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Article

Lean and Agile Supply Strategies in Distribution Centres to Deliver Value-Added Services (VAS)

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Abstract: *Background:* This paper examines how logistics managers increase performance by incorporating VAS in their distribution centres in the context of different natures of customer demand. The study is underpinned by the principles of lean and agile strategies as two key concepts that can be applied to respond to different customer expectations. *Methods:* Based on the phenomenological interpretivist paradigm, an empirical multiple-case study was conducted in German distribution centres operated by six companies. The empirical data were collected through semi-structured interviews, built on the triangulation of sources. Open, axial, and selective coding were employed to analyse data collected through eighteen in-depth interviews with managers from the distribution centres. *Results:* The findings indicated that the construct of customer demand forms different benefits that the logistics service providers can achieve through VAS. Simultaneously, various customer demands on VAS requires the distribution centres to focus on developing different operational capabilities to gain superior performance. *Conclusions:* Based on the research findings, a conceptual model was created. This model can support logistics service providers in improving company performance through effectively managing VAS in their distribution centres. The high dynamic VAS customer demand can bring more financial and non-financial benefits but needs higher flexibility in the warehouse operation system. Stable and predictable VAS, in turn, require a higher degree of standardisation.



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Keywords: value added services; distribution centres; logistics service providers; lean and agile supply strategies

1. Introduction

Well-organised logistics operations are one of the main criteria of superior company performance [1]. Thus, the performance of logistics service providers is crucial for the entire supply chain. In this context, the central element of achieving high performance is the distribution centre, whose function is to “. . . accumulate and consolidate products from various points of manufacture within a single firm, or from several firms, for combined shipment to common customers. . .” [2] (p. 3).

“Inbound”, “storage”, and “outbound” operations can be considered the main activities which underpin the flow of goods within distribution centre facilities [3]. However, apart from these traditional warehouse operations, different customer-specific services can also be performed in distribution centres. These services are often referred to as value-added services [4–6], with other terms such as value-added processing [7] or value-added logistics [3].

Provision of different VAS leads to an increase in customer satisfaction, demarcation from competitors, and higher returns [8–10]. Moreover, a higher capability of logistics service providers to manage different VAS can positively contribute to their performance [11,12] as well as to the performance of their customers [13,14]. Hence, it is no surprise that the availability of VAS in the portfolio of LSP is one of the major factors

when choosing a logistics service partner [15]. Over the past decades, numerous surveys and studies have confirmed that incorporating different VAS in distribution centres is an increasing trend [9,16–19].

A high diversity of customer requirements; however, can lead to a higher degree of complexity in warehouse processes [20–23]. This complexity implies difficulty in forecasting needed resources or avoiding the interruptions of the material flow within distribution centres. Thus, such complexities challenge maintaining high efficiency in operational processes. To achieve a high level of performance with dynamic customer demands, the warehouse management structure needs to be adapted to the context of customer demand [24]. Furthermore, distribution centres need to develop those supply attributes which can make it possible to respond to customer demand adequately [25]. It can be suggested that VASs lead to an increase in the heterogeneity of customer demands in distribution centres, as these services are characterised by a high degree of customisation [8]. The VAS customer demand needs to be deeply understood by the logistics service providers [26]. Therefore, to ensure a sufficient level of company performance by offering different VASs, it is important that customer demand is responded to by logistics service providers in the most appropriate way.

Lean and agile concepts are two commonly adopted strategies that managers should refer to, depending on the context of action [27]. Leanness implies “developing a value stream to eliminate all waste, including time, and to ensure a level schedule. . .” [28] (p. 108), whereas agility can be described as “. . .the ability to efficiently change operating states in response to uncertain and changing demands placed upon it” [29] (p. 443). Based on the framework of lean and agile paradigms, the research aim is to understand how logistics managers align their strategy to increase performance with the different natures of VAS customer demand in distribution centres.

2. Literature Review

2.1. Definitions of VAS

Value-added services (VAS) are customer-specific services; therefore, it is difficult to provide a universal definition of the term. According to Berglund [30], for example, VAS in the logistics context can be understood as. . . “services that add extra features, form, or function to the basic service” (p. 83). Bowersox and Closs [31] suggested that the term VAS can be demarcated into five performance areas: customer-focused (e.g., customised labelling or packaging, such as packing the products into special bins according to the OEM standards, to supply customers of the automotive industry), promotion-focused (e.g., making point-of-sales displays), manufacturing-focused (e.g., postponement assembly), time-focused (e.g., just-in-time), and basis service (e.g., reverse logistics or quality control). The logistics service providers; however, can also develop different types of VASs that go beyond these five categories. According to Soinio, Tanskanen, and Finne [32], for example, services such as “3PL with planning”, “consulting”, and “outsourced chief logistics officers” can also be offered by logistics service providers. Herrera and Yang [10] suggested that in the case of “non-material” VAS, logistics service providers can extend their service portfolio with VAS such as IT assistance, e-commerce, purchasing, consulting, or financial support. Shi et al. [33] and Shi, Arthanari, and Wood [34], in turn, highlighted third-party purchasing (TPP) as a potential type of VAS.

These VAS definitions concern the field of logistics in general and, therefore, are more appropriate when considering this term at the level of a logistics service provider. A more distribution centre dedicated demarcation of VAS was proposed by Furmans and Deml [9] (p. 20):

“. . . Value-Added-Services in distribution centres are all additional services that go beyond classic warehouse activities such as product receiving, storage, order picking, packaging and shipping.” (Translated from German by authors).

This definition refers to the material-related VASs (e.g., customised packaging, kitting, labelling, small assembly). A frequent reason for developing such services on the site of

logistics service providers is the requirement that production companies strive to place different VAS at the last possible stage of the supply chain, which is often located in the distribution centre. This approach refers to the so-called postponement strategy, which implies a delay in the final processing or manufacturing activities to the latest possible decoupling point in the supply chain in order to respond to customer demands in the most appropriate way [35]. This strategy can provide both cost reduction by lower inventories [36] and higher efficiency by increased flexibility [37].

According to Furmans and Deml [9], apart from material-related services, VAS in distribution centres can also be associated with information-related activities. In this respect, Furmans and Deml [9] mentioned the invoicing and organisation of transport as possible VASs that can be performed in distribution centres.

2.2. *Lean and Agile in Warehouse Logistics*

Previous studies in the field of warehouse logistics indicated that customer demand in distribution centres can be quite heterogeneous, making it necessary to develop different supply attributes depending on each specific business case. Anderson et al. [38], for example, showed that for some clients of LSPs, price is the vital component, while other companies attached more importance to the delivery performance. Mokadem [39] concluded that if manufacturing companies pursue a lean strategy, they will select suppliers who can help to improve efficiency, while the companies that are focused on an agile strategy will give preference to suppliers who can contribute to their responsiveness.

