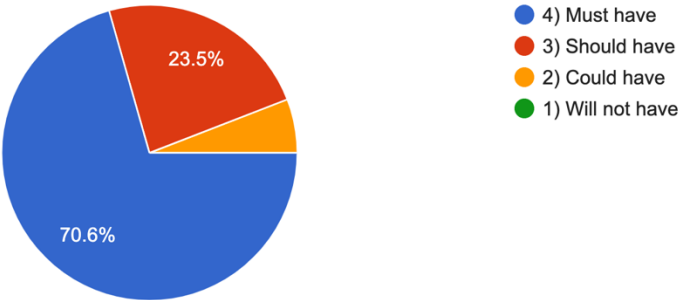- ● 3) Should have
- ● 2) Could have
- ● 1) Will not have
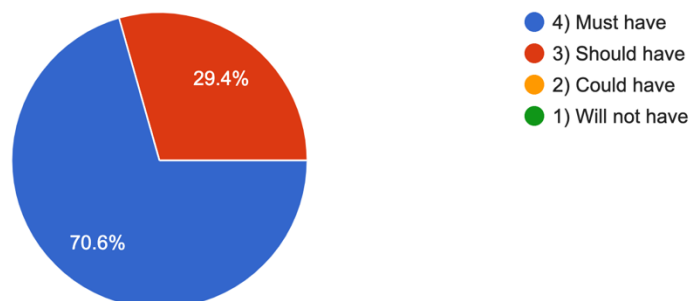
Document indexing

17 responses
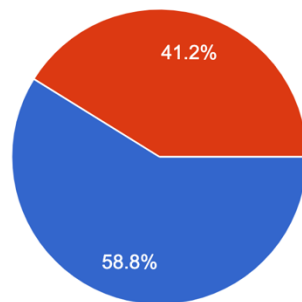
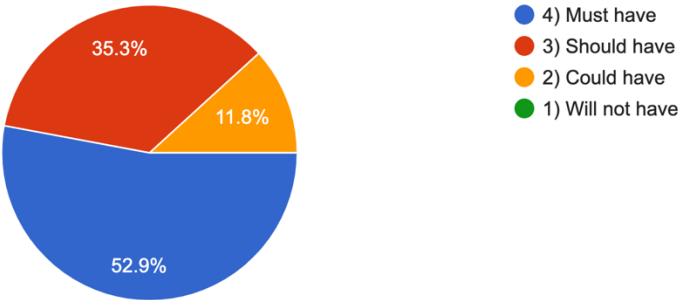- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

58.8%
41.2%

Single document download

17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

23.5%
11.8%
64.7%

Bulk document download

17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

35.3%
23.5%
41.2%
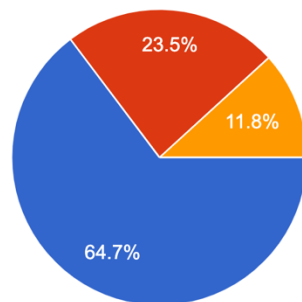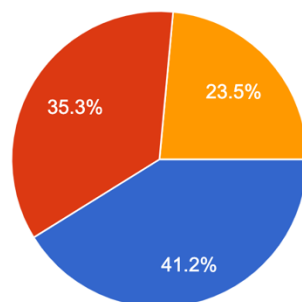
PDF document search function

17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

52.9%
11.8%
35.3%
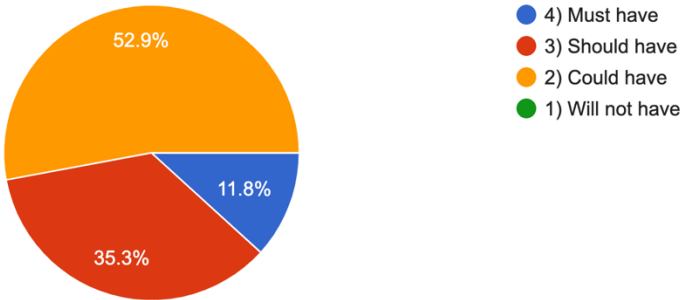
Automatic and real-time updates on the certificate status of suppliers

17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

23.5%
70.6%
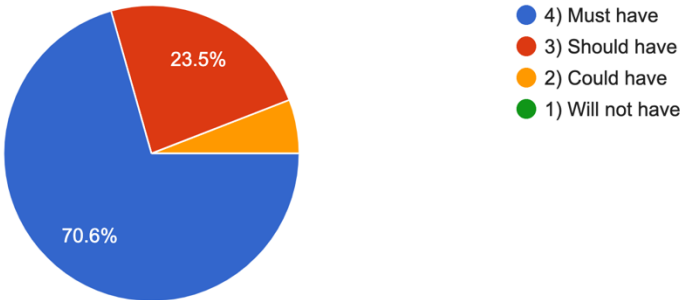
Document filtering

17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

17.6%
11.8%
70.6%
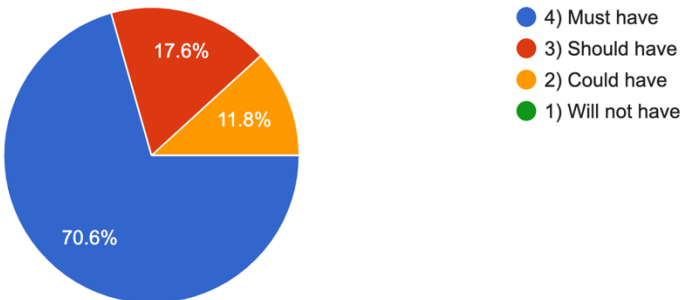
Document review
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

