PERFORMANCE MANAGEMENT IN OUTSOURCED GLOBAL MANUFACTURING SUPPLY CHAINS

Lappeenranta–Lahti University of Technology LUT

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Examiner(s): Professor, Minna Saunila

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ABSTRACT

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Performance management in outsourced global manufacturing supply chains

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The objective of this study was to develop a performance management and measurement framework for a company that outsources the manufacturing of its supply through global supply chains and has a nominated expert organization responsible for managing and measuring the supply chain's performance. In addition, the objective was to define suitable supply chain strategies that consider the current turbulent environment and future trends.

The study was empirical, utilizing qualitative research practices and a case study as its research strategy. In addition, the research followed constructive research methodology. The research process consisted of two main phases: a literature review and an empirical semi-structured interview with a thematic approach.

The results of the study present a new construct: a framework for procurement and supply chain performance measurement and management.

The empirical findings indicate that effective supply chain performance management requires strong organizational control mechanisms, people- and supplier-related capabilities, alignment of strategy, and cross-level and cross-functional collaboration. In addition, the results highlight the increasing importance of sustainability, risk management, regionalization, multi-sourcing strategies, and artificial intelligence in future supply chain performance management.

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Suorituskyvyn johtaminen globaaleissa valmistavissa toimitusketjuissa

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Avainsanat: suorituskyvyn johtaminen, suorituskyvyn mittaaminen, hankinta, alihankinta, toimitusketju, toimitusketjun johtaminen

Tämän tutkimuksen tavoitteena oli kehittää suorituskyvyn johtamisen ja mittaamisen viitekehys yritykselle, joka ulkoistaa toimitusketjunsa tuotannon globaaleihin toimitusketjuihin ja jossa nimetty asiantuntijaorganisaatio vastaa toimitusketjun suorituskyvyn johtamisesta ja mittaamisesta. Lisäksi tavoitteena oli määritellä sopivia toimitusketjustrategioita, jotka huomioivat nykyisen epävakaan toimintaympäristön sekä tulevat trendit.

Tutkimus oli empiirinen ja siinä hyödynnettiin laadullisia tutkimusmenetelmiä sekä tapaustutkimusta tutkimusstrategiana. Tutkimus noudatti lisäksi konstruktiivista tutkimusotetta. Tutkimusprosessi koostui kahdesta päävaiheesta: kirjallisuuskatsauksesta sekä empiirisestä teemahaastatteluihin perustuvasta aineistonkeruusta.

Tutkimuksen tuloksena esitetään uusi konstruktio: hankinnan ja toimitusketjun suorituskyvyn mittaamisen ja johtamisen viitekehys.

Empiiriset tulokset osoittavat, että tehokas toimitusketjun suorituskyvyn johtaminen edellyttää vahvoja organisatorisia ohjausmekanismeja, henkilöstö- ja toimittajakyvykkyyksiä, strategian yhdenmukaisuutta sekä eri organisaatiotasojen ja funktioiden välistä yhteistyötä. Lisäksi tulokset korostavat kestävyyden, riskienhallinnan, alueellistumisen, monitoimittajastrategioiden sekä tekoälyn kasvavaa merkitystä tulevaisuuden toimitusketjun suorituskyvyn johtamisessa.

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Espoo, 28 April 2026

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Table of contents

Abstract

Acknowledgements

1 Introduction 9
1.1 Background of the study 9
1.2 Research objectives and exclusions 10
1.3 Research methodologies 12
1.4 Structure of the research 15
2 Performance measurement and management 17
2.1 Concept of performance 19
2.1.1 Internal and external performance 21
2.2 Purpose of Performance Measurement and Management 22
2.3 Individual's role in performance measurement 23
2.4 Strategic Alignment in Performance Management 24
2.5 Organizational and management control systems 26
2.6 Design principles 28
2.6.1 Key success factors 29
2.6.2 Metrics characteristics 30
2.6.3 Leading and lagging metrics 32
2.6.4 Performance management in changing environment 32
2.6.5 Change trends on Performance Management 34
3 Procurement and supply chain management 35
3.1 Concept of supply chain 36
3.2 Objectives of procurement and supply chain management 38
3.3 Supplier relationship management 39
3.4 Risks in supply chains 39
3.5 Change trends in supply chains 41
3.5.1 Technological breakthroughs 41
3.5.2 Changing ecosystems 42

3.5.3 Changing customer requirements 43
3.5.4 Sustainability 44
4 Performance measurement and management in procurement and supply chains 46
4.1 Dimensions and metrics 47
4.1.1 Sustainability dimension 53
4.2 Supply Chain Operations Reference Digital Standard (SCOR DS) model 54
5 Case company and empirical findings 59
5.1 Case company and research case 59
5.2 Method for interviews 60
5.3 Results of interviews 62
5.3.1 Current practices in Performance Measurement and Management 62
5.3.2 Supplier Relationship Management in Performance Management 68
5.3.3 Design requirements for the new framework 72
5.3.4 Organizational Control and Individual's role in Performance Management ... 78
5.3.5 Risk, resilience, and future trends in supply chain performance management 81
5.3.6 Additional insights from interviewees 84
6 Developed supply chain performance measurement and management framework 86
6.1 Procurement and supply chain performance concept 87
6.1 Performance measurement and management system 89
6.1 Design principles 92
6.2 Strategic alignment 94
6.3 Cause-and-effect relationships and strategy maps 96
6.4 Key success factors 97
6.5 Framework characteristics 99
6.6 Metrics characteristics 102
6.7 Procurement and supply chain performance dimensions 104
6.8 Supplier relationship management 106
6.9 Sustainability performance models 108
6.10 Supply chain performance models 109
6.11 Changing environment 110
6.12 Risks in supply chain 112
6.13 People 114
7 Results, conclusions, and recommendations 115

7.1 Research results and conclusions 115
7.2 Future research opportunities and recommendations 123
8 Summary 125
References 127

Appendices

Appendix 1. Interview themes and questions

Appendix 2. Performance measurement and management framework for global procurement and supply chain management

DECLARATIONS

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The originality of this thesis has been reviewed with the Turnitin similarity checking service.

AI usage

The author of the thesis, Ollantay Castro, used the following AI-tools during the preparation of the thesis:

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        ii. Providing text written by the researcher from literature and findings either in English or Finnish and prompting the AI-tool to improve the clarity, structure, and academic language of the given text in English.

Responsibility

The author, Ollantay Castro, takes full responsibility for the content of this thesis and has reviewed and edited the content generated by the possible use of AI tools.

1 Introduction

Today's supply chain management includes many activities that ensure seamless flow of material, financial and information where resources must be combined with partners and external parties in the complex global networks since companies can have large portfolios of suppliers globally which they utilize for specific needs and costs. Also, in recent decades the global logistics and supply chain management sector has developed drastically and witnessed both new innovations and disruptions like COVID-19 pandemic, Ukraine war and rising costs which have resulted in stockouts and delays across the world. (Merker & Hoberg 2023, 6-8). Meanwhile concerns regarding global warming and sustainability of the planet coupled with rapid technological development, are forcing changes in how organizations are managed (Bititci et al. 2012, 305).

1.1 Background of the study

Trends like deglobalization, onshoring, Internet of Things, Artificial Intelligence, and responsible supply chain (Merker & Hoberg 2023, 8;85), multicultural collaboration, autopoietic networks, servitization, open-innovation, knowledge-worker's value creation will shape current ways of measuring, managing, and accessing performance of organizations (Bititci et al. 2012, 318). Value creation has shifted to knowledge-work from manual work and demand for improved collaboration between complex global multicultural networks has risen. Performance measurement is changing towards managing trans-organizational, autopoietic networks and collaborative organizations in supply chain management. (Bititci et al. 2012, 314).

On the other hand, greenhouse gas emissions have risen considerably which has resulted in actions to reduce emissions. Raw materials and commodities are consumed rapidly by humans which causes difficulties to acquire these at steady and reasonable prices and can become a real challenge in the future. (Merker & Hoberg 2023, 44-45). Also, it has been noticed that the pursuit of sustainable and responsible business models is accelerating beyond the boundaries of individual organizations. (Bititci et al. 2012, 311–314). Example,

reducing scope 3 emissions which includes indirect emissions in companies' value chain, are increasingly becoming more important (Merker & Hoberg 2023, 45).

It will be critical to rethink supply chain strategies in different functions such as sourcing and procurement for the coming years (Merker & Hoberg 2023, 8) which calls for small and large organizations to innovate and adapt to new operational models and ways of working to answer to these challenges (Bititci et al. 2012, 318). The impacts of these factors, and their implementation in performance management and measurement particularly in global supply chain management remain insufficiently studied. This gap invites research to develop a performance management and measurement framework that considers today's business environment with its challenges, changes, and the necessities for success in tomorrow's world.

This research is conducted for a case company that operates globally with complex manufacturing supply chains around the globe. The company has recently published its new strategy for the upcoming years and has undergone major restructuring in the past. A dedicated team manages the performance management and measurement of the global supply chains regarding direct sourcing, being responsible for determining measuring methods and suitable indicators. However, no realignment or harmonization has taken place since the restructuring, and with the new strategy, there is a clear need to develop a new performance management and measurement system for supply chain management to address these gaps.

1.2 Research objectives and exclusions

The objective of this study is to develop a performance management and measurement framework for a company that outsources the manufacturing of its supply through global supply chains and has a nominated expert organization responsible for managing and measuring the supply chain's performance. In addition, the objective is to define suitable supply chain strategies that consider the current turbulent environment and future trends. The supply chain performance management and measurement framework are designed for the specific use of the case-company, taking into consideration the company's strategy, objectives, and industry.

Three research questions were formed to achieve the research objectives. The research aims to answer following questions:

- How can a performance management system framework be designed to measure and manage the performance of globally outsourced manufacturing supply chain?
- Which performance management system dimensions and performance measurement indicators are most suitable for global supply chain management?
- How should the current turbulent environment and future trends be considered in global supply chain performance management and measurement?

The study is limited to the design of a new supply chain performance measurement and management framework for the case-company's expert organization, including a set of key performance indicators that could be used within the framework to manage global supply chain performance. The actual construction of the performance measurement system, including the selection of key performance indicators for the case company, setting measurement targets, as well as the implementation and testing of the framework, is excluded from the scope of the research. These topics will still be addressed in the study, as it represents a natural area for further development after this research.

The case-company operates in commercial markets on a global scale with a complex network of partners and suppliers. Therefore, entities such as foundations and public sector organizations are excluded from the scope of the framework and the research. Since the case-company is a large international technology company, the empirical part of the study is limited to the supply chain management of a single business area with the measurement and management of its direct suppliers' performance. Indirect suppliers and other business areas are excluded, as they do not fall under the management scope of this case-company's expert organization.

Specifically, the research concentrates on the supply chains management and measurement of the organizations that outsource manufacturing most of their supplies to end customers. This focus aligns with the case company's expert organization, which is responsible for managing the performance of suppliers manufacturing goods on behalf of the company for its customers. The study emphasizes enterprise functions related to procurement and sourcing, which are typically accountable for supply chain management and measurement. Other corporate functions, such as sales, marketing, and human resources, are excluded, as

they are generally not responsible for managing supply chain performance. Target of the framework is to allow expert organization to follow and improve the performance of their direct suppliers.

1.3 Research methodologies

The research type can be theoretical desk research or empirical, meaning observational research, where empirical research can further be divided into quantitative or qualitative research. Quantitative research is also referred to as statistical research, which investigates questions in terms of numbers and percentages, with results presented through numerical values, tables, and charts. Qualitative research aims to understand a smaller, more limited research subject, explaining subject's behaviors and decisions, without seeking statistical generalizations (Heikkilä 2014, 12–15).

According to Rashid et al. (2019, 2–6), the case study research process can be structured into four main phases:

1. Foundation phase, which involves first defining the research philosophy in terms of ontology, epistemology, and paradigm. The next step is selecting the appropriate inquiry technique, either quantitative or qualitative, followed by clarifying the research logic as inductive or deductive.

2. Pre-field phase, which includes the decide step, where it is evaluated whether the case study is a suitable strategy for the research. This phase also involves developing the case study protocol, which defines the execution of the study, including the research questions, research methods, permission procedures, ethical considerations, interpretation process, and assessment criteria.

3. Field phase, which begins with the contact step, where the researcher prepares for empirical data collection by familiarizing themselves with the case and the participants. The next step, interact, involves the actual collection of empirical material.

4. Reporting phase, which focuses on case study reporting and includes the description of the case, participants, and relationships, as well as details of field protocols, empirical data analysis, and conclusions.

This introductory chapter serves as the foundation phase, as it defines the research methodologies applied in the study. A case study is a qualitative research strategy with the goal of achieving a deeper understanding of the phenomenon under research (Metsämuuronen 2006, 90-91) by collecting and analyzing data, on a topic of significant interest to the researcher and arguable to others, to address a specific research question (Farquhar 2012, 5–6). It is particularly suited to answering questions beginning with how, who, and why. Case study research entails gathering evidence, typically within its actual context, such as within a company or a country, using data collection methods like interviews or surveys. (Farquhar 2012, 5–6).

Since a case study is a qualitative research strategy that belongs to the empirical research category and is used to collect data within a company's real context, this research is empirical in nature, utilizing qualitative research practices and a case study as its research strategy, as it focuses on a single case company. Furthermore, because the case study approach is well suited for answering "how" questions, it is considered appropriate for this research. A case study follows an inductive approach when its aim is to generate theory from data (Farquhar 2012, 25), which aligns with the objective of this study. Therefore, the research logic is inductive.

In empirical research methodology, the constructive approach can be either quantitative or qualitative, and it is applicable to the case method (Kasanen et al. 1991, 255; 261). The constructive approach is a research method used to define and solve real practical problems or to improve existing systems (Oyegoke 2011, 576;578) by developing new constructions through the design and development of organizational models, diagrams, plans and procedures (Kasanen et al. 1991, 244-245). To support the inductive approach, which aims to generate theory from data, this research also adopts a constructive approach, as it is well suited for case studies and qualitative methods. The constructive approach seeks to solve practical problems, and in this study, the objective is to develop a new framework for supply chain performance management and measurement, which serves as the construct.