Examining the literature concerning lean and agile paradigms in the context of warehouse logistics, it becomes clear that the lean paradigm remains a dominant researched concept. Many contemporary studies continue to indicate the opportunity for performance increase by applying different lean methods in the warehouse logistics environment [40–42]. Moreover, the positive effects of a lean approach for warehouse logistics were recently investigated by Abushaikha, Salhieh, and Towers [43], who identified the causal relationship between waste reduction based on the lean strategy and warehouse operational performance.

On the other hand, the concept of agility seems to also be important in the warehouse logistics field. The adoption of agile supply attributes across the supply chain leads to a situation where the distribution centres need to be able to adequately support such strategies. For example, the responsive supply chain strategy may require an increase in warehouse stock in order to respond to the customer demand, which would mean that distribution centres must be able to provide a higher storage capacity [44]. In turn, the result of a study by Jernsittiparsert, Sutduean, and Sriyakul [45] shows that the warehouse attributes in terms of responsiveness can play a significant role in the performance of warehouses. A statistical analysis indicated that the ability to quickly respond to customer orders can contribute to warehouse supply chain efficiency. In this respect, Baker [46] provided a framework that can support distribution centre capability in aligning themselves to perform in an agile environment.

Several studies indicated the importance of aligning warehouse strategies with the customer demand [21,24,25,47]. However, when considering studies dealing with the strategic aspects of distribution centres, it becomes clear that they are mainly focused on the traditional warehouse operations such as storage, pick, pack, and ship activities [48–51]. The few studies on VASs which explore the performance of VASs from the perspectives of logistics service providers are presented below.

2.3. *VAS Research*

Soinio, Tannskanen, and Finne [32]; Lv and Chen [52]; and Shi, Arthanari, and Wood [34] are concerned with more strategic perspectives of developing peculiar types of VAS which go beyond the border of the physical supplementary activities. Protic et al. [53], Andersson and Roso [54], and Menegaki and Alexopoulos [55] investigate VAS opportunities in specific industrial contexts beyond the frame of warehouse logistics. Tang, Qian,

and Wang [56] deal with the understanding of the role of VAS in a specific geographical context (Yunnan Province in China).

Some studies are quantitative in nature and strive to identify causal relationships between different factors in the context of VAS. For example, Chen and Notteboom [57–59] deal with the effects of the VAS characteristics on the decision regarding the location of VAS. Rivera, Sheffi, and Knoppen [6] showed that within the context of logistics clusters, agglomeration in logistics parks and training can positively impact the provision of VAS. Okorie, Tipi, and Hubbard [14] provided evidence for the increase in port attractiveness by a higher range of offered VASs. Russo and Gronalt [60] find out that offering VASs can positively impact the performance of intermodal inland terminals.

By contrast, the studies by Atkacuna and Furlan [5], Furmans and Deml [9], Herrera and Yang [10], and Jum’a and Basheer [61] are more explorative in nature and based on the data gathered through surveys and interviews of managers of logistics service providers (and their customers). These studies are concerned with the performance of VAS in distribution centres from the perspectives of logistics service providers and thus provide a valuable basis for this particular study. A summary of previous studies on VASs in logistics is shown in Table 1 below.

Table 1. Previous Studies on VAS in Logistics.

Authors	Year	Name of Publication	Aim of the Study	Methodology
Atkacuna and Furlan [5]	2009	Value-Added Services in Third Party Logistics: A study from the TPLs providers’ perspectives about value-added services, driving forces and barriers.	To investigate how TPLs create value-added services and to understand the driving forces and barriers of this procedure.	Qualitative multiple case studies. The empirical data gathered from three TPLs: Bring Logistics Solutions, Aditro Logistics and Schenker Logistics.
Soinio, Tannskanen, and Finne [32]	2012	How logistics-service providers can develop value-added services for SMEs: A dyadic perspective.	To create a theory-based and initially tested model which helps to identify the opportunities of further development of advantageous VAS.	The semi-structured interviews within a case company (a large Finnish logistics service provider), its customers, and experts from the area of logistics services.
Chen and Notteboom [58]	2012	Determinants for assigning value-added logistics services to logistics centers within a supply chain configuration.	To develop a framework that helps to identify the most appropriate location (DC) for the VALS based on different factors including product characteristics.	Analytical approach of understanding different business concepts and their connections and additionally the investigation of case studies.
Chen and Notteboom [57]	2012	Distribution and value added logistics in the cold chain product market with application to the role of seaports.	To understand the development and specific of the cold chain product market and to identify how its specificities influence the location decisions regarding VALS.	Case studies on bananas, pineapples and kiwifruits cold chain.
Furmans and Deml [9]	2013	Systematische Bewertung von Value-Added-Services in Distributionzentren (eng. Systematic Evaluation of VAS in DCs).	To develop a universal approach to assess VAS in distribution centres.	A quantitative survey of 21 distribution centres in Europe and following development of analytical models.

Table 1. Cont.