11.8%

88.2%
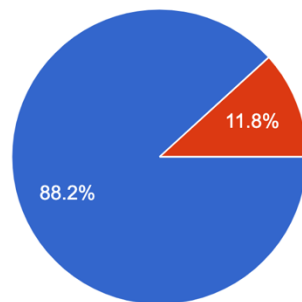
Document saving
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

11.8%

88.2%
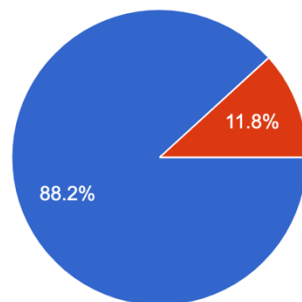
Supplier evaluation and rating
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 4) Will not have

58.8%

35.3%
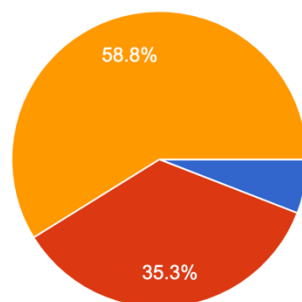
Supplier response timing analytics

17 responses

- ● 4) Must have
- ● 3) Should have
- ● 2) Could have
- ● 1) Will not have

76.5%

17.6%
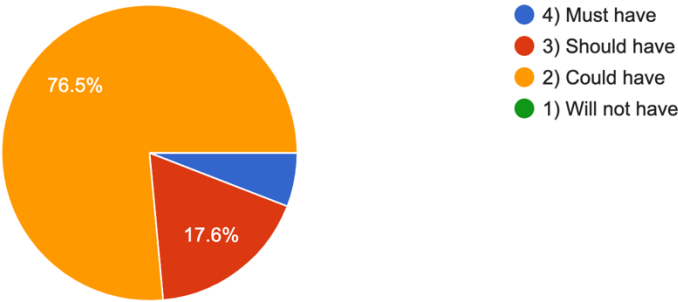
Sustainability reporting

17 responses

- ● 4) Must have
- ● 3) Should have
- ● 2) Could have
- ● 1) Will not have

23.5%

52.9%

23.5%
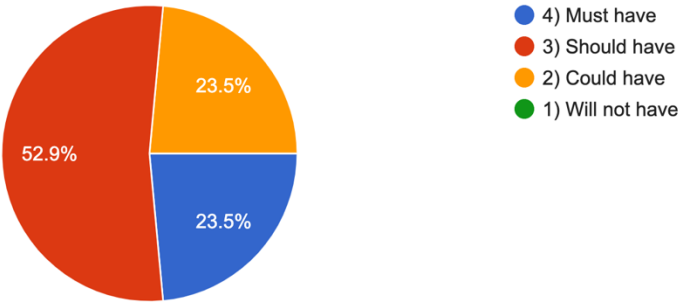
Due diligence reporting on sustainability and social risks

17 responses

- ● 4) Must have
- ● 3) Should have
- ● 2) Could have
- ● 1) Will not have

23.5%

41.2%

35.3%
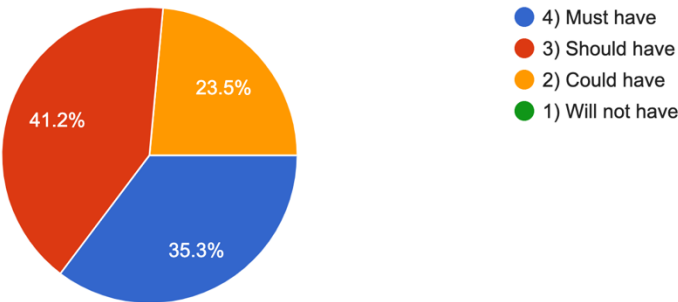
Automatic document collection
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

94.1%
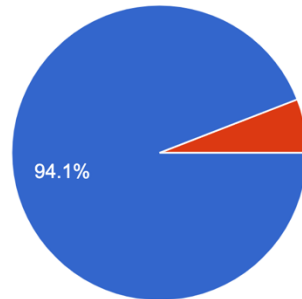
Automatic document reviewing
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

47.1%

41.2%

11.8%

Request documents based on frequency
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