The constructive research approach is typically structured into distinct phases (Kasanen et al. 1991, 246). According to Oyegoke (2011, 576), these include:

1. Identifying a practically relevant problem that holds research potential,

2. Developing a broad and comprehensive understanding of the topic,
3. Creating and designing an innovative construct,
4. Demonstrating the functionality of the construct in practice,
5. Establishing the theoretical linkages and scholarly contribution of the proposed solution
6. Assessing the extent to which the solution can be applied in various contexts.

Constructive research as a methodology starts by identifying a practical problem and supporting it with relevant literature. The defined problem then guides the formulation of research questions, which are addressed through the design and development of a solution. (Oyegoke 2011, 576). As presented in the earlier sections, a real-world problem has been identified based on the literature, and appropriate research questions have been defined along with a potential solution to address the problem. Therefore, the first step of the constructive research approach has been completed. Due to resource constraints, step four of the approach, the functionality demonstration of the construct, will be excluded.

The empirical part of the research is guided by a framework that connects the theoretical and empirical sections into a whole, so that the theoretical part is not just a summarization from literature (Heikkilä 2014, 24). This also applies to the constructive approach, as the second step requires developing extensive knowledge of the topic, and the fifth step involves linking theoretical knowledge to both the problem and the construct, ensuring that the construction maintains a strong theoretical foundation. This ensures that the research results can be generalizable, meaning the construction could be applied to other instances and cases (Kasanen et al. 1991, 246; 259).

The theoretical section of this research is conducted through a review of existing literature to examine theory of performance measurement and management systems, procurement and supply chain management, and performance measurement and management in procurement and supply chains while providing an overview of current and emerging trends influencing supply chain management and performance management. The theoretical framework is designed to support and guide the empirical part of the study, providing a comprehensive understanding of the relevant topics and thereby contributing to the development of the construct.

In qualitative research, common data collection methods include observation, text analysis, interviews, and transcription (Metsämuuronen 2006, 88; 111), of which interviewing is perhaps the most common (Eskola & Suoranta 2014, 86). An interview is a researcher-initiated and guided conversation aimed at exploring what the interviewee has in mind (Eskola & Suoranta 2014, 86). Metsämuuronen (2006, 113) says that according to Hirsjärvi & Hurme (1985, 15) interviews are beneficial when the goal is to interpret questions, explore the research area, and obtain descriptive examples.

For this reason, interviews were selected as the data collection method in the empirical part of the research, as they support the development of the construct for the case company, but also for other similar contexts. To gain a holistic understanding of the case company's specific needs, nine interviews were conducted across its geographical units to ensure diversity and a more comprehensive understanding of geographic influences. Furthermore, both internal and external company materials were studied to interpret the organization's newly published strategy and objectives.

1.4 Structure of the research

This research consists of five levels and eight chapters as demonstrated in the Figure 1. The first level introduces the research, outlining its background, objectives, exclusions, questions, methodologies, and structure. The second level of the research is the theoretical section, which includes a literature review on performance measurement and management systems, procurement and supply chain management, and performance measurement and management in procurement and supply chains. The third level is the empirical section, which presents the case company, interview results, and the proposed performance management and measurement framework for globally outsourced supply chains. The fourth level presents the results, conclusions, and recommendations. The fifth and final level provides a summary of the study, including its objectives, phases, and key conclusions.

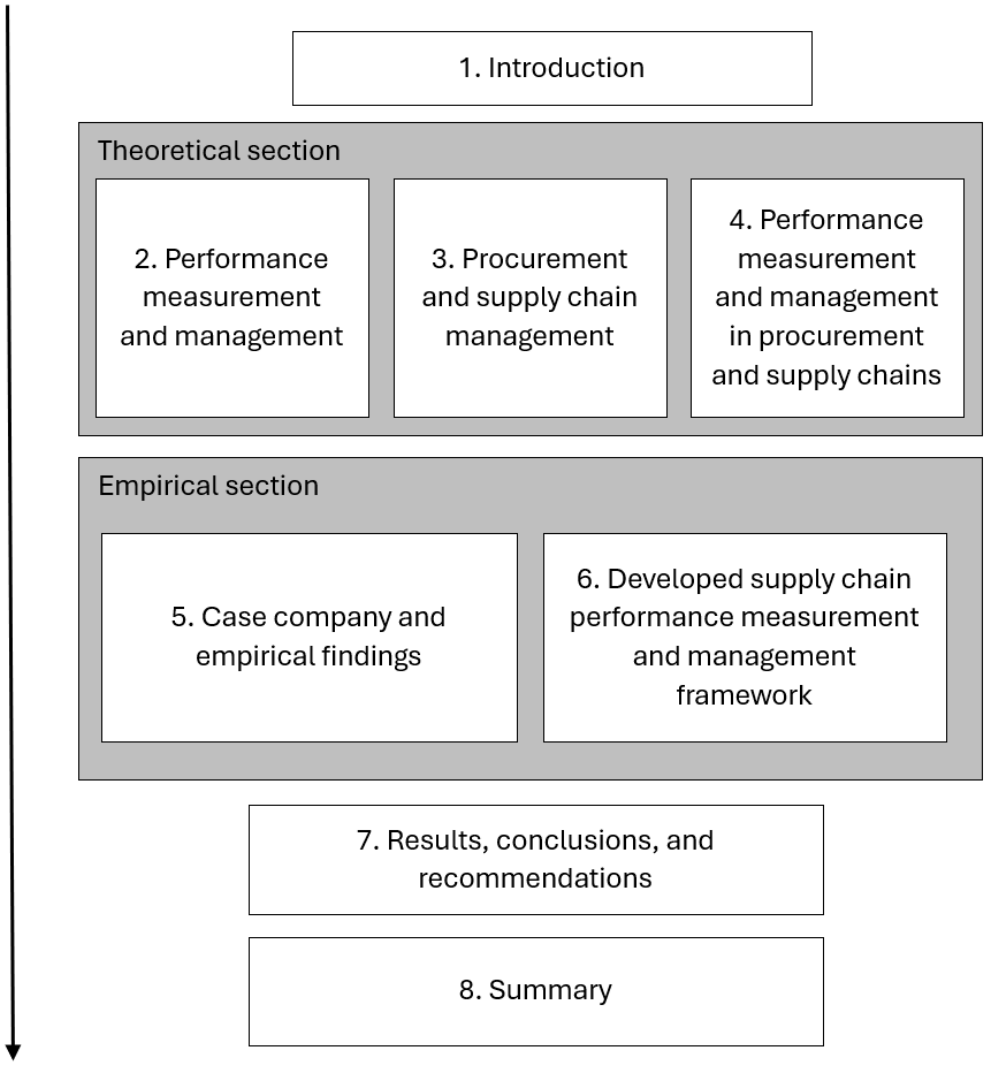

Figure 1. Structure of the research

2 Performance measurement and management

According to Rantanen and Holtari (1999, 60), the old saying “what you measure is what you get” implies that any process intended for development must first be measured. This principle highlights the importance of performance measurement and management in the effective operation of organizations, whether they are factories, businesses, hospitals, or schools (Bourne et al. 2018, 2010) since it allows the collection of operational data to guide resource allocation and improvement actions (Ukko et al. 2007, 10), which enables control and correction through the comparison of current performance with desired outcomes (Melnyk et al. 2013, 173).

Performance measurement is defined by Neely et al. (2005, 1229) as the process for quantifying the effectiveness and efficiency of action. Effectiveness means the degree to which the outcome of an action aligns with expectations or requirements, and efficiency refers to the resources consumed in producing that result or output (Neely et al. 2005, 1228; Nudurupati et al. 2021, 2). According to Ukko et al. (2007, 3), performance measurement is future-oriented and relates to the capability to achieve outcomes in the desired performance.

A performance measure, in turn, is a metric used to quantifying the effectiveness and efficiency of actions (Neely et al. 2005, 1228; Nudurupati et al. 2021, 2). Melnyk et al. (2013, 175) has similar definition as according to them, a performance measure is a quantifiable and verifiable metric used to assess the efficiency and effectiveness of actions. A metric should consist of three essential elements described below, where omitting one of them reduces its effectiveness:

1. It quantifies current state of operations.
2. There is a target that defines what is considered good or bad performance which guides the organization’s direction.
3. Consequences are defined related to meeting, falling short of, or being above the target. (Melnyk et al. 2013, 175).

This means that performance metrics must be meaningful and useful so they can be utilized for planning, guiding, and improving operations (Rantanen & Holtari 1999, 15).

An organization requires a single performance measurement and management system that integrates strategic, financial, operational, and human resource perspectives into it (Bititci, 2015, 25). Melnyk et al. (2013,175) says that the performance measurement and management systems consist of two integrated elements:

1. The performance measurement system
2. The performance management system

A performance measurement system is described as a set of metrics employed for quantifying efficiency and effectiveness of actions. (Neely et al. 2005, 1228; Nudurupati et al. 2021, 2). A metric set is a collection of metrics designed to reflect strategy and guide the actions of individuals, groups, teams, functions, or the organization (Melnyk et al. 2013, 175). Performance measurement system provides comprehensive view of the organization's operations, success, performance, and causal relationships between them (Rantanen & Holtari 1999, 15).

According to Lebas and Euske (2007, 137), to manage performance an organization must:

- Describe the value creation process within its context and time frame.
- Share this model with all relevant stakeholders.
- Collaborate and allocate decision rights.
- Define descriptive measurements for both results and the steps leading to them.
- Document these measurements in an information system.
- Choose references for benchmarking and external validation.
- Evaluate the signals and messages derived from each measurement.
- Identify, assess, and implement actions that enhance the likelihood of achieving results consistent with the organization's strategic intent.

Bititci (2015, 25) defines that performance management refers to the process in which performance measures are applied to manage an organization's performance. Performance management system is described by Nudurupati et al. (2021, 2), as the process of setting goals, developing performance measures, collecting, analyzing, reporting, interpreting, reviewing, and acting on performance data. Ferreira & Otley (2009, 264) has similar but more detailed description as they define performance management systems as formal and

informal mechanisms, processes, and networks that organizations use to channel key objectives and goals selected by the management while supporting strategic process, daily management and organizational learning and change by analyzing, planning, measuring, controlling, rewarding, and managing performance.

This means the performance management system includes processes for assessing differences between actual and desired outcomes, identifying and flagging those that are critical, understanding if and why deficiencies have occurred, and initiating corrective actions to close significant performance gaps (Melnyk et al. 2013, 175) through established practices and routines within organizations where performance is evaluated in multiple occasions and different levels in the organization from top management to lower levels (Bourne et al. 2018, 2015-2016). Simplified, performance management ensures that organizational performance is managed in line with the organization's strategies and objectives (Saunila et al. 2015, 370-371).

To better understand the difference between performance measurement and management, Saunila et al. (2015, 374) says that according to Brudan (2010) performance measurement focuses on assessing results while performance management concentrates on the actions that needs to be taken to achieve desired results. Another way to distinguish between performance measurement and performance management is to view them through the lens of organizational control. According to Smith and Bititci (2017, 1209), performance measurement is associated with technical control, while performance management is associated with social control.

2.1 Concept of performance

It is a demanding duty to manage an organization and its performance since it requires a lot of data, skill, and competence (Rantanen & Holtari 1999, 1). This is why it is important to clarify what is meant by the term performance. Lebas and Euske (2007, 125–134) says that performance is a complex, multifaceted and dynamic concept that simultaneously refers to the action itself, the result of the action, and the success of that result in comparison to a benchmark. They define performance as "doing today what will lead to an outcome of measured value tomorrow" and as "the sum of all processes that lead to a potential or future sequence of outcomes and results".

Rantanen & Holtari (1999, 3) have similar definition since they say that according to Laitinen (1998), performance is the capability to achieve outcomes in the desired dimensions and objectives where these are related to maximation of stakeholder needs. They divide performance to four main level that can be analyzed, and they say that Uusi-Rauva (1996) and Sink (1985) divides the organization level even further as demonstrated in Figure 2.

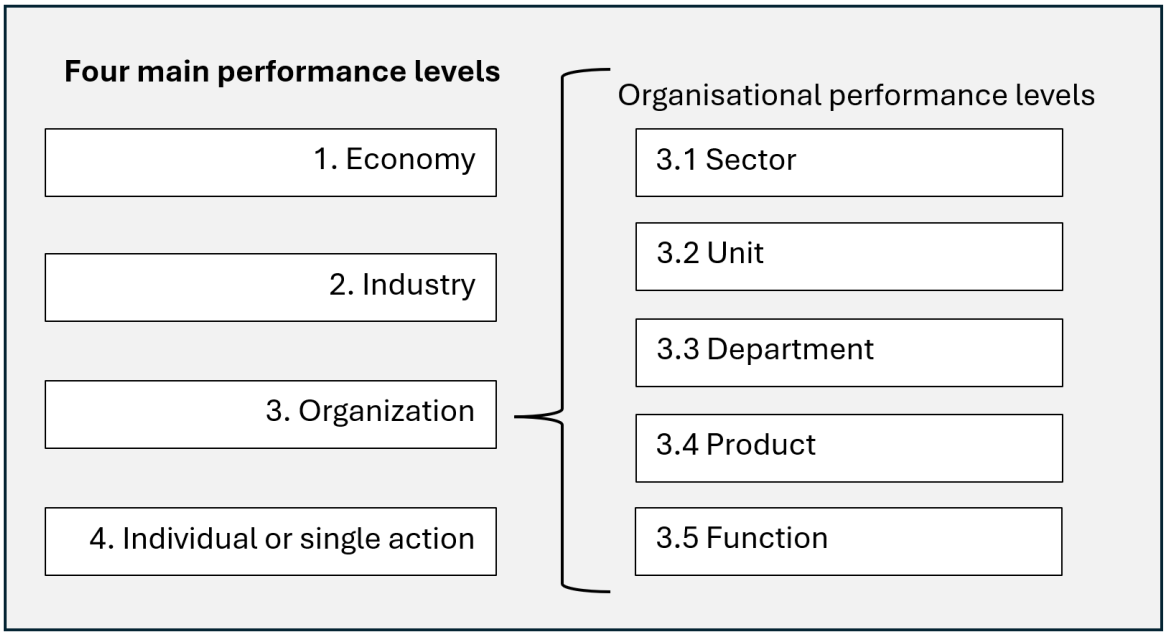

Figure 2. Performance levels (after Rantanen & Holtari 1999, 3) who refer to Uusi-Rauva (1996) and Sink (1985).