Authors	Year	Name of Publication	Aim of the Study	Methodology
Lv and Chen [52]	2013	The Extension of Third-Party Logistics Value-Added Services in the Financial Field.	To explore the advantages and disadvantages of two financial services which can be provided by TPLs: Agent Supervision Service and Agent Purchasing Service.	Case studies of two TPLs in China.
Chen and Notteboom [59]	2014	A cost perspective on the location of value-added logistics services in supply chains.	To understand the impact of locations of VAS on the supply chain configurations and logistics costs.	Analytical developed model, which is finally evaluated by the examination of a case study.
Okorie, Tipi, and Hubbard [14]	2016	Analysis of the potential contribution of value-adding services (VAS) to the competitive logistics strategy of ports.	To understand the potential contribution of VAS to port logistics strategy of competitiveness.	A mixed methods' research. The data gathered from a multiple case-study of different ports.
Rivera, Sheffi, and Knoppen [6]	2016	Logistics clusters: The impact of further agglomeration, training and firm size on collaboration and Value Added Services.	To identify the causality between the benefits of logistics clusters (in terms of collaboration and VAS provision) and agglomeration and training opportunities.	Quantitative study, which used structural equation modelling to analyse data from a survey conducted in the Zaragoza (Spain) Logistics Cluster.
Andersson and Roso [54]	2016	Developing dry ports through the use of value-added services.	To understand the role of VAS in developing a conventional inland terminal into a dry port as well as the role of VAS in developing of an existing dry port.	Combination of literature review with empirical data collected via interviews with terminal managers, operators and customers and via gathering secondary data.
Herrera and Yang [10]	2017	Understanding value-added service offering by 3PL providers: VAS as a source of competitive advantage for the provider and the customer.	To understand how a 3PL determines which VAS can be profitable, and which service-development strategies are appropriate in which context.	Survey of 38 3PLs and 48 logistics user companies and additionally semi-structured interviews with seven 3PL companies.
Shi, Arthanari, and Wood [34]	2017	Developing third-party purchase (3PP) services: New Zealand third-party logistics providers' perspectives.	To understand the advantages for third-party logistics providers if developing further VAS in the form of Third-Party Purchasing.	A structural equation modelling test of the data gathered from the 166 3PLs in New Zealand.
Menegaki and Alexopoulos [55]	2017	Evolution of Logistics Centers and Value-Added Services Offered in Port Areas and the Importance of Marketing.	To examine the historical development of logistics centres and VAS in the port industry and to understand the future VAS opportunities and the role of the marketing in this context.	Review of current research on the topic in question.
Tang, Qian, and Wang [56]	2018	Analysis on the Development of Value-added Services of Logistics Enterprises in Yunnan.	To understand the status-quo of VAS performed by logistics service providers in Yunnan Province.	Examination of current research on VAS and analysis of the statistical data of Yunnan Province industry.

Table 1. Cont.

Authors	Year	Name of Publication	Aim of the Study	Methodology
Protic, Fikar, Voegl, and Gronalt [53]	2020	Analysing the impact of value added services at intermodal inland terminals	To identify the drivers of a strong service offered by terminal operators, to recognise new VAS and the impact of new VAS on the performance of terminals.	Workshops and interviews with experts in Belgium and Austria. The results were validated by two cases.
Russo and Gronalt [60]	2021	Value added services at intermodal inland terminals and the importance of choosing a moderate innovation path.	To understand the impact of offering VAS (train OCR gates and a fast lane service for trucks) on a terminal's operational performance.	Quantitative analysis based on the generic system dynamics.
Jum'a and Basheer [61]	2023	Analysis of Warehouse Value-Added Services Using Pareto as a Quality Tool: A Case Study of Third-Party Logistics Service Providers	To analyse VAS data for the 3PLs and to identify opportunity of service and costs improvements	Pareto analysis as a quality tool

2.4. Research Gap

The limitation of previous studies refers to the fact that the nature of customer requirements explored by VAS performance in distribution centres was generalised. Thus, some conclusions derived from previous studies need to be further verified. Firstly, previous studies provide evidence that VAS can provide LSPs with a number of different advantages and also bring a higher degree of complexity into warehouse processes, which can lead to a decrease in efficiency. However, these effects can be different depending on the context and the different nature of customer demands. Secondly, existing research suggests that improving leanness and agility is an appropriate strategy for distribution centres. Yet, in this case, the characteristics of customer demands can require a different strategic focus. Thus, this study strives to gain a new insight into the scientific knowledge on VAS performance by answering the following research questions:

- What benefits can distribution centres gain by incorporating VAS with different customer demands?
- How can distribution centres increase the performance of VAS with different customer demands?

3. Theoretical Modelling

The underlying basis of developing a conceptual framework is a detailed analysis of the knowledge gained by conducting the literature review on the topic in question. Key topics and issues that stem from the literature review represent different theoretical concepts which are transformed into one model. The key variables of the explored topic are VAS performance in distribution centres and supply strategies, which are connected by the concept of customer demand.

The differing nature of customer demand is attributable to different characteristics of the products or services, which are either “functional” or “innovative” [62]. The “functional” or “innovative” products and services have different characteristics of customer demand, which can be determined by criteria such as demand stability, demand predictability, lead time, and value of the customer orders [59,63,64]. These two types of products and services require different strategies, which are typified by the application of different capabilities [65] and different performance measures [66–68].

The conceptual framework was determined based on this theoretical paradigm and serves as an underpinning construct for further development of the data collection procedure shown in Figure 1 below.

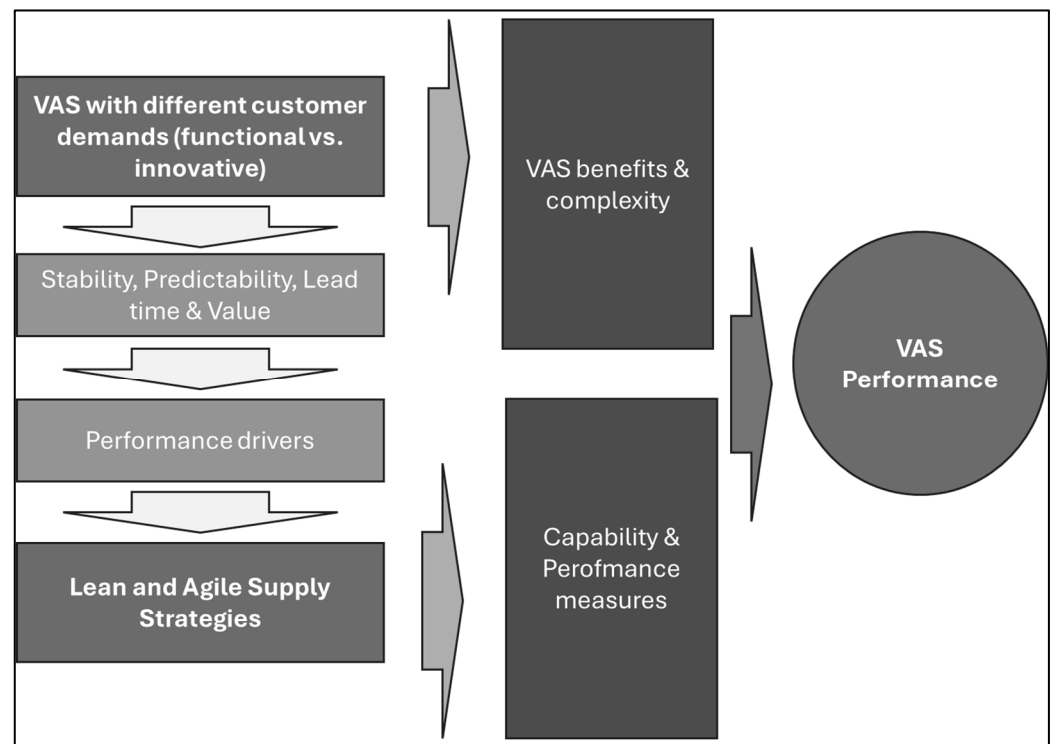


Figure 1. Conceptual Framework.