23.5%

47.1%

29.4%

Creation bulk request rules

17 responses

- ● 4) Must have
- ● 3) Should have
- ● 2) Could have
- ● 1) Will not have

23.5%

70.6%

Open requests

17 responses

- ● 4) Must have
- ● 3) Should have
- ● 2) Could have
- ● 1) Will not have

41.2%

11.8%

47.1%
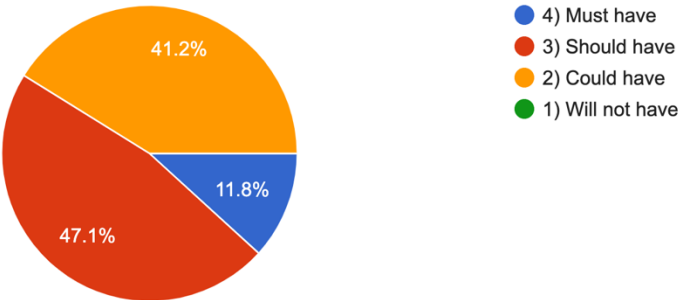
Automatic season based supplier archival

17 responses

- ● 4) Must have
- ● 3) Should have
- ● 2) Could have
- ● 1) Will not have

41.2%

17.6%

41.2%
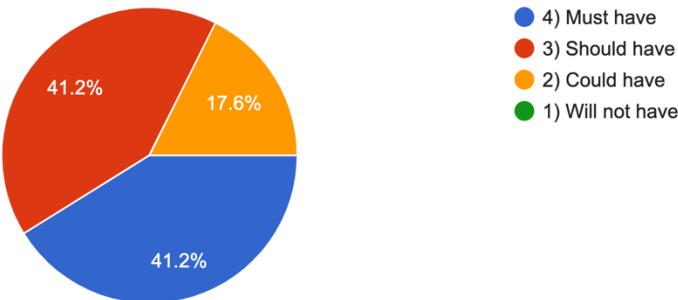
Bulk update sub-supplier status
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

41.2%

52.9%
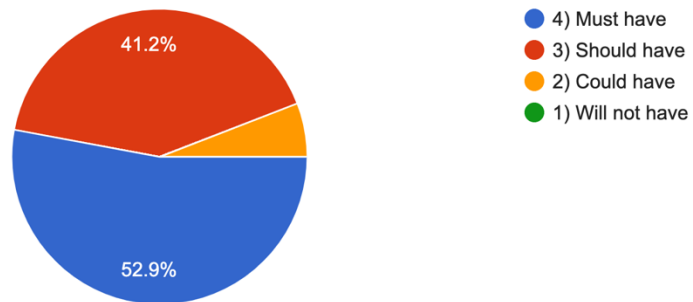
Supplier management

Complete record of supply chain
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

17.6%

76.5%
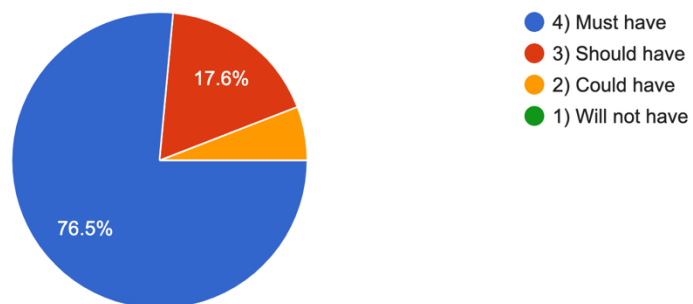
Filter suppliers
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