This idea is supported by Lebas & Euske (2007, 133) since they state that performance is always linked to a domain of responsibility, such as a manager, team, management system, product, or service. Therefore, it carries different descriptions across the levels. This implies that performance does not have a single, universal operational definition. (Lebas & Euske 2007, 133).

Performance can exist only when an outcome or result can be described or measured, allowing it to inform decision-making and guide actions (Lebas & Euske 2007, 134). Furthermore, performance is a comparative concept that requires evaluation and interpretation, as it must be assessed in terms of being good or bad (Lebas & Euske 2007, 135–136). In other words, performance can be viewed as successful or unsuccessful. Ukko et al. (2007, 4-6) express that organization's performance and its success is usually assessed through:

- Profitability – capability to create profit.
- Productivity – capability to create more outputs from the inputs.
- Economic efficiency - capability to create outputs with lower costs or more output with existing costs.
- Effectiveness – capability to achieve desired objectives.
- Efficiency – capability to achieve desired objectives in the wanted time frame.
- Competitiveness – capability to compete and remain in the markets.

Additionally, of the list from Rantanen & Holtari (1999, 8-9) adapting Sink (1985), we can add three more:

- Quality – capability to fulfil end user's or customer's expectations and needs.
- Quality of work life – capability to create satisfaction and motivation to organizational members.
- Innovation – capability to create innovations.

Since the definition of performance is complex, performance management can be used to create alignment of performance concept between external and internal decision makers to achieve efficient use of resources, fulfilment of strategic intent and performance to occur. (Lebas & Euske 2007, 125;138).

2.1.1 Internal and external performance

Rantanen & Holtari (1999, 4) says that background to improve performance has come from the need to satisfy organization's stakeholders. Organization's stakeholders are the actors, presented below, that are in continuous interaction with the organization and that the organization is dependable of:

- Owners
- Management
- Employees
- Customers
- Suppliers
- Investors

- Unions
- Government (Rantanen & Holtari 1999, 4–5).

Everyone defines performance within their own context, shaped by factors such as time frame, objectives, intent, or perspective and has value if it influences decision-making (Lebas & Euske 2007, 131). For example, the meaning of performance differs depending on whether it is defined by an internal or external actor (Lebas & Euske 2007, 132) which means that performance can be divided into external and internal performance (Rantanen & Holtari 1999, 11).

Internal performance refers to an organization's self-assessment, focusing on its own internal operations and performance, where the organization typically possesses more comprehensive and accurate information than external parties. Conversely, external performance refers to the evaluation of an organization's performance in relation to its external environment, which can be carried out by outside parties or internally within the organization (Rantanen & Holtari 1999, 11-12).

External stakeholders may assess performance using general indicators, such as financial metrics, while internal stakeholders operationalize performance collaboratively within the organization (Lebas & Euske 2007, 132-133). This is because external actors don't have the same data available and base the performance evaluations on publicly available information (Rantanen & Holtari 1999, 13).

2.2 Purpose of Performance Measurement and Management

There are many purposes for performance measurement and management. Here are listed the main purposes identified by practitioners:

- to produce useful and trustworthy information that can be used in decision making (Rantanen & Holtari 1999, 17).
- to support organizational control (Nudurupati et al. 2021, 2).
- to support the management of the organization (Ukko et al. 2007, 11).
- to communicate strategic objectives and their progress (Ukko et al. 2007, 11).
- to guide decision-making at organizational, unit, and team levels from top to bottom (Ukko et al. 2007, 11).

- to communicate key objectives and direct attention to important topics (Hannula & Lönnqvist 2002, 31).
- to monitor operations and to identify issues on processes (Hannula & Lönnqvist 2002, 31).
- to enable bonus-based pay (Hannula & Lönnqvist 2002, 31).
- to assess successfulness of the strategy implementation and to understand the business environment's dynamics (Hannula & Lönnqvist 2002, 31).
- to improve business processes (Hannula & Lönnqvist 2002, 31).
- to evaluate success in achieving objectives, key success factors, strategies, and plans in different levels of the organization (Ferreira & Otley 2009, 271).
- to establish position by determining current levels of performance (Melnyk et al. 2013, 176).
- to communicate direction by clarifying what is to be achieved (Melnyk et al. 2013, 176).
- to influence behavior by reinforcing desired and discouraging undesired performance (Melnyk et al. 2013, 176).
- to stimulate action by identifying when intervention is needed (Melnyk et al. 2013, 176).
- to facilitate learning by supporting both single- and double-loop learning (Melnyk et al. 2013, 176).
- to implement strategy by ensuring that change is executed (Melnyk et al. 2013, 176).

2.3 Individual's role in performance measurement

For a successful performance measurement, people must be involved in the development of the performance measurement system and as well in the measurement itself since desired objectives can't be achieved without individuals and their input or output (Ukko et al. 2007, 7; 12). Organizations function as social systems because they are composed of groups of people with specific purposes which use specific resources to perform activities that result in either good or poor performance outcomes, meaning that people operate processes that deliver performance as illustrated in Figure 3. (Bititci, 2015, 25; 28). Therefore, a performance measurement and management system should not treat employees as purely

rational machines, as doing so may disengage them, lower motivation, and diminish the organization's capacity for innovation (Bititci, 2015, 28).

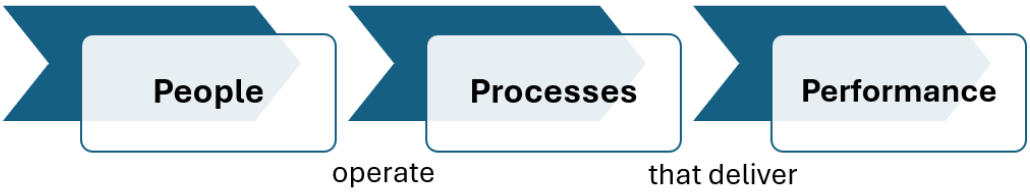

Figure 3. Underlying performance concept of organizations (after Bititci 2015, 25)

With performance measurement, the organization can clarify its vision and objectives to the organizational members (Ukko et al. 2007, 12) and influence them (Ferreira & Otley 2009, 271) by increasing commitment, motivation, and creativity of the individuals (Ukko et al. 2007, 7). Ukko et al. (2007, 12) also explain that, according to Uusi-Rauva (1996), performance measurement can also affect organizational members in the following way:

- it motivates,
- highlights the value of what is being measured,
- directs effort towards the right actions,
- clarifies objectives,
- creates a spirit of competition and rivalry,
- creates prerequisites for rewarding.

2.4 Strategic Alignment in Performance Management

Ferreira & Otley (2009, 267) says that purposes and objectives are the starting point for performance management. According to Rantanen & Holtari (1999, 44) performance measurement and management systems are based on organization's strategy and objectives. Ukko et al. (2007, 52) states that one way to design a performance measurement system is through company's vision and strategy. In the end, organizations need convincing core

values, mission, vision, strategy, and objectives that motivates employees, customers, suppliers (Johnson et al. 2008, 9-11; 163) to achieve the orientation and direction that the organization desires (Ferreira & Otley 2009, 268; Kaplan & Norton 2004, 43). Since performance measurement and management are founded on these concepts, it is essential to define them clearly:

- **Core values** – the underlying principles that steer organization's strategy (Johnson et al. 2008, 163).
- **Mission** – a concise statement explaining why the organization exist and how they are going to compete and provide value to customers (Kaplan & Norton 2004, 43) meaning aligning the purpose of the organization with the values and expectations of main stakeholders (Johnson et al. 2008, 163-164).
- **Vision** – a statement illustrating the desired future state which the organization aspires to achieve (Johnson et al. 2008, 164), how the organization wants them to be perceived by the world, and what kind of objectives they have for the three to 10-year term (Kaplan & Norton 2004, 43).
- **Strategy** – long term direction and scope of the organization by expressing broad statements what kind of direction and actions should be taken to achieve desired objectives (Johnson et al. 2008, 3), mission and vision (Kaplan & Norton 2004, 43). According to Johnson et al. (2008, 7), strategy can be divided into three levels:
    - Corporate-level – involves overall purpose and scope of the organization and expressing how value will be achieved in different business units.
    - Business-level – expresses how the specific businesses should compete in the markets.
    - Operational – involves how the functions of organization deliver corporate- and business-level strategies in terms of resources, processes, and people.
- **Objective** – a quantifiable outcome that the organization wishes to achieve (Johnson et al. 2008, 166). Ukko et al. (2007, 26) outline several key factors that should be considered when formulating objectives:
    - Acceptability – Objectives are more likely to be achieved when they are perceived as fair. Unfair objectives may be ignored or resisted.
    - Flexibility – Objectives must be adaptable to significant changes in the company's operating environment.
    - Motivating – Objectives should be high enough to be inspiring but not so high as to be frustrating. Objectives that are too easy are not motivating.

- Consistency – Objectives must be consistent with higher-level objectives to ensure a unified direction. Lower-level objectives should support higher-level ones.
- Understandability – Objectives must be clearly and simply articulated so that all employees understand what is to be accomplished and how success is measured.
- Attainability – Objectives must be realistic and achievable. They should align with the company's internal resources and external opportunities.
- Definition component – defines the activity to be improved.
- Activity component – describes the desired direction for the activity.
- Target-level component – clarifies the desired level to be achieved.
- Constraint component – defines in which rules it must be achieved on, such as time.

Communication strategies and objectives are vital to strategic success since failing to communicate these to organizational members results in a lack of understating how individuals can contribute to it. Thus, performance measurement and management can be used to communicate strategies and objectives to organizational members (Ferreira & Otley 2009, 270-271) through cause-and-effect relationships, meaning that each metric should form part of this chain and reinforce the strategic priorities of the organization (Ukko et al. 2007, 16). This means that organizations must establish clear strategies and objectives at multiple organizational levels such as company, unit, team, and individual employee while deriving from those above, creating a top-down chain (Ukko et al. 2007, 25). One effective way to illustrate these relationships is by developing a strategy map that visualizes the connections between different dimensions and metrics (Ukko et al. 2007, 16).

2.5 Organizational and management control systems

As performance measurement and management are closely linked to organizational control and management control systems, it is important to understand their theory to clarify this connection. Management controls refer to the mechanisms and systems used by management to direct employee behavior and decision making toward the organization’s objectives and strategies, whereas organizational control represents a broader concept that includes these same elements but also incorporates controls not specifically aimed at employees, such as

inventory control (Malmi and Brown, 2008, 290). Organizational control consists of two types: technical and social control (Tessier & Otley 2012, 179; Smith and Bititci (2017, 1208).

For long-term sustainable performance, it is essential to maintain a balance between technical and social controls (Bititci, 2015, 29), where in these contexts, performance measurement is associated with technical control and performance management is associated with social control (Smith and Bititci 2017, 1209). These types of controls can be applied to influence performance and compliance at both strategic and operational levels through diagnostic or interactive approach, enabling or constraining methods, and rewarding or punishing outcomes (Tessier and Otley, 2012, 180). Furthermore, Nudurupati et al. (2021, 2) illustrates how Simons' (1995) four levers of control are linked to technical and social control, as belief and interactive systems are associated with social control, while diagnostic and boundary systems are associated with technical control. These relationships are presented in the Figure 4.

Technical controls are rational, planned, bureaucratic and structural elements within an organization, including activities such as planning, measuring performance, and setting objectives, policies, rewards, and procedures (Nudurupati et al. 2021, 2). In the context of performance measurement, technical control practices include developing metrics, setting targets, and collecting, analyzing, and reporting performance data (Smith and Bititci, 2017, 1208–1209).

Social controls are cultural and behavioral aspects in the organization which includes shared values, collaboration, participatory, decision-making, open and honest information sharing and trust. (Nudurupati et al. 2021, 2). Tessier & Otley (2012, 179) says that according to Ray (1986), social controls influence employees by appealing to their emotional, affective, and non-rational dimensions. In relation to performance management, social control focuses on the practices through which organizational performance is used and managed (Smith and Bititci, 2017, 1208–1209).