This leads us to the following three research objectives which are as follows:

1. To understand the different characteristics of VASs in warehouse logistics depending on the nature of customer demands.
2. To identify the supply strategies necessary to respond to VAS customer demand in DC.
3. To investigate how managers of distribution centres align operational strategies to VAS capability performance.

4. Methodology

4.1. Research Paradigm

As there is no prior theory on the supply strategies in the context of VAS performance in distribution centres, the research aim is explorative in nature. This research highlights the necessity to gain knowledge and insight through understanding the perspective of logistics experts on the performance of VASs in distribution centres with different customer demands. In this way, this study is not striving to achieve a generalisable result but is rather attempting to comprehend the underlying construct of VAS performance realities using an inductive-based approach. The perspectives of phenomenological interpretivism served as a basis for the research design of this study as it provided greater-detailed insight into the subject under investigation [69]. These perspectives make it possible to understand the explored issues within their contexts. As a result, a qualitative multiple case study was chosen as the research strategy for the empirical process. In terms of data collection and analysis, the method of semi-structured interviews by a quota sampling technique and a grounded analysis procedure were determined to be the most suitable approaches.

4.2. Research Sampling

This study aimed to obtain the necessary empirical data to acquire an extensive knowledge of the topic of VASs in distribution centres. Therefore, it was crucial that the design of research sampling groups considers different perspectives, adopting a triangulation of sources approach. For this purpose, principles of the triangulation method were applied. Triangulation in research implies the collection of data by multiple methods or use of

multiple data sources in order to gain a greater understanding of phenomena [70]. Hence, the procedure of including different experts in the interview process was not a random approach but was based on predetermined types of research participant groups. Such a strategy made it possible to collect data from different expert groups with heterogeneous attributes. Following this strategy, three groups of experts, namely “distribution centre managers”, “customer managers”, and “operations managers” were determined for the purpose of gathering data.

The distribution centre managers group included those company experts who have overall responsibility for one or more distribution centres in their organisations. In some cases, such managers are logistics unit leaders, in others these managers can be in the role of CEO or even owner of the company. The data collected from these groups of research participants made it possible to gain an understanding of how distribution centre executives perceive the contribution of supply attributes in the performance of VASs in distribution centres and hence, to consider the strategic perspectives of logistics service providers.

The group of research participants defined as customer managers consisted of managers in charge of handling customer demand. Therefore, those managers who interact with customers on daily business-related or project-related levels were selected for this particular group. Including managers with a wide customer expertise in the process of data collection helped this study gain a better understanding of customer perspectives on the topic.

The research participants group, operations managers, in contrast, included managers who are partly or fully responsible for the daily operational process in terms of VASs in distribution centres. This group consisted of different operational supervisors, such as operations managers, warehouse managers, or team leaders. The data gathered from this group of research participants helped this study to understand the operational practises in distribution centres and see how distribution centres align their strategy with customer demands in order to achieve superior VAS performance.

4.3. Semi-Structured Interviews

The creation of interview questions was based on the reflection of the research objectives and the conceptual framework. As a result, each of the developed interview questions was linked to one of three research objectives and the content of the questions addressed the concepts represented in the conceptual framework. In order to justify and refine the questions before gathering the necessary data, pilot interviews with three managers (who were not included in the main process of data collection) were carried out. The aim of the pilot interviews was to understand how appropriate the questions were and which adjustments were necessary before proceeding with the main stage of data collection. Based on this approach, thirteen final interview questions were determined shown in Table 2 below.

Table 2. Interview Questions.

Research Objectives	Interview Question	Comments
RO1	1. How do you define VAS in your DC and what types of VAS does your DC provide?	
	2. What advantages do VAS provide your DC?	
	3. What challenges does the implementation of VAS imply?	

Table 2. Cont.

Research Objectives	Interview Question	Comments
RO2	4. Is the customer demand for VAS in your DC more stable or fluctuating?	
	5. Is the demand on VAS orders more predictable or more unpredictable?	
	6. Does the customer expect a short completion of VAS orders or is the lead time of the customer orders adequately long?	A short or a long lead time determined of interviewees by their subjective perception, whether the customer expect very fast completion of the customer orders, or whether the time to provide VAS is sufficient to complete the order accurately.
	7. Is the value of VAS customer orders in your DC high or low?	The meaning of Value here is the monetary benefits gained by provision of VAS. To determine whether Value is high or low, the interviewees discuss it in the context of benefits from "standard warehouse operations"
RO3	8. Which capabilities does the DC require to successfully implement VAS?	
	9. Do VAS require more standardisation or flexibility in the processes?	
	10. Which performance measures show that the implementation of VAS is successful?	
	11. How important is the cost efficiency and which measurements are you using to track it?	
	12. How do you measure performance of such VAS which are extremely dynamic and require particular customer responsiveness?	
	13. How do you know that the customer is satisfied, and which performance measures indicate customer satisfaction?	

4.4. Data Analysis

For the purpose of data analysis, the attributes of the company experts participating in this study were pre-coded. The managers of the six companies were coded as "C" (for company), followed by the company number. The roles of the managers in their organisation, namely distribution centre manager, customer manager, and operations manager, were accordingly referred to as "DM", "CM", and "OM". Thus, the combination of company codes and manager roles represented the coded attributes of the research participants (Table 3).

Table 3. Attributes of Research Participants.

	Distribution Centre Manager (DM)	Customer Manager (CM)	Operations Manager (OM)
Company 1 (C1)	C1_DM	C1_CM	C1_OM
Company 2 (C2)	C2_DM	C2_CM	C2_OM
Company 3 (C3)	C3_DM	C3_CM	C3_OM
Company 4 (C4)	C4_DM	C4_CM	C4_OM
Company 5 (C5)	C5_DM	C5_CM	C5_OM
Company 6 (C6)	C6_DM	C6_CM	C6_OM

The analysis of data was based on the coded procedure, which included an analysis of the transcribed interviews according to open, axial and selective coding steps [71]. In the first step of analysis, transcripts unloaded in Nvivo were read line-by-line and conceptualised as Open Codes. Additionally, 'Word Cloud' and 'Word Tree' tools were utilised. In the second phase of the data analysis, the open codes were transformed according to an axial coding procedure. This means that some open codes with similar characteristics were created as one code, thus reducing the overall number of codes. These new codes were used to analyse the data in the context of the predefined attributes represented. In the last phase of the data analysis, selective coding, the main concept of the analysed data was identified, and the other codes were logically connected to this concept.