11.8%

88.2%
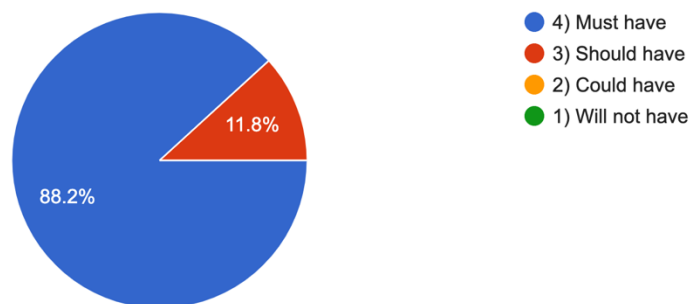
Search suppliers

17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

94.1%
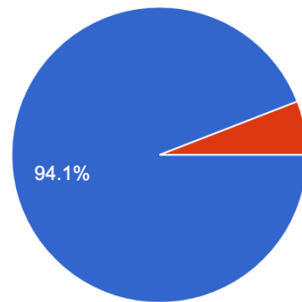
Retrieve supplier information

17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

29.4%

70.6%
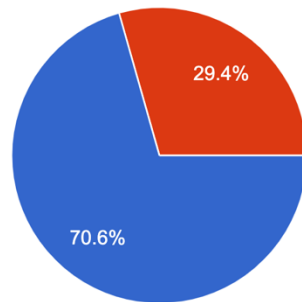
Network graph

17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

64.7%

29.4%
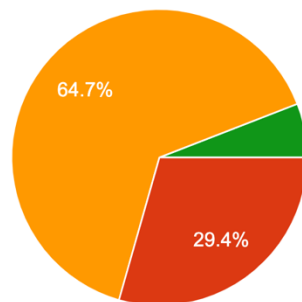
Delete suppliers

17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

35.3%
11.8%
52.9%

Request sub-supplier intake

17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

29.4%
64.7%
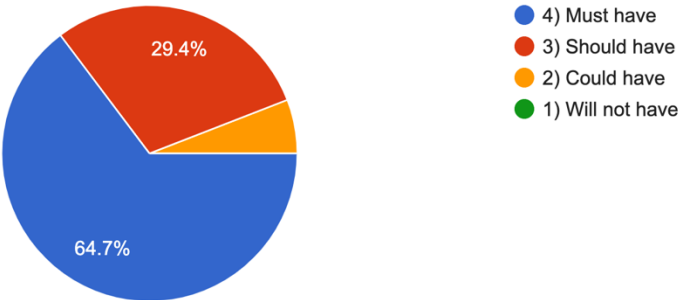
Supplier categorization

17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

52.9%
11.8%
35.3%
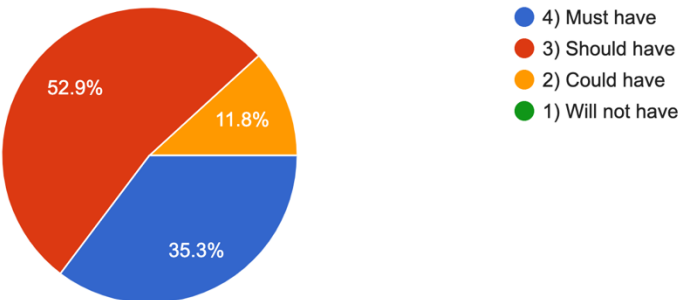
Generate approved supplier list overview

17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

58.8%
11.8%
29.4%
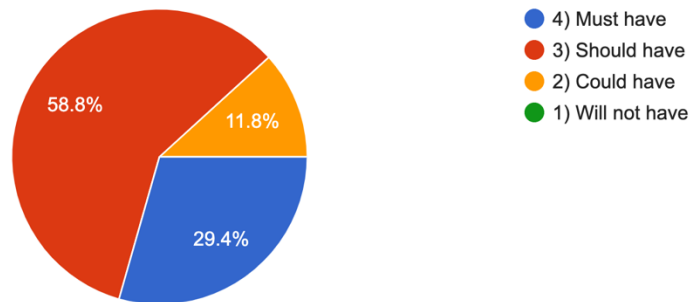
Communication

Chat messenger within the platform

17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

41.2%
11.8%
41.2%
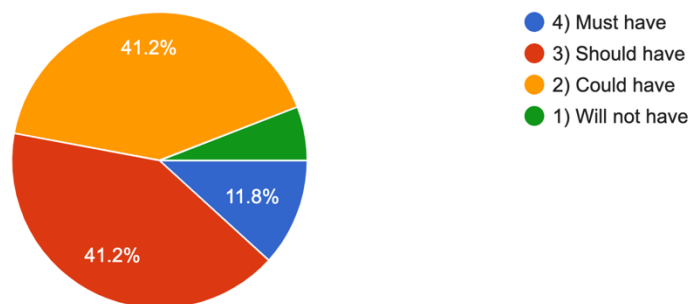
Single-channel for all due diligence communication

17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

76.5%
17.6%
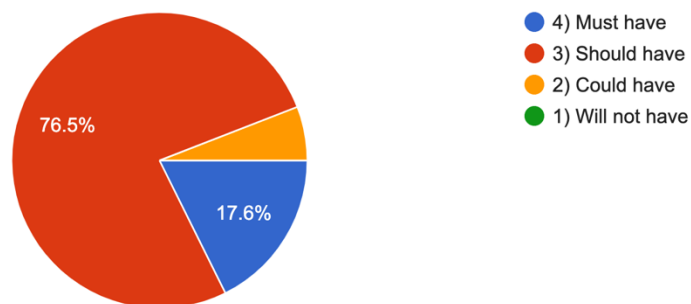
Synchronize data

Centrally manage organizational divisions
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

23.5%
47.1%
29.4%
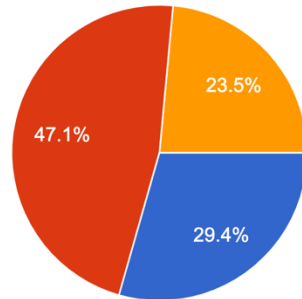
Integration with internal systems
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

23.5%
17.6%
58.8%
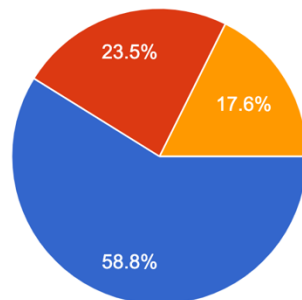
Notifications and reminders