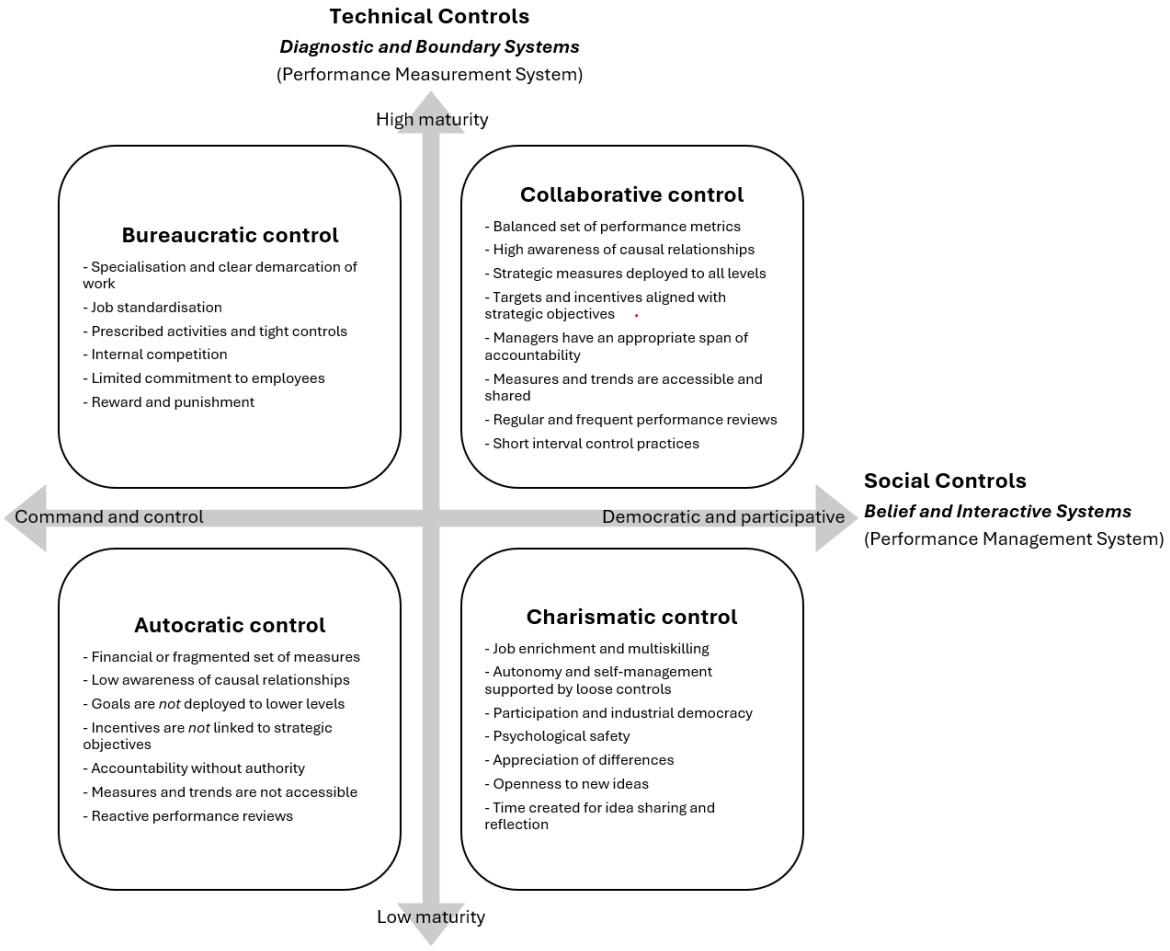

Figure 4. Performance measurement and management relationship to organizational control after Nudurupati et al. (2021, 3) which is developed from Simons (1995), Tessier and Otley (2012) and Smith and Bititci (2017).

2.6 Design principles

It is important to decide the scope of the measurement system in the organization as it can involve the whole organization or only one specific function, but measurements must be conducted in all organizational levels to achieve common objectives (Rantanen & Holtari 1999, 24). As performance measurement is grounded in an organization's strategy and objectives, it should encompass the key success factors along with their leading and lagging indicators (Rantanen & Holtari 1999, 44) and have an organizational structure that supports performance measurement and management design and use (Ferreira & Otley 2009, 266).

According to Ukko et al. (2007, 12), performance measurement consists of four main phases:

1. **Design of the performance measurement system** – the measurement subjects and metrics are selected and aligned with the organization's overall objectives from upper management to lower-level teams (Ukko et al. 2007, 13).
2. **Deployment of the performance measurement system** – how, by whom, and through what type of system the data will be collected and presented, emphasizing the importance of displaying performance information in a clear and comprehensible format (Ukko et al. 2007, 13).
3. **Use of the performance measurement system** – collecting performance data and reviewing the selected metrics within the organization (Ukko et al. 2007, 13) and planning improvement actions based on the results (Rantanen & Holtari 1999, 37).
4. **Maintenance of the performance measurement system** – updating the system and its metrics in response to changing objectives (Ukko et al. 2007, 13; Rantanen & Holtari 1999, 14).

Furthermore, according to Ukko et al. (2007, 57), design and deployment process for performance measurement system consists of:

- Initiating the performance measurement system project
- Defining the company's vision and strategy
- Specifying the purpose of the performance measurement system
- Defining key success factors and main objectives
- Defining the metrics
- Finalizing the metrics
- Pilot testing and evaluating the metrics.

2.6.1 Key success factors

Performance measures should focus on the key success factors that enable the organization to remain viable (Bititci, 2015, 25). Ferreira & Otley (2009, 269) says that according to

Thompson and Strickland (2003) activities, attributes, competencies, and capabilities that are crucial for the success of the organization in specific time periods, are the key success factors. According to Ukko et al. (2007, 16), key success factors are linked to organization's strategy, and represent the areas in which the organization must prevail to achieve success.

The key success factors make the organization's objectives visible (Ukko et al. 2007, 16) by translating the vision and mission into key reportable dimensions for a defined period to assess if the vision and mission is achieved (Ferreira & Otley 2009, 269). Using key success factors provided from developed performance measurement frameworks should be applied with caution because organization must know and define their own key success factors considering their specific operations and context in which success is required for achieving progress in these areas. After key success factors are defined, specific performance metrics are then developed for these. (Ukko et al. 2007, 16).

2.6.2 Metrics characteristics

It is needed to use many metrics to achieve a comprehensive and wide perspective of the organization's performance. However, number of individual metrics is good to be limited. (Rantanen & Holtari 1999, 43-44). Kaplan & Norton (2004, 45) suggest around 20 to 30 metrics for a performance measurement system. Also, it is important for the workforce to enforce why to have a specific metric and how it serves the organization's objectives by selecting appropriate, understandable, and realistic measures to prevent a sense of excessive control that could negatively influence employee motivation (Ukko et al. 2007, 12-13) and satisfaction. Rantanen & Holtari (1999, 20) says that according to Sink (1985) and Laitinen (1998), metric's and measurement system's design criteria should be:

- Validity – measuring exactly the thing from which information is desired.
- Accuracy and precision – the results are close to one another.
- Completeness – selected metrics must provide a balanced picture of the operations.
- Uniqueness – one metric for each item to be measured.
- Reliability – the results must be the trustworthy with every measurement instance.
- Comprehensibility – the metrics must be simple enough for everyone to comprehend.
- Quantifiability – the results must be presented as easily perceptible values.
- Controllability – it must be possible to control the metrics.

- Cost effectiveness – the benefits must be higher than the sacrificed resources.
- Relevance – the results must matter in decision-making.
- Credibility – decision-makers can trust the results.
- Timeliness – the results must express the current operations.
- Simplicity – the metrics must be easy to use.

Additionally, according to Rantanen & Holtari (1999, 20) who adapt Latinen (1998), the following requirements should be considered in the metrics:

- They measure longer-term rather than short-term performance.
- Both financial and non-financial
- They are calculated and used continuously.
- Simple and easy to understand and implement.
- Adaptable to changes in the production process.
- They complement other performance metrics.

Rantanen & Holtari (1999, 8) especially highlight that measures should not be only financial but include also non-financial metrics. The challenge with non-financial metrics is that their impact on financial results may not be immediately apparent. For example, improved on-time delivery might not directly increase financial performance. (Rantanen & Holtari 1999, 15). This is also enforced by Ukko et al. (2007, 10), because according to them organization's performance cannot be only measured and managed by financial metrics since it will result in:

- short-sightedness – aim for better short-term results.
- lack of strategic view – no visibility to example quality, employee satisfaction, flexibility, customer needs, competitors, or other non-financial metrics.
- sub-optimization - focus on single things while ignoring holistic continuous improvement.

Metric's measurement itself cannot be achieved without data collection, as it facilitates the statistical and qualitative comparison to another value, both of which must be placed on a scale of measurement (Rantanen & Holtari 1999, 18). Measurement can be direct, using results from the actual subject, or indirect, where measurement targets sub-subjects and the main subject's results are interpreted from those data points (Rantanen & Holtari 1999, 19).

2.6.3 Leading and lagging metrics

Performance measurement systems commonly extend from the organizational level down to the individual level. In such cases, it is essential to ensure that lower-level metrics and objectives support those of the higher levels, meaning that lower-level goals act as enablers for upper-level objectives. (Ukko et al. 2007, 16). Kaplan & Norton (2004, 41-43) says that these cause-and-effect links from bottom to top can be shown visually with strategy maps since it presents how intangible assets are connected to value-creating processes. The cause-and-effect links can be structured with lagging and leading metrics by forming a hierarchical structure from top to bottom, in which the alignment and interconnection of objectives across all levels must be clearly understood (Ukko et al. 2007, 16).

Lagging metrics are the strategy's tangible outcomes that indicate if the strategy is succeeding or failing (Kaplan & Norton 2004, 41) and are usually coming from traditional financial statement information which reflects the historical aspect of performance, indicating how the organization performed during the previous financial period (Ukko et al. 2007, 14). Also, customer value proposition is strongly linked to strategic outcomes and usually contain lagging metrics (Kaplan & Norton 2004, 41). In contrast, leading metrics are measurements that focus on the factors influencing future performance (Ukko et al. 2007, 14) and are connected to lagging metrics by cause-and-effect relationship (Kaplan & Norton 2004, 42). Typical examples of leading metrics include customer satisfaction, product quality, process efficiency, employee satisfaction, and employee competence (Ukko et al. 2007, 14).

2.6.4 Performance management in changing environment

Already over twenty years ago scholars have enforced the fact of changing operation environment and its effects to performance measurement. Example, Rantanen & Holtari (1999, 14) stated in 1999 that the environment where organizations operate has changed and is changing rapidly which affects how stakeholders are satisfied which means performance measurement must be improved. According to Bititci (2015, 23), "One-size-fits-all" solutions rarely apply to performance management for companies, as the world is changing rapidly both socially and economically with increased complexity and demanding current

global challenges and challenges that we can't even imagine yet. On the other hand, accelerating development in almost all areas of science and technology provide means to deal with these challenges. (Bititci 2015, 23;29).

Therefore, changes in the business environment or strategy within the current turbulent and dynamic context may create a need for new or revised measures and metrics (Melnyk et al. 2013, 173; Ukko et al. 2007, 10) where organizations must adapt their performance measurement and management approaches, styles, and processes to meet the needs of each period (Bititci 2015, 29). If these are not updated, the strategy and the performance measures may become unsynchronized (Melnyk et al. 2013,173). According to Ferreira and Otley (2009, 275), the required changes must concern both the design of the performance measurement system, including control techniques and metrics, and the performance management system, including the ways in which information is used.

This means strategic changes must be reformulated into new measures, communicated effectively, and accepted by the participants. The performance measurement and management system should have direct alerts when changes occur in the organizational structure, culture, corporate strategy, or external environment since it is most effective when aligned with these aspects (Melnyk et al. 2013, 174-175). This relationship is illustrated in Figure 5.

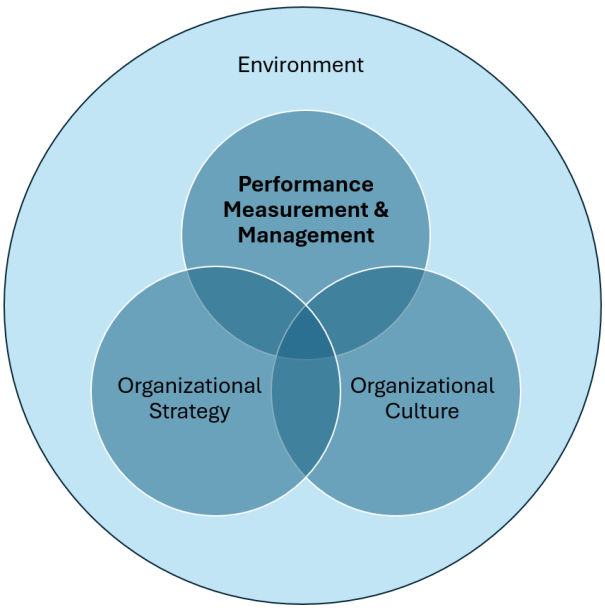

Figure 5. Interfaces of performance measurement and management system (after Melnyk et al. 2013, 175).

2.6.5 Change trends on Performance Management

Nudurupati et al. (2021, 4 & 10) have recognized five key trends that are affecting performance measurement systems' and performance management's usage, purpose, strategic objectives, deployment, measuring and assessments, which are:

- Emerging Technologies
- Networking and Collaboration
- Servitisation and Value Co-creation
- Innovation & Knowledge Work
- Environment & Sustainability

The use of performance measurement systems has evolved towards more interactive, open, and participative where it aims to engage internal and external stakeholders in discussions about organization's performance. The purpose of performance management is also changing, moving away from monitoring and surveillance towards fostering engagement, learning, and continuous improvement. It is transforming from a directive management control tool into a more interactive, performance-enabling framework. (Nudurupati et al. 2021, 9-10)

Performance reviews are becoming more transparent, with performance information being more openly shared, reported, and reviewed across organizations. This is further supported by collaborative and social media technologies, which are enhancing the accessibility of performance information to both internal and external stakeholders within the value creation network. (Nudurupati et al. 2021, 10)

3 Procurement and supply chain management

Outsourcing specific activities or even business functions has risen significantly to achieve strategic objectives, reduce costs, improve customer satisfaction and so on. Example, in United States outsourcing marked has risen to US$92.5 billion in 2019 from US$45 billion in 2000 and same trends are observed in Europe and Asia as well. This means that procurement is a key driver for business success in the increased competitive environment since many companies today spend over half of the sales turnover on purchasing which means efficient supply management and supply chain management are needed to achieve often conflicting customer demands of price, quality, delivery time, flexibility, and sustainability (van Weele & Rozemeijer 2022, 77-79: 2; 210).

According to van Weele & Rozemeijer (2022, 7; 10) procurement refers to “the management of the company’s external resources in such a way that the supply of all goods, services, capabilities and knowledge which are necessary for running, maintaining and managing the company’s primary and support activities is secured at the most favorable conditions covering the materials, information and money flows up to the point of consumption”. Procurement can be either direct or indirect where direct procurement refers to the procurement of all materials and products that are used in the manufacturing of a company's final goods. In the other hand, indirect procurement means the procurement of materials, components, and services that support the company's infrastructure and back-office operations. (van Weele & Rozemeijer 2022, 7-8). Procurement involves:

- Defining procurement requirements, including specifications such as quality and quantity.
- Preparing procurement procedures and processes.
- Conducting sourcing activities, including identifying, selecting, contracting, and managing sources of supply, as well as defining sourcing categories and strategies
- Determining contractual terms and preparing and conducting negotiations with the supplier for agreements.
- Issuing purchase orders to the chosen supplier.
- Performing expediting activities to ensure timely supply and verifying invoices against agreed terms and conditions.