4.5. Data Saturation

The selection of companies in this study was conducted via a random approach, whereby two selection criteria needed to be fulfilled. Firstly, the company operated its own distribution centres, and secondly, different types of VASs were performed in these centres. To maintain confidentiality as part of the ethical principles underlying this research, the actual names of the companies were coded (Company 1, Company 2, etc.).

The number of companies included in the data collection was determined by data saturation. Generally, data saturation refers to the idea that the data collection process can cease when the last analysed data do not provide new information [72]. Thus, on identifying that the empirical data would not lead to new codes, the collection of data in this study was completed, as shown in Figure 2 below. The main indicator of data saturation was the lack of new codes identified during an evaluation of the codes created using the axial coding procedure. Indeed, there were a few new open codes that could be derived from previous transcripts. However, when it came to the level of axial coding, no new codes were identified after the data of Company 3 had been examined. Fundamentally, this means that the data from Company 4, Company 5, and Company 6 provided no new concepts in the context of axial coding. Therefore, the data collection was terminated, and the case size of this empirical study was restricted to these six companies.

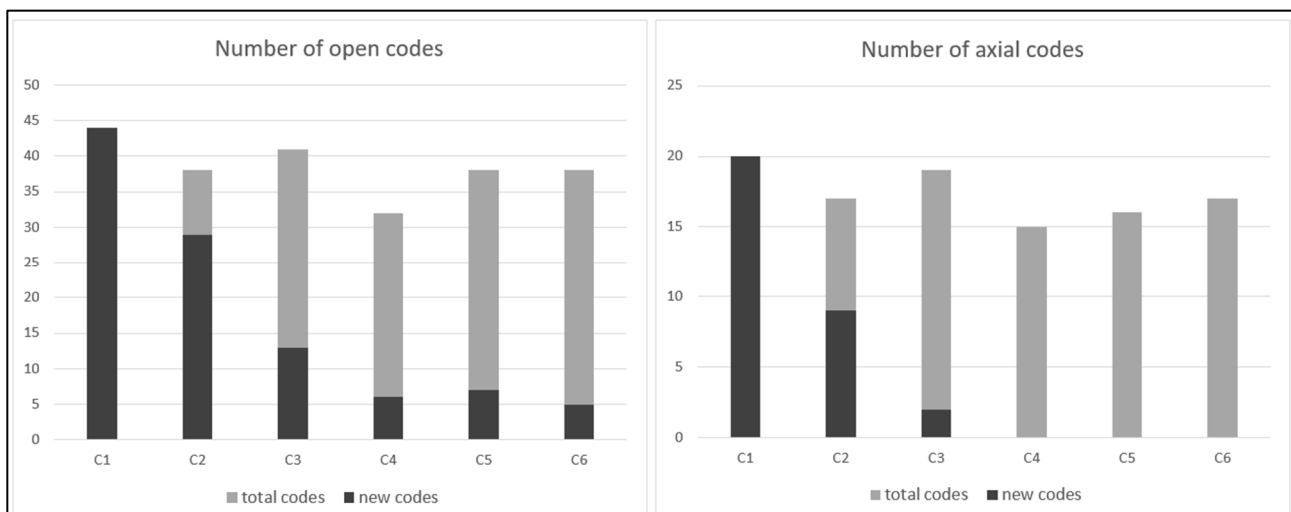


Figure 2. Data Saturation.

4.6. Companies

Company 1 is a US manufacturing corporation specialising in motion and control technology. At the time of data collection, around 60,000 people were working for this company worldwide. The company runs its own distribution centres, where the finished products are stored and shipped to the distributor or to the end customers. The distribution centre which took part in this particular study is a central distribution centre of

EMEA logistics chain of Company 1 (EMEA: Europe, the Middle East, and Africa.) This distribution centre mainly focuses on storage activities, although different supplementary logistical services are also performed in this distribution centre. The portfolio of VASs in this distribution centre can be divided into two groups: different “postponement” activities which are triggered by the production sites of Company 1, who outsourced their storage operations, and VASs which are driven by the OEM business requirements. Activities such as “kitting”, “relabelling”, and “repacking” are the most frequently performed VASs in this distribution centre. While Company 1 is a production enterprise, the other five companies involved in this study are third-party logistics (TPLs).

Company 2 is a relatively small TPL with about 230 employees that concentrates on offering different logistics solutions. The distribution centre in this study is one of three distribution centres this company is operating in Germany. The distribution centre of Company 2 participating in this study is driven by various customised services. Thus, the main driver of the company turnover is not simple warehousing but VASs. Apart from relabelling and repackaging, different rework activities such as inlaying country-specific power cords or warranty cards are among the VASs offered in this distribution centre.

Company 3 is a big, international service enterprise. This company owns 85 locations in 20 countries with more than 70,000 associates worldwide. Apart from CRM, IT, and finance fields, logistics are considered an important segment of Company 3. When it comes to logistical solutions, the company is active in different industries like fashion, tech, healthcare, telecommunication, and automotive. The distribution centre participating in this study is the largest logistics location where the products of all these industries are represented. The VASs in form of “postponement” activities are performed in the distribution centres of Company 3.

Company 4 is a family enterprise and resembles mid-size TPLs, with around 4,500 workers in 42 locations throughout Germany, Europe, the United States, and the Arabian Peninsula. Both transport logistics and warehouse logistics are included in the portfolio of the company’s services, which are offered in different business segments. The distribution centre, which was the primary focus of this particular study, concentrates on the storing and distribution of products from the field of trade logistics. Apart from the simple labelling and packaging VAS, the range of VASs offered in this distribution centre includes quality control, which occurs in the inbound as well as in the outbound areas.

Company 5 is a TPL which owns 10 logistics sites in Germany with a large logistics surface and its own fleet. This company it has its biggest focus on the e-commerce fulfilment business and can be seen as a fast-growing company. The range of VASs offered in the distribution centre used for the data obtainment process is quite wide. Primarily, the activities run in this distribution centre in terms of VASs include services such as the pre-assembly, refinement, and neutralisation of the products which are stored in this warehouse.

Company 6 is a TPL which is known in Germany as an expert in transport logistics. The difference between Company 6 and the other five companies in question is that this company has long-term experience in transport logistics but can be seen as a relatively new player in terms of warehousing. Today, the company strives to develop different logistics services for their customers. The distribution centre included in this study represents a location where outsourced warehouse activities from a customer are carried out by Company 6. As this type of logistics service is quite novel for Company 6, there is no fixed portfolio of VASs provided by this distribution centre. Indeed, the development of VASs can be seen as an ongoing learning process in this distribution centre. The main part of such VASs includes basic supplementary activities, such as customised labelling and packaging.