Non-delivery notification
17 responses
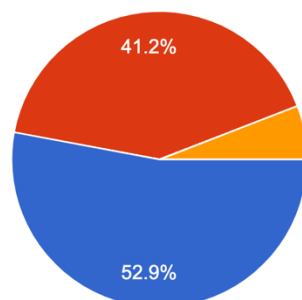
- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

41.2%
52.9%

Default email notifications and reminders
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

29.4%

11.8%

58.8%
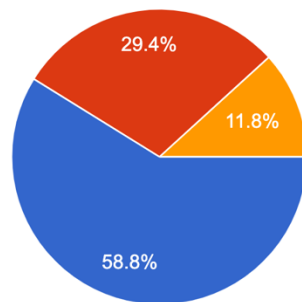
Notify about blacklisted pesticide use
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

35.3%

29.4%

35.3%
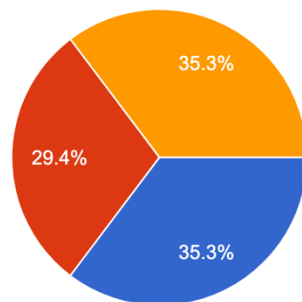
Document import

Single and bulk document imports
17 responses
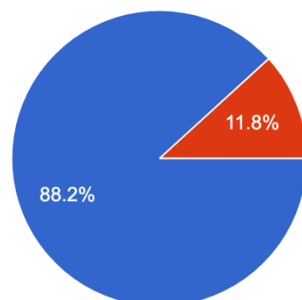
- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

11.8%

88.2%

Document and data security
17 responses
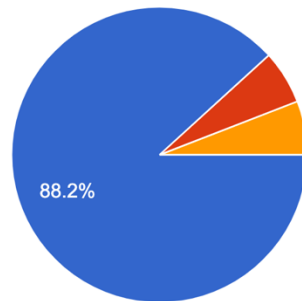
- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

88.2%

Default role-based access control
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

29.4%

70.6%

Customizable role-based access control
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

41.2%   17.6%

41.2%

59
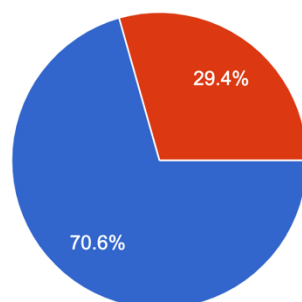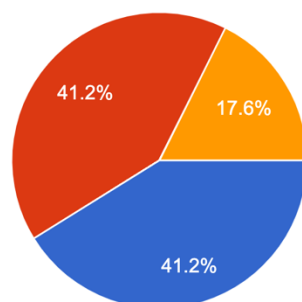
Create quality rules templates

17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

52.9%
41.2%
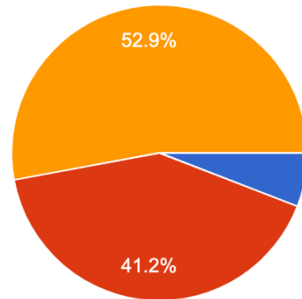
Standard message templates

17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

23.5%
58.8%
17.6%
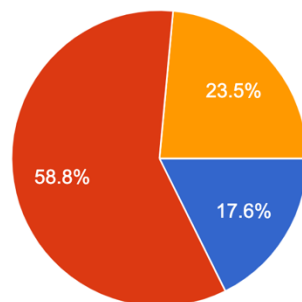
Auditing

Preparation for auditing

17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

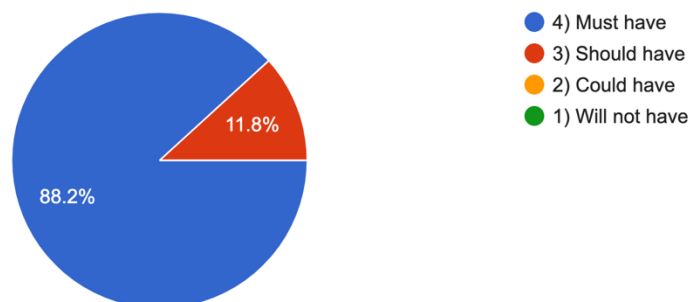29.4%
17.6%
47.1%
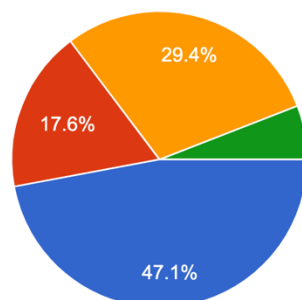
From certificate to audit report
17 responses

- 🔵 4) Must have
- 🔴 3) Should have
- 🟠 2) Could have
- 🟢 1) Will not have

29.4%
52.9%
17.6%
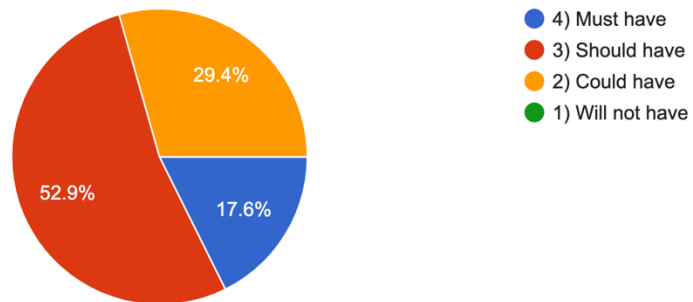
Document archival
17 responses