- Assessing supplier performance, including handling claims, resolving disputes, and conducting supplier ratings and rankings.
- Keeping supplier information and documentation updated.

Supply chain management, in contrast, encompasses the management of activities, information, knowledge, and financial flows involved in the logistics and transformation of goods and services from suppliers of raw materials, components, and other inputs, ensuring that end user expectations are met or exceeded. It also includes supplier relationship management (SRM) across all supplier tiers, from first tier suppliers to lower levels. (van Weele and Rozemeijer, 2022, 10; 217). According to Grant et al. (2017, 9), supply chain management refers to the planning and management of all activities involved in sourcing, procurement, conversion, and logistics, as well as the collaboration with partners including suppliers, intermediaries, service providers, and customers. Prater & Whitehead (2013, 9), in the other hand, states that supply chain management involves the cost-effective coordination of the flow and storage of materials, in-process inventory, finished goods, and related information from the point of origin to the point of consumption, all aimed at meeting customer requirements.

3.1 Concept of supply chain

According to Balfaqih et al. (2016, 135-136), Guide et al. says that supply chains play a role throughout the entire product life cycle, from sourcing materials and manufacturing to, the recycling and disposal of the product. Supply chain involves series of companies in the production and delivery of a good or service to final consumers, starting from the source of raw materials and subcomponents to the point of consumption (Prater & Whitehead 2013, 8). From the perspective of the focal company, the supply chain's immediate customers and suppliers are referred to as first-tier customers and suppliers. The subsequent actors in the chain, namely the customers of the first-tier customers and the suppliers of the first-tier suppliers, are considered second-tier customers and suppliers, and this pattern continues throughout the chain. Goods are transported between each tier, and at every stage they are stored or processed by the respective actor. These relationships are illustrated in Figure 6. (Grant et al. 2017, 10).

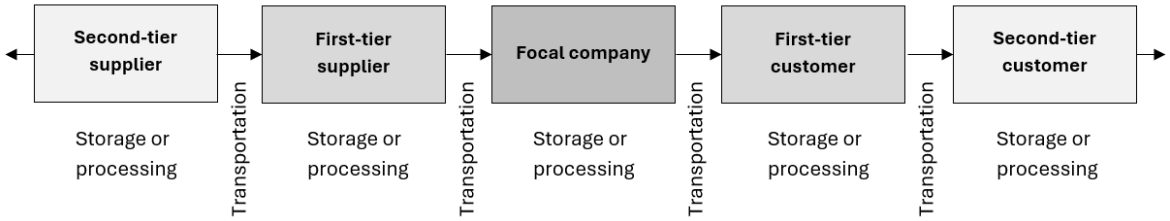

Figure 6. Simplified supply chain network (after Grant et al. 2017, 10).

A supply chain is a network of companies that forms a sequence of interconnected stages responsible for planning, coordinating, and controlling the flow of materials, components, and finished products from suppliers to end customers. Figure 7 illustrates different structural forms that supply chain actors may represent, depending on their position in the chain:

- Diverging – a single input is distributed into several subsequent stages across different industry segments.
- Linear – one item flows directly as the sole input to the next stage.
- Converging – multiple items or inputs are combined in the next stage of the process. (van Weele & Rozemeijer 2022, 215–217).

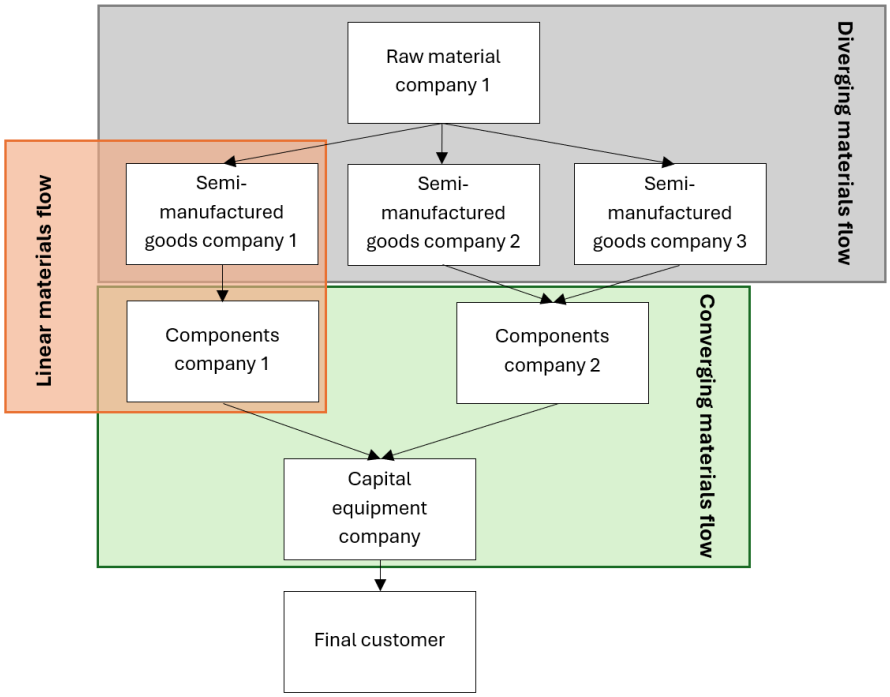

Figure 7. Structure of supply chain (after van Weele & Rozemeijer 2022, 215-216).

3.2 Objectives of procurement and supply chain management

Having the correct product, in the right quantity, from the right supplier, at the right time, at the right location, at the best possible quality and at a competitive price is the ultimate goal of supply chain management and procurement (Prater & Whitehead 2013, 11; Merkert & Hoberg 2023, 8; van Weele and Rozemeijer, 2022, 49; 371). Today, this is increasingly important for a company's competitive position, as business activities are being outsourced to suppliers to a greater extent, which requires procurement and supply chain management objectives to be aligned with the company's overall mission, objectives, and strategic plan (van Weele and Rozemeijer, 2022, 49; 58).

Procurement and supply chain management aims to develop company's supply chain into an optimally efficient and customer-satisfying process, where whole supply chain's effectiveness is more important than individual departments (Prater & Whitehead 2013, 9-10). According to van Weele and Rozemeijer (2022, 49), the objectives of procurement and supply chain management include:

- Operational excellence – ensuring the on-time, on-specification, and on-budget availability of goods and services so that operations can run without interruption.
- Cost and spend management – securing goods and services at the lowest total cost of ownership or best overall value, which requires balancing cost, risk, and value considerations.
- Supply risk management – minimizing exposure to supplier and supply chain risks, such as dependency on a limited number of suppliers, and ensuring that all suppliers comply with responsibility requirements including human rights, child labor prohibition, local regulations, and environmental standards.
- Innovation – leveraging supplier capabilities to support the development of new products, technologies, and processes.

3.3 Supplier relationship management

According to van Weele and Rozemeijer (2022, 238), supplier relationship management is future-oriented where opportunities, risks, resources, and capabilities are collaboratively developed between the buyer and supplier to co-create innovative business solutions. It consists of four management activities:

1. Supplier control – ensuring that suppliers understand and fulfil buyer's requirements by prequalifying and conducting proper screening.
2. Supplier management – assessing, measuring, and monitoring supplier performance, providing feedback, and requesting corrective actions and improvements, when necessary. Enabling two-way communication in which supplier provides improvement suggestions to the buyer as well.
3. Supplier development – supporting suppliers to create better performance and capabilities by knowledge sharing, training, consulting, collaborative problem solving and so on.
4. Supplier innovation – improving relationships and growing business together with business-critical and strategic suppliers by utilizing their innovation capabilities on improving customer value propositions. (van Weele & Rozemeijer 2022, 239-240).

Suppliers should support the strategies and objectives of their customers, as customer growth typically translates into growth opportunities for the supplier as well (van Weele & Rozemeijer 2022, 125).

3.4 Risks in supply chains

Risk can be defined as the variability in the probability distribution of potential outcomes. In a supply chain context, risk refers to unforeseen events that disrupt the normal flow of goods and may result in losses related to productivity, revenue, customer relationships, or even human lives. Although the full costs of such disruptions are difficult to quantify, the Business Continuity Institute reported in 2014 that 23.6 percent of companies included in its study experienced annual supply chain disruption losses exceeding one million euros (Grant

et al. 2017, 212–213). Grant et al. (2017, 214–215) identify several types of risk in global supply chains that require monitoring and mitigation due to their impact on organizational performance, including:

- Demand risk – uncertainty and distortion in demand, such as the bullwhip effect.
- Supply risk – disruptions on the supply side, including design changes, quality problems, price volatility, supply shortages, shipping delays, and natural disasters.
- Operational risk – failures in operations, process variability, accidents, information system outages, and power interruptions.
- Competitive risk – pressures arising from competitor innovations, price reductions, special offers, and price competition.
- Security risk – threats such as terrorism, vandalism, sabotage, and breaches of physical or information security.
- Macroeconomic risk – changes or crises related to economic conditions, government actions, and capital markets.
- Policy risk – national and international policy changes, including sanctions, trade restrictions, taxation, and licensing requirements.
- Reputational risk – loss of trust, negative perceptions, or customer boycotts resulting from misconduct.
- Criminal risk – fraud, bribery, corporate crime, illegal trading practices, and misuse of financial resources.
- Resource risk – depletion of scarce resources, disruptions caused by disasters, and reliance on resources from politically or economically unstable regions. (Grant et al. 2017, 214–215).

3.5 Change trends in supply chains

Businesses are living in an environment of volatility, uncertainty, complexity, and ambiguity (VUCA) (van Weele and Rozemeijer, 2022, 62; Nudurupati et al. 2021, 3). Current and future drivers of change will impact all levels of the supply chain and its management. Thus, it is important to always assess the drivers of changes and its impacts which will affect the adjustment of supply chain operations, circumstances, and objectives (Prater & Whitehead 2013, 34-35; 156).

Merkert & Hoberg (2023, 43-44) have identified four key trend categories that will affect the future of supply chain management which are technological breakthroughs, changing ecosystems, changing customer requirements, climate and resource security. For harmonization reasons, climate and resource security will be renamed as sustainability.

3.5.1 Technological breakthroughs

Currently there are many supply chain 4.0 technologies piloted and tested which will enable new opportunities and affect fundamentally supply chain processes regarding efficiency, resilience, agility, and customer orientation. However, it also brings concerns regarding internet security and loss of human capabilities. (Merkert & Hoberg 2023, 6). Recognized technologies transforming procurement processes and the ways in which organizations collaborate with suppliers across the supply chain are e-sourcing, big data, blockchain, artificial intelligence, robotic process automation (van Weele and Rozemeijer 2022, 18), advanced robotics, autonomous transport, virtual applications, smart sensor applications, supply chain analytics technologies, analytics for end-to-end supply chain planning, analytics for transport and warehousing, process automation, and collaboration platforms (Merkert & Hoberg 2023, 7).

The ongoing shift towards higher levels of automation and robotics has been decreasing the reliance on labor in manufacturing, thereby diminishing the cost advantages traditionally held by low-wage countries. Technology like additive manufacturing or industrial 3D printing, is shifting production from centralized, low-cost locations to on-demand, local manufacturing, which reduces lead times and increases supply chain resilience against disruptions. (Gattorna et al. 2022, 30-31).

Recent technological advancements have risen the exposure to cyber risks. Supply chains are particularly vulnerable due to reliance on multiple IT systems, while many hosted in the cloud. Cyberattacks can lead to substantial costs as companies resort to manual and alternative methods to maintain operations. Also, the long-term damage to customer relationships is likely significant. (Gattorna et al. 2022, 34).

3.5.2 Changing ecosystems

Increased market concentration, omni-channel distribution, e-commerce, horizontal and vertical collaborations, shift from globalization to onshoring or sure shoring, and political regulation has increased the need for resilient and agile supply chains. (Merkert & Hoberg 2023, 9). The concentration of supply nodes, including reliance on a single supplier for critical inputs, suppliers located in specific geographic areas, or a sizable portion of goods moving through one port or airport, is now recognized as a vulnerability in supply chains. Since COVID-19, there is a growing focus on domestic manufacturing and self-sufficiency in strategic inputs, reducing reliance on politically unstable sources. (Gattorna et al. 2022, 30-31).

As competition today in global markets are supply chain to supply chain, it is important to evaluate companies' supply chain flexibility, reliability, and role (Prater & Whitehead 2013, 5). This has resulted that many have shifted towards global sourcing which refers to the proactive integration and coordination of common items, materials, processes, designs, technologies, and suppliers from a global perspective across operational locations. Therefore, companies establish international procurement offices in various regions worldwide, which requires effective navigation of diverse cultures and languages. Procurement must be also capable of working within cross-functional teams and solving the conflicting requirements of stakeholders such as engineering, production, and logistics. (van Weele and Rozemeijer, 2022, 18).

Companies are increasingly outsourcing non-core processes and functions, with some organizations even externalizing most of their operational activities. This requires management of assets, activities, performance, and people that they do not control and possible never even see. It also requires that management of supply chain must extend to include management of suppliers' suppliers. (Prater & Whitehead 2013, 157-158). A

growing share of innovations originates from suppliers, necessitating earlier and closer involvement with them in new product development and innovation. This requires organizations to adapt their innovation processes and supplier relationship practices. Furthermore, procurement should consider how to reward innovative and high-value suppliers through gain and risk-sharing agreements, which help build longer-term and stronger supplier relationships. (van Weele and Rozemeijer 2022, 18).

3.5.3 Changing customer requirements

Complexity of design, sourcing, and manufacturing has risen since customers expect options and customization of products. The same time, everything is used to get in the next or same day with one-click ordering and instant gratification. This will lead to hyper-expectations also in business-to-business customers and it might be challenging to charge these expectations. (Merkert & Hoberg 2023, 8). Two supply chain paradigms, lean and agile, have been developed to address the need for greater efficiency in manufacturing operations and shorter lead times across logistics and supply chains (Grant et al. 2017, 17).

The lean paradigm focuses on minimizing inventory and work in progress while enabling just-in-time operations, making it suitable for organizations operating in high-volume and low-variety environments. In contrast, the agile paradigm aims to respond quickly to changes in customer demand in terms of volume and variety by emphasizing flexibility and responsiveness, which is appropriate for environments characterized by demand uncertainty and high product variety. In practice, most companies are likely to require a combination of both lean and agile approaches across different supply chains and product categories. (Grant et al. 2017, 17–18).