5. Results of Data Analysis

The process of gathering data from these six companies involved conducting eighteen interviews with the managers of the distribution centres. Some interviews were undertaken at the company whilst others were carried out using Microsoft Teams software because of

access restrictions caused by the COVID-19 pandemic. All interviews were documented via an audio recorder and then transcribed. The analysis of the transcripts was underpinned by the open, axial, and selective coding procedures.

As a result of open coding, 104 codes were developed with the assistance of Nvivo software. Grouping these codes according to their similarity led to the transformation of the codes to axial codes (See Appendix A). The final analysis of these codes in the context of research participant attributes (company and function of managers) showed that these codes could be grouped according to the “general”, “company-related”, “role-related”, and “individual” perspectives.

The axial codes and their grouping were used for the selective coding process. In this context, the nature of customer demand, which (according to company-related codes) varies between different distribution centres, was determined as the central concept of the coded data. In particular, the nature of customer demand in the distribution centres of Company 1 and Company 4 is connected with the “lean business environment”. This means that the VASs in their distribution centres are associated with rather stable and predictable demand. In contrast, the nature of customer demands in the distribution centres of Company 2, Company 5, and Company 6 was associated with the “agile business environment”, as the customer demand for VASs tends to be unstable and unpredictable. In turn, the nature of customer demand for VASs in the distribution centres of Company 3 depends on the particular business case.

Based on the concept of lean and agile environments, all other codes regarding the category of “company-related perspectives” were integrated into the scheme of selective coding. Additionally, the codes concerning “general perspectives” and “role-related perspectives” were also placed into this scheme. Moreover, the codes were structured according to the research objectives. Following this approach, a final scheme of the selective coding procedure was developed, as shown in Figure 3 below. The final scheme highlighted the research findings, which provide novel contributions to the knowledge about VASs in distribution centres.

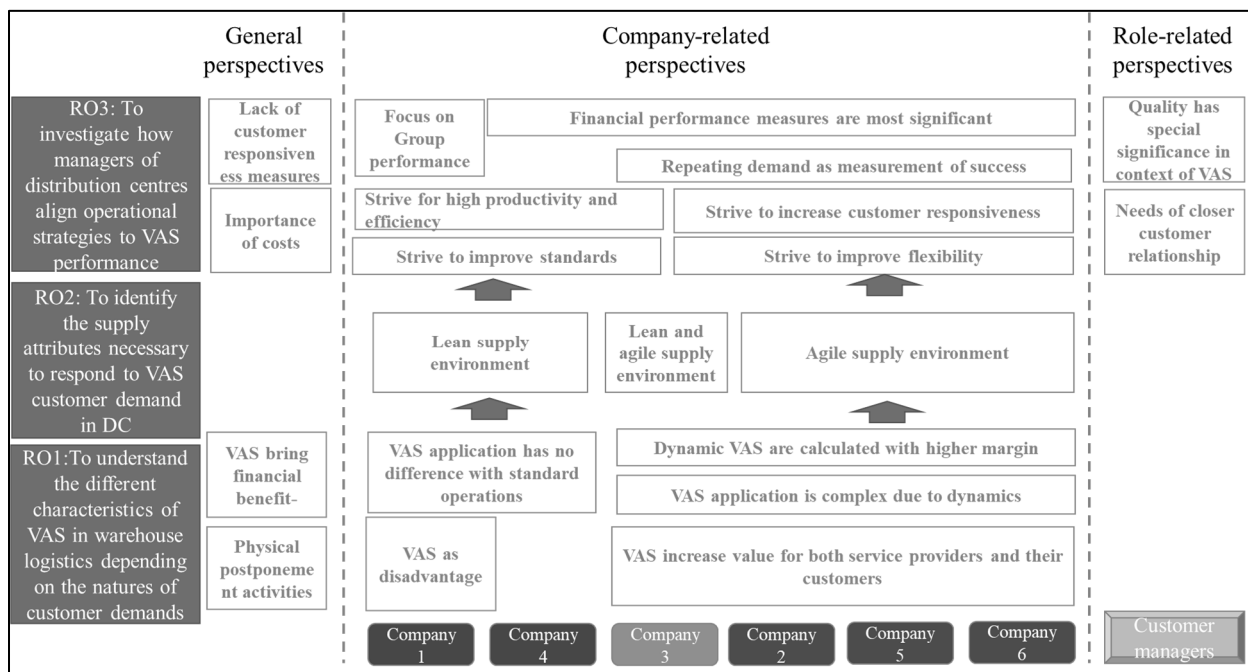


Figure 3. Results of Data Analysis—Final Scheme.

6. Findings

6.1. Research Objective 1

The nature of customer demand has a general impact on the expectations of advantages linked to VAS incorporation. While the financial advantages were generally perceived as the most crucial aspect of VAS application, the role of non-financial benefits, according to the research findings of this study had a more contextual nature. The research findings indicated the alignment between the construct of customer demand and the opportunity to gain marketing advantages such as “unique selling point”, “customer loyalty”, or “competitive advantages”. These points were only highlighted by the managers of distribution centres dealing with more dynamic customer orders. Therefore, it can be concluded that the concept of agility in the context of the construct of customer demand is a crucial factor, which enables logistic service providers to gain different non-financial benefits by providing VASs. This conclusion is a novel view on the question of what capability advantages VASs can have for logistics service providers. While the non-financial value-added advantages of applying VASs were previously considered as an objective effect [5,8,10], the results of this study contradict this position by emphasising the importance of a contextual perspective on this topic.

Moreover, according to the empirical data, different contexts in which VASs in distribution centres are performed can also impact how managers see the possible increased complexities of their operational processes. While previous researchers considered how and what impact the application of different services in warehouse logistics can have [20,22,23], this study identified under which conditions this effect might occur. In particular, it was identified that the level of complexity of VAS applications is linked to the nature of customer demand. This conclusion is based on the fact that in response to the interview questions, the increased complexity was not understood by DC managers focusing solely on cost but was only understood by those operating in an agile customer focused environment. This perspective provides a new contextual insight to the discussion of the possible negative effects that can result from the application of VASs in cost-driven warehouse operations.