- 🔵 4) Must have
- 🔴 3) Should have
- 🟠 2) Could have
- 🟢 1) Will not have

64.7%
35.3%
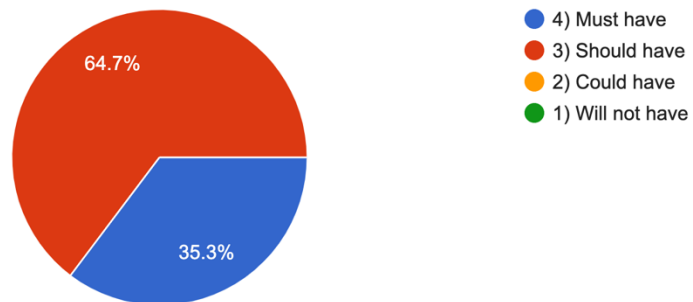
Information sharing

Document sharing
17 responses

- 🔵 4) Must have
- 🔴 3) Should have
- 🟠 2) Could have
- 🟢 1) Will not have

88.2%
11.8%

Automatic information sharing to retailers
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

23.5%
17.6%
35.3%
23.5%
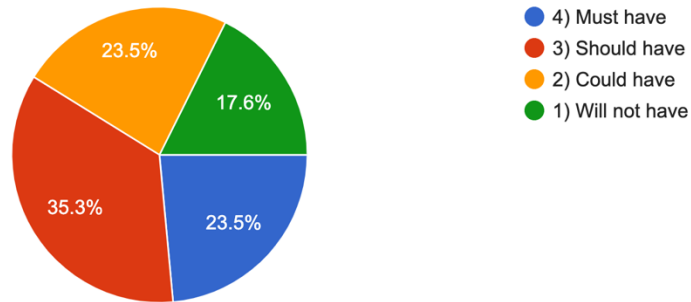
Information sharing among all AgriPlace Chain users
17 responses
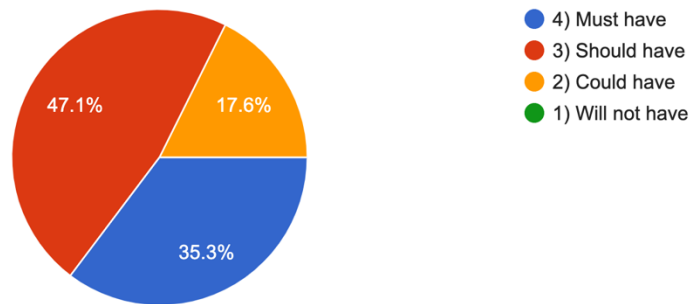
- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

47.1%
17.6%
35.3%

Customization

Personalized outgoing document requests
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

29.4%
52.9%
17.6%
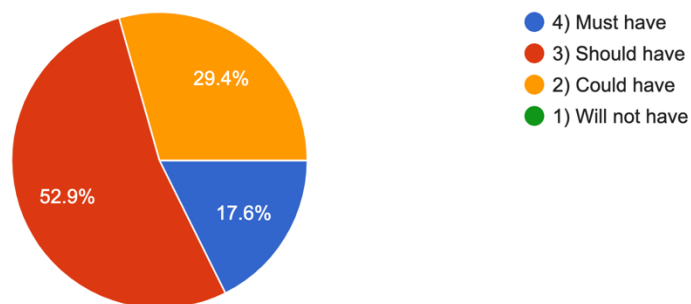
Customizable default user settings

17 responses
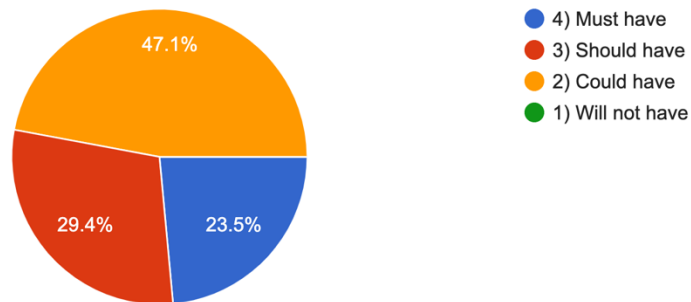
- 🔵 4) Must have
- 🔴 3) Should have
- 🟠 2) Could have
- 🟢 1) Will not have