Globally, demand dynamics are shifting, with Asia becoming increasingly significant as a consumer of world production. By 2040, it is estimated that Asia will generate 50% of global GDP and account for 40% of global consumption. As consumption grows, a larger share of local production in Asia will be directed toward the regional market. (Gattorna et al. 2022, 35).

3.5.4 Sustainability

Society and national governments increasingly demand higher levels of corporate social responsibility, regulatory compliance, business integrity, and environmental and climate performance which in turn drives governments to introduce stricter regulations to address these challenges (van Weele & Rozemeijer 2022, 18; 283). Additionally, to increased attention on protecting the environment, concerns about social dimensions are rising, where supply chains should achieve social sustainability (DeSmet 2024, 132). This includes that companies must act socially responsible regarding legal, economic, ethical, and discretionary dimensions (Quarshie et al. 2016, 4).

In 2015 nations around the world agreed to limit global warming to 1.5°C which requires significant decrease of carbon emissions by 2030 and near-zero emissions by 2050. These reduction efforts fall to supply chain management since manufacturing and shipping all kind of products are associated to it. Supply chain must collaboratively reduce emissions, especially since reducing scope three emissions which includes indirect emissions in companies' value chain, are increasingly becoming more important. (Merkert & Hoberg 2023, 7-8). Additionally, many large corporations need to report sustainability impacts alongside financial results (Gattorna et al. 2022, 31).

Growing attention is being directed towards the circular economy, in which products and materials are continuously reprocessed through either biological or technical cycles. This concept is now extending into procurement as *circular sourcing*, which is still in its early stages but is expected to develop rapidly and challenge current sourcing practices (van Weele & Rozemeijer 2022, 297–300). Closely related to this development is the growing importance of reverse logistics, which affects companies' competitive advantage. Reverse logistics means that the manufacturer of products systemically accepts shipped goods from consumption point for recycling, remanufacturing, resale, or disposal. (Prater & Whitehead 2013, 159-160).

Procurement must adopt proactive measures to secure access to critical materials and products since essential resources such as water, agricultural land, food products, oil, gas, and energy face unprecedented demand, creating volatility and uncertainty in both availability and pricing (van Weele & Rozemeijer 2022, 18). Demand patterns can become highly unpredictable during external disruptions which means products with stable buying

practices became suddenly unavailable due to concerns about future availability. (Gattorna et al. 2022, 35). This means acquiring commodities and raw materials at reasonable and steady price has become challenging and race between countries securing future rights of these commodities for their growth and it might be difficult to access these materials in the future. (Merkert & Hoberg 2023, 7-8).

As a result of all these sustainability trends, procurement must address these expectations throughout the supply chain and pursue sustainable procurement which can improve profitability and enable companies to outperform less sustainable competitors. (van Weele & Rozemeijer 2022, 18; 283).

4 Performance measurement and management in procurement and supply chains

According to van Weele & Rozemeijer (2022, 246–248), the role of suppliers in the value chain has increased, which calls for objective assessment and management of procurement and supply chain performance to identify strengths and weaknesses that may affect the ability to meet long-term buyer requirements, ensure sustained supply, and support negotiations on performance improvements. An increase in the number of supply chain tiers and suppliers adds to overall supply chain complexity, thereby increasing the need for enhanced visibility and monitoring, as customers and consumers commonly hold focal companies responsible for activities occurring deeper in the supply chain, even when those activities are beyond the company's direct control (Grant et al. 2017, 158).

Procurement and supply chain performance refers to the extent to which the procurement function can achieve its predetermined objectives while using the company's resources as efficiently as possible. In this context, procurement performance aims at flawless procurement and business processes operating at the lowest achievable cost, as reflected in effective material cost control, delivery lead times, supplier on-time performance, supplier product quality, and supplier sustainability performance. (van Weele & Rozemeijer 2022, 370–371).

One method for assessing procurement and supply chain performance is the use of a limited set of key performance indicators that provide measurement data on supply chain performance (van Weele & Rozemeijer 2022, 246–248) and in the past decades there have been developed many approaches, techniques, criteria, and metrics for performance measurement of supply chain depending on the supply chain strategy (Balfaqih et al. 2016, 144). This includes the use of models ranging from the Balanced Scorecard to the Supply Chain Operations Reference (SCOR) model, with various analysis methods such as Delphi and uncertainty-based approaches, incorporating a wide range of criteria and metrics from financial performance to innovation. (Balfaqih et al. 2016, 144-145). Common between all these systems is that they aim to provide comprehensive view of the performance within the system's dimensions. (Rantanen & Holtari 1999, 44).

Performance measurement and management supports companies in managing their supply chains in competitive and turbulent global markets by enabling the monitoring of supply chain strategy implementation, identifying areas for improvement, and providing benchmarks against competitors to support decision making (Grant et al. 2017, 261). Practitioners have identified following purposes for procurement and supply chain performance measurement:

- To identify procurement success, progress on improvement plans and if customer needs are achieved (Gunasekaran & Kobu 2007, 2820) by increasing transparency to results and objectives (van Weele and Rozemeijer 2022, 369).
- To support procurement to understand its processes and revealing what they know and what they do not know. (Gunasekaran & Kobu 2007, 2820).
- To identify supply chain problems, bottlenecks, waste and where improvements are needed (Gunasekaran & Kobu 2007, 2820) to have greater value creation from procurement activities (van Weele and Rozemeijer 2022, 369).
- To have improved decision on supply chain (van Weele and Rozemeijer 2022, 369) by basing them on facts and not on emotion, faith, or intuition (Gunasekaran & Kobu 2007, 2820).
- To have enhanced communication between procurement departments and higher levels of motivation (van Weele and Rozemeijer 2022, 369).
- To achieve cost reductions, lower material prices, and fewer rejections on supply chain (van Weele and Rozemeijer 2022, 369).

4.1 Dimensions and metrics

Practitioners have developed a wide range of supply chain dimensions and metrics, many of which overlap, reflecting the inherent complexity of supply chains (Grant et al. 2017, 261). Balfaqih et al. (2016, 144) made a literature review and identified the following as the most typical dimensions in procurement and supply chain performance management: financial, customer, internal processes, learning, innovation, flexibility, reliability, time, responsiveness, quality, asset management, efficiency, resource, output, information, sustainability, human resource, integration, and risk.

It has been also suggested that achieving sustained supply chain performance requires the application of the triple bottom line approach as demonstrated in Figure 8 which involves

evaluating supply chain performance in terms of economic, environmental, and social perspectives (Grant et al. 2017, 259) while identifying the linkages between these perspectives, adopting a future-oriented approach, and ensuring active participation from relevant stakeholders (Beske-Janssen et al. 2015, 673).

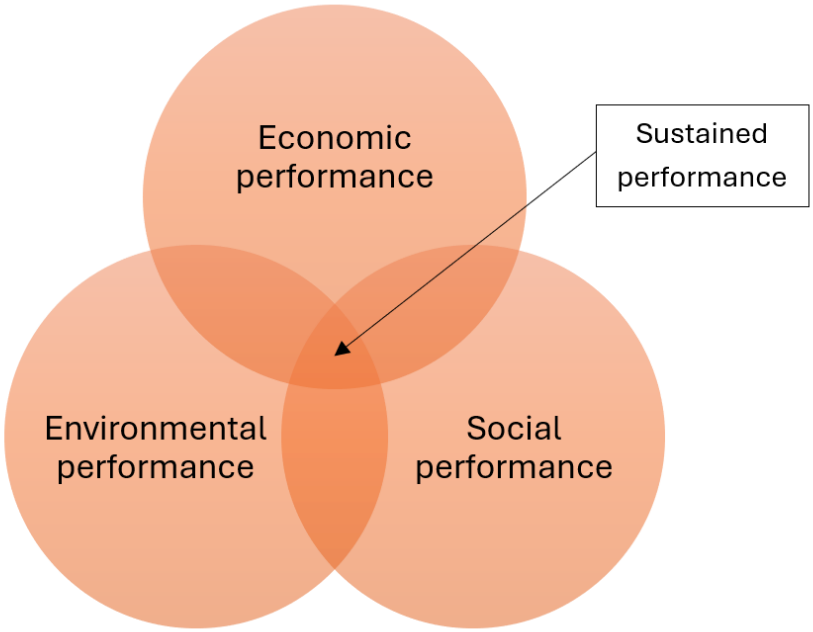

Figure 8. Sustained performance in the triple bottom line method (after Grant et al. 2017, 259).

Van Weele and Rozemeijer (2022, 256; 366; 371–375; 378; 383-384; 386) propose the following dimensions and metrics for measuring procurement and supply chain performance, which include:

- Price and cost – this dimension relate to cost control measures such as monitoring prices to manage them, conducting should cost analyzes, tracking activities aimed at reducing costs, achieving cost savings such as hard savings, soft savings, recurring savings, and one-off savings. It also includes cash improvements, such as payment terms, reverse factoring, inventory reduction, outsourcing, and lease-back arrangements.

- Product quality and innovation – this dimension is associated with total quality management and innovation, ensuring that the supply chain delivers products according to specifications, particularly in new product development, while achieving target costs and time-to-market objectives. Relevant measures include the number of change orders, sample rejection rates, complaints, reject rates, supplier-driven innovation projects, business impact of supplier innovation, and a nonconformity index reflecting both the frequency and severity of deviations.

- Delivery and logistics – this dimension concern the control of timely and accurate processing of procurement requisitions, supplier delivery reliability, monitoring suppliers' on-time delivery performance, lead time reductions, ensuring that delivered quantities are correct, and index that is calculated using weighted factors reflecting the proportion of deliveries that arrive early, on time, or late.

- Sustainability and compliance – this dimension focus on ensuring the sustainability of purchased materials and services, the number of sustainability improvement initiatives, reductions in suppliers' carbon dioxide emissions, the percentage of spend covered by approved purchase orders, the percentage of spend under formal contracts, contract compliance rates, and the number of approved suppliers.

- Organizational – this dimension relates to the internal resources required to achieve procurement objectives, including employees, management, processes, tools, templates, procedures, and systems.

- Supplier relationship – this dimension refers to external resources used to achieve objectives at both operational and strategic levels of supplier relationships, where the operational level includes factors such as price, quality, supplier response lead times, on-time delivery, and the strategic level includes the overall quality of the relationship and supplier satisfaction which can be found out by conduct periodic supplier satisfaction surveys to measure how satisfied suppliers are with the relationship, and whether there are areas where the buyer should improve.

- Risk management, such as the percentage of requirements not secured by formal contracts, the number of single-source suppliers, value chain optimization and make or buy decisions. (van Weele and Rozemeijer 2022, 256; 366; 371–375; 378; 383-384; 386).

Additionally, van Weele and Rozemeijer (2022, 351–352) enforce that the starting point for any procurement performance strategy is a clear and detailed overview of total procurement spend. By analyzing, collecting, cleansing, and classifying spend data, organizations can achieve visibility to spend, identify cost saving opportunities, identify supply risks, streamline procurement processes, manage maverick spending, identify issues related to contract compliance and benchmark spend internally and externally. Such analysis provides a comprehensive overview of procurement-related measures, such as:

- spend by commodity or category,
- number of suppliers by commodity or category,
- number of transactions by commodity or category,
- key indicators related to compliance with procurement policies and contracts,
- average purchase order value,
- spending distribution across key customers,
- material prices and price developments,
- total spend by supplier,
- spend by organizational function,
- and number of buyers per commodity or category.

Gunasekaran & Kobu (2007, 2835) and Shepherd et al. (2006, 248-251) list performance metrics for supply chain management, presented in Table 1, which are structured according to older version of supply chain operations reference (SCOR) phases which were plan, source, make, deliver, and return or customer satisfaction.

Table 1. Performance metrics for supply chain management (after Gunasekaran & Kobu (2007, 2835) and Shepherd et al. (2006, 248-251))

Plan	Sales Profit Return on investment Rate of return on investment Net profit vs productivity ratio Information carrying cost Variations against budget Total supply chain management costs

	Selling price of goods and services Cost of goods sold Asset turns Value added productivity Overhead cost Intangible cost Incentive cost and subsides Sensitivity to long-term costs Percentage sales of new product vs sales Expansion capability Capital tie-up costs Total supply chain response time Total supply chain cycle time Order lead time Order fulfilment lead time Customer response times Product development cycle time Total cash flow time Cash-to-cash cycle time % decrease in time to produce a product Fill rate Order entry methods Accuracy of forecasting methods Autonomy of planning Perceived effectiveness of departmental relations Order flexibility Perfect order fulfilment Product and service variety Mix flexibility New product flexibility Number of new products launched Use of new technology Bidding management cycle time Compliance to regulations
Source	Supplier cost-saving initiatives Percentage of late or wrong supplier delivery Supplier lead time against industry norm Supplier's booking-in procedures Purchase order cycle time Efficiency of purchase order cycle time Buyer–supplier partnership level Level of supplier's defect-free deliveries Supplier rejection rate Mutual trust Satisfaction with knowledge transfer Satisfaction with supplier relationship Supplier assistance in solving technical problems Extent of mutual planning cooperation leading to improved quality Extent of mutual assistance leading in problem-solving efforts Distribution of decision competences between supplier and customer Quality and frequency of exchange of logistics information between supplier and customer

	Quality of perspective taking in supply networks Information accuracy Information timeliness Information availability Supplier ability to respond to quality problems
Make	Labor efficiency Total cost of resources Manufacturing cost Inventory investment Inventory obsolescence Work in process Cost per operation hour Capacity utilization Inventory cost Inventory turnover ratio Inventory flow rate Inventory days of supply Economic order quantity Effectiveness of master production schedule Accuracy of scheduling Number of items produced Warehouse costs Stock capacity Inventory utilization Stockout probability Number of backorders Number of stockouts Stock-out cost Average backorder level Percentage of excess/lack of resource within a period Storage costs per unit of volume Disposal and scrap costs Planned process cycle time Manufacturing lead time Time required to produce a particular item or set of items Time required to produce new product mix Inventory accuracy Inventory range Percentage of wrong products manufactured Conformance to specifications Production flexibility Capacity flexibility Volume flexibility Number of tasks worker can perform
Deliver	Total logistics costs Distribution costs Delivery costs Transport costs Transport costs per unit of volume Personnel costs per unit of volume moved Transport productivity

	Shipping errors Delivery efficiency Percentage accuracy of delivery Delivery lead time Frequency of delivery Product lateness Average lateness of orders Average earliness of orders Percent of on-time deliveries Delivery performance Delivery reliability Number of on-time deliveries
Return or customer satisfaction	Effectiveness of distribution planning schedule Effectiveness of delivery invoice methods Driver reliability for performance Quality of delivered goods Achievement of defect-free deliveries Quality of delivery documentation Delivery flexibility Responsiveness to urgent deliveries Transport flexibility Warranty/returns processing costs Customer query time Customer satisfaction (or dissatisfaction) Level of customer perceived value of product Customer complaints Rate of complaint Product quality Flexibility of service systems to meet particular customer needs

4.1.1 Sustainability dimension

The main objective of sustainable supply chain management is to reduce risk and improve performance by developing supply chains that are less harmful and that contribute positively to sustainability outcomes (Beske-Janssen et al. 2015, 672; 675) and to society (Grant et al. 2017, 259). According to van Weele and Rozemeijer (2022, 298), a wide range of performance metrics can be used to evaluate suppliers' sustainability performance, including:

- the percentage of suppliers that have signed the supplier code of conduct.
- the percentage of spend sourced from sustainable suppliers.
- the number of supplier sustainability audits conducted.