6.2. Research Objective 2

The outcomes of this study showed that different managers focused on different strategies when performing VASs in their distribution centres. According to the research findings, one of the factors that influenced manager positions was specific to the VAS business of each distribution centre taking part in this study. The managers of some distribution centres stressed productivity as the most decisive aspect of the VAS' performance. Others, in contrast, emphasised the necessity of being able to react quickly to VAS customer orders. A third group suggested that it is crucial to focus on both aspects when supplying VAS. Such different positions, in turn, correlated with different structures of VAS customer demand in different distribution centres. Thus, productivity was highlighted by the managers of those distribution centres dealing with stable and predictable customer orders. The aspect of customer responsiveness, in contrast, was pointed out by the managers who were faced with more dynamic customer demand. Therefore, the findings of this study clearly indicated that the fundamental principles of Fisher's theory [62] of the supply attribute's alignment with the customer's demand is a crucial component of VAS supply strategies in distribution centres.

Additionally, the research findings indicated that the aspect of quality plays a significant role in the context of VAS performance in distribution centres independent of the nature of customer demand. Such perspectives were primarily provided by the company experts who were referred to as customer managers in this study. The managers stressed that the issue of quality always requires a special consideration in the context of VAS as such services have a higher degree of diversity and customisation in contrast to traditional warehouse operations.

Thus, when considering the VAS supply attributes in distribution centres in the context of the concept of “market winners” [73], the “VAS lean supply” area includes “quality” and

“productivity”, while in the area of “VAS agile supply” these are “quality” and “customer responsiveness”, as shown in Figure 4 below. As there is no prior theory in the context of the VAS supply attributes in distribution centres, this model represents a novel theoretical contribution.



Figure 4. Market Winners in the Context of VAS in DCs.

6.3. Research Objective 3

The research findings indicated that in terms of adopting capabilities, two fundamental concepts of lean and agile strategies are integrated into the operational strategies of distribution centres. In particular, the interpretation of the data showed that the managers of distribution centres that focus on productivity highlighted the concept of standard as the most important element in their operations when performing VASs. The managers of distribution centres that focus on customer responsiveness performance identified different aspects of flexibility (flexibility in manpower, place, and methods) in providing solutions to changing customer requirements as the most significant criterion of success. The capabilities of distribution centres that develop solutions according to either cost or VASs are seen as a focus on standardisation or on flexibility as two contradictory approaches of operation. This means that that adoption of lean cost-driven warehousing principles for the purpose of efficiency increase suggested by the previous studies [40–43] only has limited relevance in the context of VAS performance in distribution centres.

Moreover, research findings showed that distribution centres independent of their performance aims are mainly cost driven in the context of VAS performance measurements. This is evident from the fact that all company experts emphasised the importance of the cost efficiency measures in their distribution centres and, at the same time, indicated the lack of performance measures relating to customer responsiveness. Such a conclusion corresponds with the result of the study by Laosirihongthong et al. [47], who explored the significance of different performance measure categories in warehouses of “manufacturing”, “TPLs”, and “retailers”, and found that the categories related to the costs are the most dominant. While the study by Laosirihongthong et al. [47] considered the performance measures of warehouse operations in general, this study indicated that the cost measures in the particular context of VASs in distribution centres are also dominant. Therefore, the research findings suggested that distribution centres dealing with innovative VASs have some areas for improvement in terms of their performance measurements relating to customer responsiveness.

6.4. Reflected Conceptual Framework

Based on the reflection of the findings discussed above, a new framework of VAS performance in distribution centres was developed and presented in Figure 5 below. Three blocks presented in this framework (“VAS benefits and complexity”, “nature of customer demand”, and “VAS Performance”) are in accordance with the reflexion of the findings relating to the three research objectives. The arrows in these blocks show how the findings are connected.

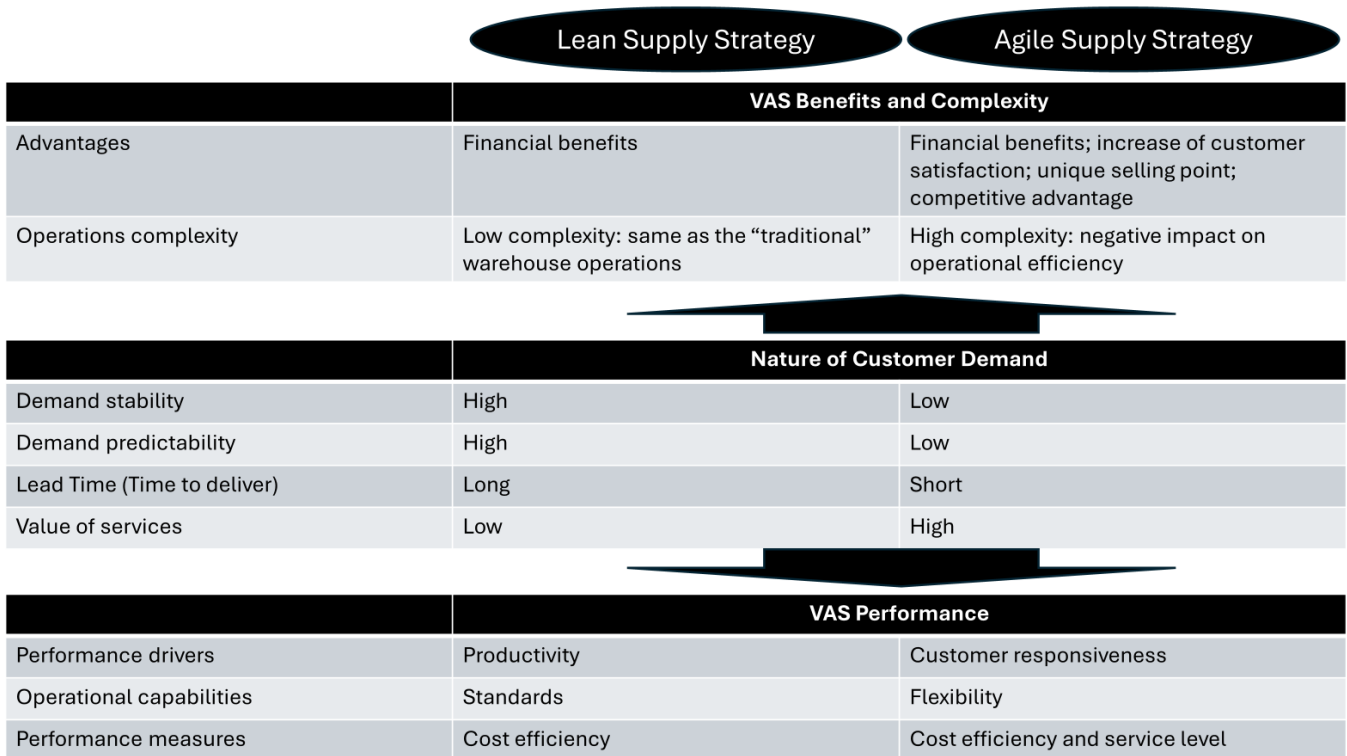


Figure 5. Reflected Conceptual Framework.