47.1%

29.4%   23.5%

Customizable messages send with automatic document requests

17 responses

- 🔵 4) Must have
- 🔴 3) Should have
- 🟠 2) Could have
- 🟢 1) Will not have

29.4%

47.1%

23.5%

Customizable notifications and reminders

17 responses

- 🔵 4) Must have
- 🔴 3) Should have
- 🟠 2) Could have
- 🟢 1) Will not have

52.9%

23.5%

17.6%
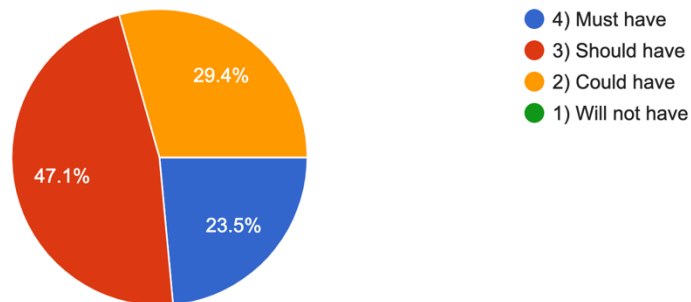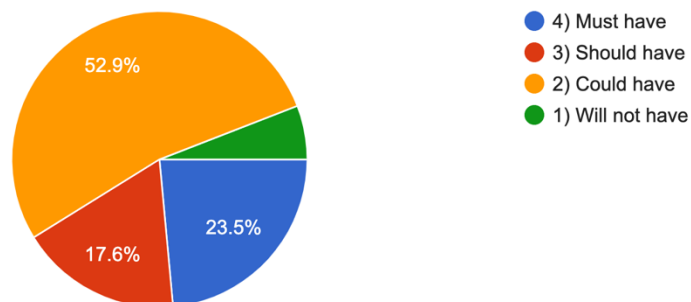
User company logo email display
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

29.4% 23.5% 47.1%
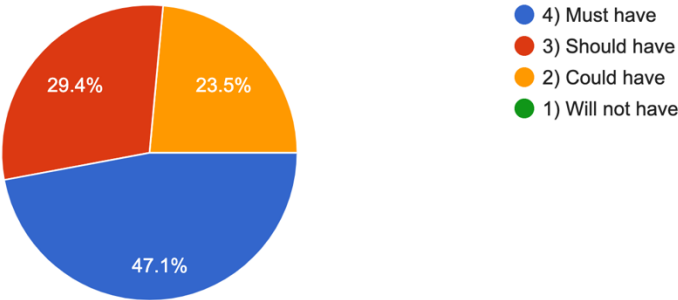
Draft document request set-up
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

29.4% 64.7%
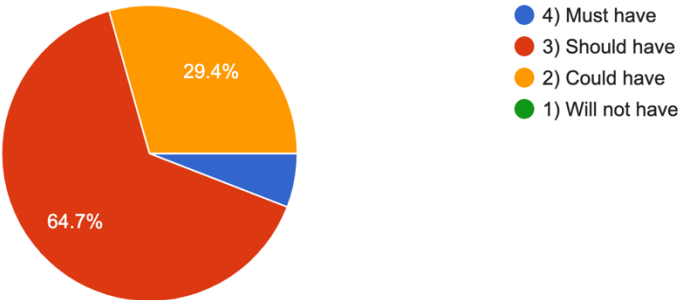
Customizable compliance overview
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

23.5% 17.6% 58.8%
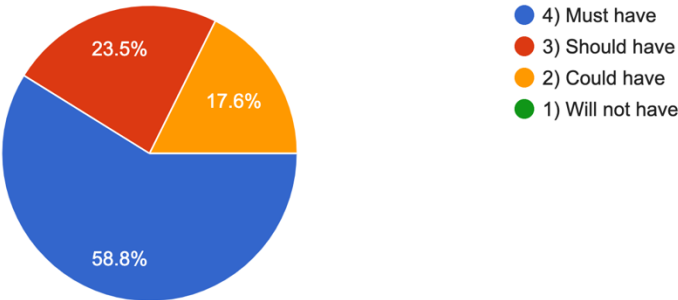
Quality control

Include quality control parameters
17 responses

- 🔵 4) Must have
- 🔴 3) Should have
- 🟠 2) Could have
- 🟢 1) Will not have

64.7% 11.8% 11.8% 11.8%
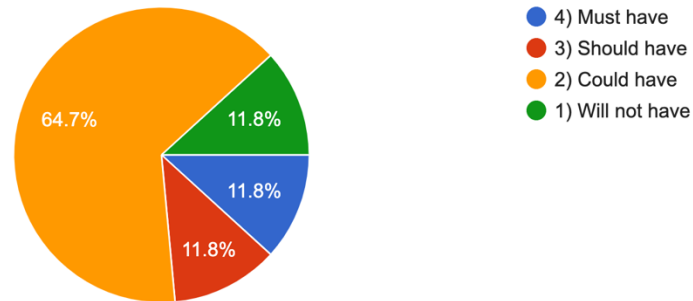
Product management