- carbon emissions, energy consumption, and waste reductions in the supply chain.
- the number of incidents related to labor practices and supplier code of conduct violations.

Cuthbertson and Piotrowicz (2011, 594) add the following sustainability-related metrics for procurement and supply chain:

- kilometers travelled per year for procurement activities,
- the percentage of suppliers certified according to ISO 14001, and
- the level of airfreight used in logistic.

In addition, widely used sustainability frameworks and ratings can be leveraged to develop measures for supplier sustainability performance evaluation, such as the Dow Jones Sustainability Index, EcoVadis, ISO standards (van Weele & Rozemeijer 2022, 289) and the Global Reporting Initiative (GRI) as they already provide comprehensive coverage of supply chain–related topics (Beske-Janssen et al. 2015, 675). Example, ISO has developed standard ISO 14031 to provide guidance to companies how to select environmental performance metrics and how to design and measure environmental performance which is meant for any company regardless of size, complexity, location, and type (Grant et al. 2017, 262). Another one is the ISO 20400 standard, introduced in 2017, which provides guidance for sustainable procurement and can support supplier sustainability performance management as well as the development of sustainable procurement practices (van Weele & Rozemeijer 2022, 289).

4.2 Supply Chain Operations Reference Digital Standard (SCOR DS) model

The SCOR model is one of the most important and most widely used approach in the supply chain performance measurement literature (Akyuz & Erkan 2010, 5152). The Supply Chain Operations Reference Digital Standard (SCOR DS) is a model developed by the Association for Supply Chain Management (ASCM) that provides methodologies, diagnostic and benchmarking tools to support organizations in achieving improvements in supply chain processes. SCOR offers a comprehensive framework for evaluating and comparing supply chain activities and performance by integrating business processes, performance metrics, best practices, and technologies into a unified structure. (ASCM 2025, 4).

The SCOR model is structured around process levels 0 to 3, where the level-0 process is Orchestrate which is strategy level and influences all the levels below it. Level-1 processes include Plan, Order, Source, Transform, Fulfill, and Return, and level-3 processes focus on more detailed activities. Companies may further develop standardized process descriptions within level-3, which then form level-4 processes. The SCOR model emphasizes processes rather than functions, meaning it concentrates on the activities themselves instead of the organizational units or individuals performing them (ASCM 2025, 4–6; 9).

SCOR is a process reference model that consists of four major sections:

- Performance – includes standard metrics to describe process performance and define strategic goals.
- Processes – offers standard descriptions of management processes and process relationships.
- Practices – explains management practices that produce significantly better process performance.
- People – comprises standard definitions for skills required to perform supply chain processes. (ASCM 2025, 6).

The Performance section focuses on understanding, evaluating, and diagnosing supply chain performance, recognizing three performance categories and eight performance attributes as demonstrated in Table 2. Each performance attribute includes metrics at level-1, level-2, and level-3 processes, where the relationships between these levels are diagnostic, such that level-2 metrics serve as diagnostics for level-1 metrics and level-3 metrics serve as diagnostics for level-2 metrics. (ASCM 2025, 8-9).

Table 2. SCOR model performance categories, attributes, and metrics (after ASCMa 2025 and ASCMb n.d.)

Performance attribute	**Metrics**
Performance category: **Resilience**	
Reliability	RL 1.1 Perfect Customer Order Fulfillment • RL 2.1 Percentage of Orders Delivered in Full to the Customer • RL 2.2 Delivery Performance to Original Customer Commit Date

	• RL 2.3 Customer Order Documentation Accuracy • RL 2.4 Customer Order Perfect Condition RL 1.2 Perfect Supplier Order Fulfillment • RL 2.5 Percentage of Orders Delivered In Full from the Supplier • RL 2.6 Delivery Performance to Original Supplier Commit Date • RL 2.7 Supplier Order Documentation Accuracy • RL 2.8 Supplier Order Perfect Condition RL 1.3 Perfect Return Order Fulfillment • RL 2.9 On Time • RL 2.10 In Full (Correct Product) • RL 2.11 Correct Documentation • RL 2.12 Perfect Condition RL Level-3 metrics: Up to 60 metrics defined in the SCOR Digital Standard (not listed here).
Responsiveness	RS 1.1 Customer Order Fulfillment Cycle Time • RS 2.1 Order Cycle Time • RS 2.2 Source Cycle Time • RS 2.3 Transform Cycle Time • RS 2.4 Fulfill Cycle Time • RS 2.5 Return Cycle Time RS Level-3 metrics: Up to 118 metrics defined in the SCOR Digital Standard (not listed here).
Agility	AG 1.1 Supply Chain Agility • AG 2.1 Order Agility • AG 2.2 Source Agility • AG 2.3 Transform Agility • AG 2.4 Fulfill Agility • AG 2.5 Return Agility AG Level-3 metrics: Up to 14 metrics defined in the SCOR Digital Standard (not listed here).
Performance category: **Economic**	
Costs	CO 1.1 Total Supply Chain Management Cost • CO 2.1 Order Management Cost • CO 2.2 Material Acquisition Cost • CO 2.3 Inventory Carrying Cost • CO 2.4 Supply Chain Finance & Planning Cost • CO 2.5 Supply Chain IT Cost CO 1.2 Cost of Goods Sold (COGS)

	• CO 2.6 Direct Material Cost • CO 2.7 Direct Labor Cost • CO 2.8 Indirect Cost Related to Production CO Level-3 metrics: Up to 26 metrics defined in the SCOR Digital Standard (not listed here).
Profit	PR 1.1 Earnings Before Interest and Taxes (EBIT) as a Percent of Revenue PR 1.2 Effective Tax Rate
Assets	AM 1.1 Cash-to-Cash Cycle Time • AM 2.1 Days Sales Outstanding • AM 2.2 Inventory Days of Supply • AM 2.3 Days Payable Outstanding AM 1.2 Return on Fixed Assets • AM 2.4 Revenue • AM 2.5 Fixed Assets AM 1.3 Return on Working Capital • AM 2.6 Accounts Payable • AM 2.7 Accounts Receivable • AM 2.8 Inventory AM Level-3 metrics: Up to 34 metrics defined in the SCOR Digital Standard (not listed here).
Performance category: **Sustainability**	
Environmental	EV 1.1 Materials Used • EV 2.1 Renewable Materials Used • EV 2.2 Nonrenewable Materials Used EV 1.2 Energy Consumed • EV 2.3 Renewable Energy Consumed • EV 2.4 Nonrenewable Energy Consumed EV 1.3 Water Consumed • EV 2.5 Water Withdrawal • EV 2.6 Water Discharged EV 1.4 GHG Emissions • EV 2.7 Direct (Scope 1) GHG Emissions • EV 2.8 Energy Indirect (Scope 2) GHG Emissions • EV 2.9 Other Indirect (Scope 3) GHG Emissions EV 1.5 Waste Generated • EV 2.10 Generated Waste Diverted from Disposal • EV 2.11 Generated Waste Directed to Disposal

	EV Level-3 metrics: Up to 25 metrics defined in the SCOR Digital Standard (not listed here).
Social	SC.1.1 Diversity and Inclusion SC.1.2 Wage Level SC.1.3 Training SC Level-3 metrics: Up to 13 metrics defined in the SCOR Digital Standard (not listed here).

The Practices section consist of industry-neutral practices that represents a unique way to configure a process or a set of processes, where the uniqueness may stem from process automation, the application of specific technologies, the use of specialized skills, a distinctive sequence of process execution, or a unique method for distributing and connecting processes across organizations. The People section provides a standard for describing skills required to perform tasks and processes on supply chain management domain where the key elements are skills, experiences, and training. (ASCM 2025, 10).

5 Case company and empirical findings

5.1 Case company and research case

The case company is a large technology enterprise operating in the industrial sector across more than fifty countries. It has numerous market areas and offices worldwide, serving customers on a global scale. The company employs approximately 17,000 people globally and generates an annual turnover of €4.9 billion. Its headquarters is in Finland, and its shares are listed on the Nasdaq Helsinki stock exchange.

The research case company has undergone major restructuring in recent years, including divestments and combinations of business lines and areas, reorganization of organizational and leadership structures, harmonization of tools and systems, and streamlining of processes and procedures. Many of these reform initiatives have already been completed and have created additional value for the company. However, several changes are still ongoing or planned, presenting both opportunities and challenges that must be addressed to ensure successful implementation.

Additionally, the company has recently released its strategy for the 2026–2030 period, setting clear objectives for its future direction. The strategic focus emphasizes business growth, enhanced profitability, stronger customer centricity, market leadership, and an increased contribution from the aftermarket. These priorities translate into objectives such as delivering the best customer experience, expanding the share of aftermarket sales, achieving leadership in sustainability and safety, and maintaining financial excellence. The financial targets include annual sales growth of at least 7%, an adjusted EBITA margin exceeding 18%, a net debt-to-EBITDA ratio below 1.5, and a dividend payout of at least 50% of earnings per share. (Case company’s website 2026).

The company operates global manufacturing supply chains in which a dedicated team is responsible for performance management and measurement related to direct sourcing, including the definition of measurement methods and appropriate indicators. However, no realignment or harmonization of these practices has taken place following the recent restructuring, and considering the new strategy, there is a clear need to further develop the

existing performance measurement and management approaches to better address current operational requirements.

Currently, the company's performance measurement is conducted at multiple levels, ranging from group level and business areas to individual functions and teams. Results and targets are reported frequently to stakeholders and are also used as a basis for employee bonus payments. Procurement and supply chain performance is currently measured using key performance indicators such as spend, savings, weighted average payment term, vendor on-time arrival, on-time delivery, customer satisfaction, customer claims, vendor non-conformities, cost of poor quality, chargebacks, supplier audits, and vendor engagement in CO_2 reduction.

Procurement and supply chain measurements are improved annually, and new metrics are added periodically. However, a well-defined and systematic process for defining these metrics in line with best practices identified in the literature is missing. In addition, the presentation of performance metrics is scattered across different dashboards, and data collection is not fully streamlined, which may lead to misinterpretation of overall performance or the use of outdated data in performance management decision-making. Nevertheless, the company's supply chain performance measurement system has a solid foundation with well-functioning metrics that are frequently reported, and these metrics primarily need clearer definition regarding how they create value for the company as a whole and support its strategic objectives.

5.2 Method for interviews

Interviews can be structured, semi-structured, or unstructured. Semi-structured interviews, also known as thematic interviews, focus on selected themes without a highly detailed or fixed structure regarding the wording or order of questions (Metsämuuronen 2006, 114–115). Hyvärinen et al. (2017, 21–22) state, based on Hirsjärvi and Hurme (2001), that the core idea of a thematic interview is to develop essential themes that must be addressed during the interview and that these themes should be clearly linked to the research topic and the underlying theory. Kvale (2007, 37–39) further suggests that, to develop interview themes and questions, the researcher must first have a clear understanding of the purpose of the research and the theoretical background of the subject. The purpose of the research and the

interviews may, for example, be to obtain empirical knowledge of participants' typical experiences of a topic or to further develop theoretical conceptions of the topic. By developing a theoretical understanding of the phenomenon, the researcher understands the foundation to which new knowledge is added, as without existing knowledge of the topic it is difficult to determine whether the knowledge obtained through interviews is new and what its scientific contribution is. (Kvale 2007, 37–39).

It is important to consider what kind of data is needed and how it will be used when developing interview questions. The researcher can decide whether the questions aim to elicit narratives, descriptions, explanations, or direct facts. It is also recommended to avoid questions that can be answered only with 'yes' or 'no' (Hyvärinen et al. 2017, 25; 27)

The interviews in this research will be conducted using a semi-structured interview with a thematic approach, as the data collection is intended to focus on specific themes derived from the research questions and further guided by the theoretical background established through the literature review. The purpose is to obtain empirical knowledge from the participants from the main themes that contributes to the construction of a performance management and measurement framework for a company that outsources the manufacturing of its supply through global supply chains. That is why the questions are formulated to achieve descriptions, explanations, and direct facts, rather than simple 'yes' or 'no' answers. The selected themes and interview questions by the researcher are presented in Appendix 1.

For generalizability reasons related to the research topic, interviewees should be selected so that they share relatively similar experiential backgrounds, possess relevant knowledge related to the research problem, and demonstrate interest in the research topic (Eskola & Suoranta 2014, 66). Furthermore, it would be important to involve the individuals and organizations that will ultimately apply the construct in its design and implementation process (Oyegoke 2011, 591–592).