Thus, the findings show that lean and agile supply strategies are two concepts that can be used to respond to VASs with different customer demand. The lean strategy is appropriate for working with more stable and predictable customer orders which need to be responded to by the standardisation and efficiency of processes. The agile concept, in contrast, is an adequate supply strategy for reacting to high dynamic demands. Such kinds of VASs are more beneficial, but require higher flexibility in terms of place, manpower, and method used.

7. Conclusions

This study developed a novel understanding of the underlying constructs of VAS customer demands and showed that an understanding of the nature of customer demand can help managers to increase performance by the incorporating VASs in distribution centres. The high dynamic VAS customer demand can bring more financial and non-financial benefits but needs higher flexibility in the warehouse operation system. Stable and predictable VASs, in turn, require a higher degree of standardisation. Thus, lean and agile supply strategies are two concepts that make it possible to respond to different VAS customer demands. The findings addressed the limitations of previous research and contributed a conceptual model that can support managers of distribution centres to improve performance by incorporating different VASs.

This study is limited by the principles of qualitative research, which imply that the research findings are context-specific in nature and cannot be generalised to all circumstances.

Thus, a statistical evaluation of this topic in a broader context is required. Furthermore, as VASs in the ‘real’ business world are closely connected with the strategies regarding the ‘traditional’ services of distribution centres, further research on VASs in the context of the general business systems of distribution centres will be required too.

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Appendix A

Axial Codes	Open Codes	No. of Interview Question
“Physical postponement activities”	“Customized, beyond standard”; “Physical change of outbound specification”; “Additional services”; “Technical quality check”; “Logistic quality check”	1
“VAS as disadvantage for internal logistic service provider”;	“Disadvantage for internal service provider (RO1_Q2)”; “Higher costs and less advantage”; “Disadvantage for internal service provider (RO2_Q7)”;	3
“VAS increase value for both service providers and their customers”;	“Customer loyalty”; “Unique selling point”; “Competitive advantage”	2
“VAS bring financial benefit”	“Financial benefit”; “Higher profit derived from VAS”; “High value”	7
“VAS application has no difference with standard operations”	“VAS as standard”; “No big challenge”;	3
“VAS application is complex due to dynamics”	“Dynamic workload”; “Time pressure”; “Heterogeneous, dynamic VAS”; “Quality issues through short lead time”	3
“Strive for high productivity and efficiency”	“Capacity planning accuracy”; “Lower productivity”; “Higher costs”; “Productivity (RO3_Q8)”; “Productivity is the main driver of competitive advantage”; “Productivity (RQ3_Q10)”; “Productivity (RQ3_11)”; “Productivity of new VAS”; “High productivity is necessary”; “Complexity of productivity evaluation”; “Strive to decrease costs”	8
“Quality has special significance in context of VAS”	“Quality issue”; “Quality emphasis”;	8
“Needs of physical and IT resources”	“Manpower”; “Adoptable IT systems”; “Place”; “Physical resources”; “Management team”;	8
“Needs of VAS knowhow”	“VAS expertise”; “Experts and expertise”; “Knowledge of product”; “IT expertise”;	8
“Needs of closer customer relationship”	“Understanding of customer needs”; “Closer customer relationship”; “Importance of tracking customers’ performance measures”	8
“Lean environment”	“Rather stable demand”; “Rather predictable demand”; “Rather long lead time”;	4; 5; 6

Axial Codes	Open Codes	No. of Interview Question
"Agile environment"	"Seasonality"; "Rather unstable demand"; "Rather less predictable demand"; "Unstable demand due to e-commerce"; "Rather short lead time"; "Order spontaneously";	4; 5; 6
"Lean and agile environment"	"Stable and unstable depending on customer"; "Predictability depends on the customer"; "Long and short depending on the customer"; "Flexibility importance";	4; 5; 6
"Strive to improve flexibility in operation process"	"Flexibility in manpower"; "Flexibility in process"; "Place flexibility";	8; 9
"Strive to increase customer responsiveness"	"Acceptance of ad hoc customer orders"; "Reliability and on time delivery are more important than price"; "Ability of high customer responsiveness"; "Quick reaction"; "Quick reaction and attractive price at the same time"; "Quick implementation (price not important)"; "Quick implementation of VAS"; "Production time"; "No productivity per hours"; "Monitoring daily production progressing"	8; 9
"Strive to improve standard in operation process"	"Standard importance"	8; 9
"Strive to improve both standard and flexibility in operation process"	"Both standard and flexibility are necessary"; "Lean—productivity & quality vs. flexibility & quick reaction"	8; 9
"Importance of costs"	"Cost calculation"; "Ability to estimate effort"; "Yearly increase of fix costs"	10, 11; 12
"Financial performance measures are most significant"	"Financial performance"; "Impact on financial performance"; "Financial performance measures";	10, 11
"Triangle performance measures"	"Cost measures" (RO3_Q10); "On time delivery measures"; "Quality measures"; "Quality, on time delivery, costs" (RO3_Q10); "Quality, on-time delivery, costs (RO3_Q12); "Cost measures" (RO3_Q12); "Service quality"	10, 11
"Customer feedback as measurement of customer satisfaction"	"Questionnaires (Surveys)"; "Customer feedback"	13
"Lack of customer responsiveness measures"	"No need to react quickly"; "No performance alignment"; "No customer responsiveness measures";	12
"Repeating demand as measurement of success"	"Increasing demand of VAS"; "Repeating business" (RO3_Q10); "Repeating business" (RO3_Q13);	13
"Dynamic VAS are calculated with high margin"	"Higher costs are covered by price calculation"; "Dynamic VAS have higher value"; "Order simulation and time calculation";	7
"Focus on Group performance"	"Supply chain planning accuracy"; "Performance categories determined by Group"; "Supply chain financial performance"	10
"Needs to go beyond standard as a challenge"	"Needs to go beyond standard"	3
"Wide range of VAS as a challenge"	"Wide range of VAS"	3
"Process determination as challenge"	"Process determination"	3
"Importance of tracking customers' performance measures"	"Customers' performance measures"	10
"Increasing demand as measurement of success"	"Increasing demand of VAS"	13

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