Request information per product
17 responses

- 🔵 4) Must have
- 🔴 3) Should have
- 🟠 2) Could have
- 🟢 1) Will not have

35.3% 58.8%
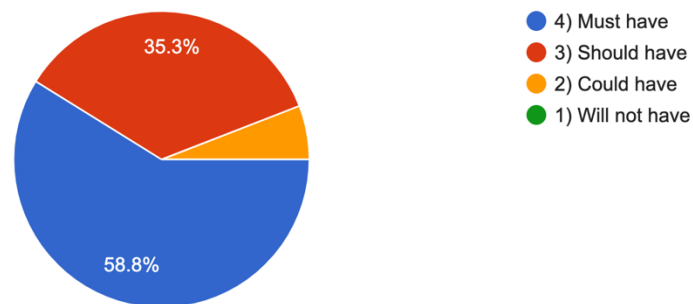
Smart analytics on producer product customer fit
17 responses

- 🔵 4) Must have
- 🔴 3) Should have
- 🟠 2) Could have
- 🟢 1) Will not have

29.4% 29.4% 41.2%
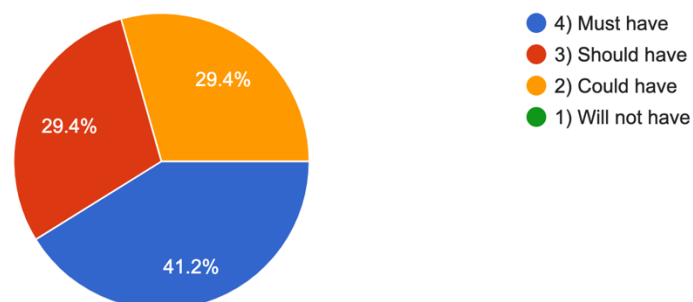
Mobile application

Mobile application
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

58.8%
11.8%
29.4%
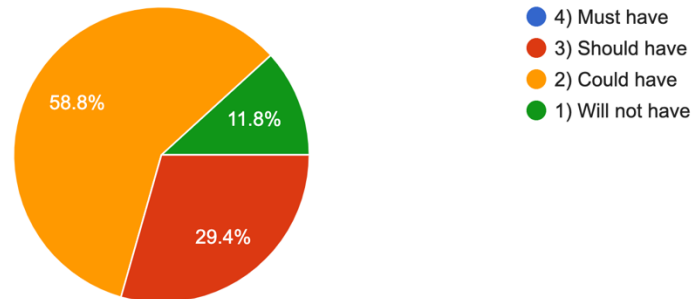
Lab analyses

Automatic retrieval of laboratory analyses
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

35.3%
17.6%
47.1%
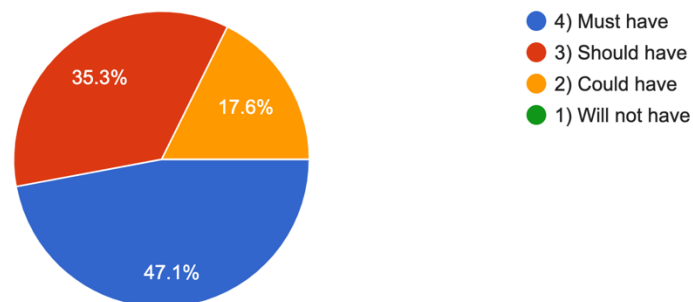
Retailer requirement modification in lab analyses module
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

58.8%
11.8%
29.4%
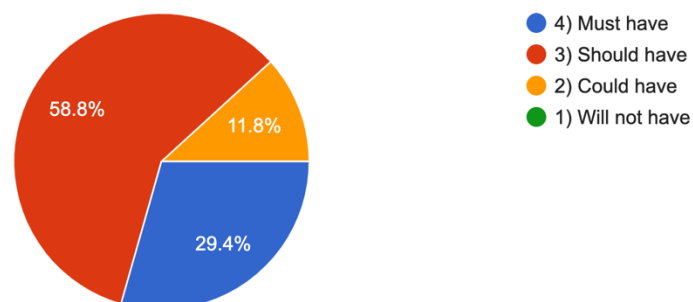
Online fillable and signable dataforms

Online fillable and signable forms
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

29.4%
41.2%
29.4%
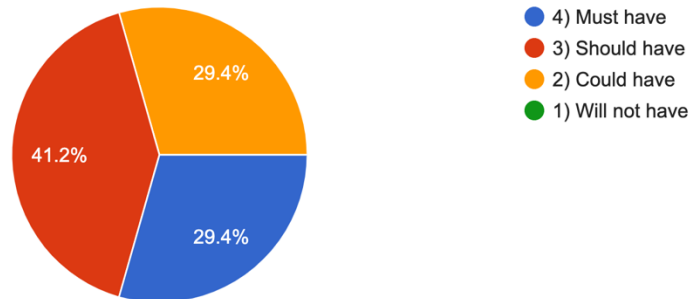
Contract management

Contract management tool (e.g., finance department)
17 responses

- 4) Must have
- 3) Should have
- 2) Could have
- 1) Will not have

58.8%
11.8%
23.5%