For these reasons, the interviews in this research were selected from the case-company for which the framework is developed. Nine interview participants were chosen globally from different regions within the procurement function managing manufacturing supply chains, representing sourcing, purchasing, logistic and quality roles across both higher and operational management levels. This selection was intended to capture a broad range of perspectives and experiences for the research topic.

5.3 Results of interviews

Interviews were conducted between 19.02.2026 and 02.03.2026 via the Microsoft Teams application. All interviews were recorded to support the transcription of responses. The personal details of the interviewees are not presented in this report to protect the privacy of both the individuals and the organization. The results are anonymized and presented in a way that they cannot be linked to any specific respondent, region, position, or function. Participants are referred to as P1 to P9.

For Finnish participants, the questions and discussions were conducted in Finnish and later translated and transcribed into English. For non-Finnish-speaking participants, the interviews were conducted and transcribed in English. The interview results were transcribed using a clean verbatim approach to improve grammar and clarify the respondents' intended meaning. The results are presented and analyzed in written format, and responses are tabulated where feasible to support the illustration of findings.

There was a total of five themes covered in the interviews, and each theme included three to five main questions that were asked of all participants. The main questions also included additional sub-questions, which were used when further clarification or deeper insights were needed from the participant. The themes were as follows:

- Current practices in Performance Measurement and Management
- Supplier Relationship Management in Performance Management
- Design requirements for the new framework
- Organizational Control and Individual's role in Performance Management
- Risk, Resilience, and Future Trends in Supply Chain Performance Management

5.3.1 Current practices in Performance Measurement and Management

In this theme, the aim was to understand how the supply chain performance is currently measured and managed in the case-company, how performance information is utilized in their organization for supply chain management and would existing supply chain

performance frameworks bring any value for their organization and what should be considered in the implementation of such frameworks.

Interviewees were asked to describe how supply chain performance is currently measured and managed in their organization. The most mentioned performance measurement metrics in the case-company for supply chain performance management are presented in the Table 3. Additionally, also following metrics were mentioned from 1 to 3 participants: Suppliers' Terms of Payment (TOP), chargebacks toward vendors, EBITDA, On-Time-Inspection, adherence to operational processes, purchase order volume and goods receipts (GR). It was also noted from the interviews that employees have personal KPIs that are tied to bonus targets. These personal KPIs are developed together with the line manager and might vary depending on the organizational function and position, but usually they are related to the function's objectives.

Table 3. Most mentioned performance metrics by the interviewees

Metrics	**Number of Participants Mentioning**
On-Time Arrival (OTA)	6 of 9
On-Time-Delivery (OTD)	5 of 9
Cost Efficiency or Savings	5 of 9
NCR rate	5 of 9
Cost of Poor Quality	5 of 9
Supplier Science Based Targets initiative (SBTi) commitment	5 of 9

Several interviewees described the current set of performance metrics as limited both in number and scope. Participants noted that the overall number of supply chain metrics is relatively small and that supplier performance management through metrics is only implemented to a limited extent. Measurement practices appear to focus primarily on a narrow set of indicators, with the main emphasis on logistics-related metrics, while other important dimensions, such as quality, were perceived as insufficiently covered. One interviewee (P6) described the situation as follows: "*In my view, we have a very limited number of such metrics, and we may measure key metrics rather poorly at a general level.*" Another interviewee (P1) stated: "*Nowadays, when talking about procurement and supply*

chain and their performance, the company is primarily measured with the traditional KPIs." These views suggest that the current measurement system does not comprehensively reflect supply chain performance as a multidimensional framework and that the existing system may not provide a sufficiently holistic view of supply chain performance.

A second major concern identified in the interviews relates to the reactive nature of current performance measurement and management practices. Multiple interviewees emphasized that measurement practices focus primarily on achieved outcomes and that the system mainly supports retrospective evaluation rather than identifying root causes of deviations or enabling predictive actions. As one interviewee (P7) explained: "*A lot of performance management ends up being reactive, but it should be more proactive*." Another participant (P8) described the situation as follows: "*Overall, the metrics are rear-view-mirror looking so they don't tell us very much*." One participant (P1) further emphasized the unrealized potential of leveraging data for predictive purposes: "*I believe the potential is much bigger, huge even, if we can find a way to translate all this data into predictive situations instead of continuing to react*." These statements indicate that while performance data is collected, its analytical use remains primarily reactive. The findings therefore point to a need to strengthen the predictive and preventive capabilities of the performance management system to support more proactive supply chain control and risk mitigation.

Thirdly, the respondents highlighted concerns regarding the credibility and relevance of the metrics used. One interviewee (P8) questioned the reliability and relevance of existing performance indicators, stating: "*Unfortunately, their credibility is not 100%. We use certain common metrics, but not all of them are relevant given the diversity of our business."* Another interviewee (P1) noted: "*I'm observing that these measures are not always consistent."* At the same time, it was recognized that KPIs should be measurable and target oriented. One interviewee (P3) stated: "*KPIs should be measurable, and we define targets for these KPIs*." These responses suggest potential issues related to data accuracy, relevance, and consistency. Although shortcomings in the current system were identified, there is also a shared understanding among participants regarding the basic requirements of effective performance measurement.

Participants were asked how performance information is used in decision-making and daily supply chain management. Interviewees emphasized that supplier performance management begins with the supplier selection process. Selecting capable suppliers was seen as the

starting point for managing supplier performance and mitigating supply chain risks. One interviewee (P6) stated that "*Managing delivery capability starts with supplier selection — being able to choose the right kind of supplier."* Another participant (P3) noted: "*We try to give orders to good-performing suppliers in particular."* In addition, the interview data highlighted capacity management as an important mechanism for ensuring supply continuity. One commonly mentioned approach involves distributing procurement volumes across multiple suppliers to reduce dependency risks. For example, one interviewee (P9) stated: "*We try to spread the load, so we don't place everything with one supplier."* These findings suggest that supplier selection and capacity management function as preventive mechanisms in supplier performance management.

Several interviewees also mentioned supplier performance monitoring and periodic performance discussions with suppliers as key performance management practices. During these discussions, suppliers are informed about their performance levels and may be asked to take corrective actions when performance targets are not met. As one participant (P6) described: "*Then there are strategic products and suppliers, for which we review certain topics quarterly or annually: how they have performed, what quality issues there have been, how the cost level has developed, and for each of these we try to consider what we could do better."* Another participant (P5) stated: "*That information can be used when we negotiate with suppliers. If there are red flags—or, conversely, strong results—we can negotiate accordingly. For both new and existing projects, this data can be used to drive supplier improvement and review performance*." These observations indicate that performance metrics are used to highlight areas requiring corrective actions and to support supplier performance improvement.

Another key mechanism for managing supplier performance is the use of audits and supplier development activities. Interviewees reported that audits are conducted regularly and serve as a structured method for evaluating supplier capabilities and compliance. One participant (P6) explained: "*We can move forward to conduct a system audit and, depending on the product requirements, a product audit to determine the supplier's ability to meet them*." These practices are complemented by supplier development initiatives. As one interviewee (P2) described: "*We have supplier development activities and pilot order management. We also conduct regular vendor audits and action plans, trainings, and continuous improvement programs with the supplier."* These activities indicate that supplier performance

management also includes capability development and structured evaluation processes aimed at improving supplier performance over time.

The organization's project-based business model and its effects on supplier performance measurement were also frequently highlighted by the interviewees. The organization's activities are largely tied to individual projects rather than recurring stock replenishment. One interviewee (P6) stated: "*Our business is project business. It's not the type where we order certain items into stock at a steady volume."* This operational context affects the relevance and interpretation of certain performance metrics. For example, On-Time Arrival (OTA) was described as less meaningful in project environments. Interviewee (P6) explained: "*In project business, when assessing OTA, if the delivery time is eight months, it may not be necessary to be on the exact day, but it should land very close to that timeframe to be considered on schedule in good conscience*." Another interviewee (P8) noted: "*For example, the On-Time Arrival percentage in project business is not as significant as it is in continuous stock purchases*." These comments suggest that current performance measurement practices may require adaptation to better reflect the characteristics of project-driven supply chains.

Interviewees identified challenges related to the availability, ownership, and utilization of supplier performance data. Accessibility to relevant information and unclear data ownership were described as obstacles to effective performance management. One participant (P8) explained: "*Our biggest problem is information availability. Access to information is somewhat weak, and we also have the issue that real ownerships are not defined here*." This suggests that limited information accessibility, organizational complexity, and unclear responsibility structures may hinder effective data management and performance monitoring.

In this interview theme, the interviewees were also asked how existing supply chain performance frameworks, such as the Supply Chain Operations Reference Digital Standard (SCOR DS) model, could be implemented in their organization. During the interviews, the researcher clarified that the literature presents numerous established performance frameworks for supply chains and that the SCOR DS model is one of them which provides methodologies and diagnostic tools to support organizations in achieving improvements in supply chain processes and performance. The responses revealed three main themes: limited familiarity with the framework, potential benefits, and organizational challenges.

The interview responses indicate that the overall level of familiarity with the SCOR DS model or similar supply chain performance frameworks is relatively limited among the participants. Several interviewees expressed uncertainty regarding the model and indicated that they did not possess sufficient knowledge to provide a definitive assessment of its applicability. For example, one participant (P4) stated that "*For the framework, it's difficult for me to give a solid answer."* Another participant (P9) noted that "*We would need to know more about what it can actually do."* Some participants also questioned whether such frameworks are well suited to project-based business environments. One interviewee (P7) commented that "*The nature of our project business is quite different from what these kinds of frameworks are usually designed for. Of course, if they have been modeled and studied specifically for project-based business, then why not*." These findings suggest that the practical implications and potential benefits of such frameworks are not widely understood within the organization.

Despite the limited familiarity with the SCOR DS model, some interviewees still identified potential benefits associated with structured supply chain performance frameworks. In particular, participants highlighted the potential of such frameworks to improve the structure, transparency, and systematic use of performance data. As one interviewee (P1) described: "*From what I know about these frameworks, they have strong structural construction. It's a really good way to explain what the next step would be for us."* Another interviewee (P5) stated: "*I see a strong opportunity to improve our data, our KPIs, and the way we work*." The interview data therefore suggests that structured supply chain performance frameworks are generally perceived as conceptually valuable.

The interviewees also identified several significant challenges related to the implementation of such frameworks within the organization. One challenge highlighted by participants relates to the organization's current level of data maturity. According to one interviewee (P1): "*The implementation requires data maturity, which we are lacking in some cases*." Another interviewee (P5) similarly stated: "*Regardless of the methodology or techniques, we need the foundation, and the foundation is the database*." Resistance to change was also mentioned as a potential barrier. One participant (P3) explained that "*People also sometimes do not accept changes directly. They have their own way, and they insist on using it*." Furthermore, implementation may require considerable resources and organizational effort. One interviewee (P8) stated that "*For us, it would definitely require organizational change.*

It requires rethinking our systems." Another participant (P1) emphasized: "*Then there is ownership—clearly defining ownership of the process. We continue stumbling on that*." In addition, the project-based nature of the business was noted as a factor that may increase the need for effective change management. As interviewee (P7) described: "*When adopting such models, change management is its own challenge in project-based business, where driving large changes clearly takes more time than in standardized-type operating models. Therefore, the model must bring some clear benefit before it is adopted and the change is carried through*." These findings suggest that the primary implementation challenges relate to organizational complexity, data maturity, and change management.

Finally, only one participant reported previous experience with supplier scoring models used to evaluate suppliers based on weighted performance criteria. Participant (P6) explained: "*Well, we have tried, for example, supplier scoring models — looking at what we value in a supplier, like price and quality, and assigning specific weights to them. The truth is that they are quite heavy, time-consuming, and perhaps a bit subjective. Maybe this could be rolled out for strategic suppliers."* Another participant also emphasized that the framework's use should focus on strategic aspects. Participant (P8) stated: "*These models are sensible; they could be leveraged. Not necessarily for day-to-day management, but for tactical and strategic decisions."* These comments suggest that structured performance frameworks may be most appropriate when applied selectively, particularly in strategic contexts, due to the time and resources required for their implementation.

5.3.2 Supplier Relationship Management in Performance Management

Questions under this theme aimed to understand how the differences between regions or suppliers influence the measurement and management of supply chain performance, how performance measurement and management of supply chain can be made globally comparable, and how should suppliers be involved in the supply chain performance measurement and management.

The interviewees were asked how differences between regions or suppliers influence the way supply chain performance is measured and managed within the organization. One of the differences between regions and suppliers influencing supply chain performance management identified in the interviews was the variation in supplier capabilities and

technical maturity. Interviewees emphasized that significant differences exist between suppliers in different regions in terms of reliability, competence, and operational maturity. One interviewee (P1) described the situation as follows: "*There are huge differences, and this affects the outcomes a lot—obviously the reliability and the supplier technical maturity. The gap is huge between some suppliers, even within the same region, not to mention between different regions."* Another participant (P3) stated that "*The level of expertise of the teams is another factor that has an impact."* These findings suggest that measuring and comparing supplier performance becomes challenging when suppliers operate under significantly different conditions and capability levels.

Cultural differences between regions, and even within countries, were also identified as a significant factor influencing supply chain performance management practices. Several interviewees noted that differences in business culture, communication styles, and negotiation practices affect how supplier relationships are managed. One interviewee (P2) emphasized that "*What happens in the Western part of the world in terms of the way of working sometimes differs from the way of working in other areas of the globe, like China and India."* Another participant (P4) stated: "*We have significant cultural differences—even inside our own country*." In addition to cultural norms, language barriers and geographical distances may also complicate communication and coordination between the organization and its suppliers. As one participant (P3) described: "*The language barrier is also another issue. Geographical differences are important too. Some countries are quite large, and it's not easy to travel; it takes time to travel within the country itself compared to smaller countries*." These findings indicate that cultural and geographical contexts strongly influence supplier relationships and supply chain performance management.

Interviewees also highlighted the difficulty of maintaining consistent performance measurement practices across regions and suppliers. Differences in working practices, cultural approaches, and process discipline were described as factors influencing supply chain performance measurement and management. As interviewee (P7) described: "*These factors have a significant impact. It probably starts with discipline—how consistently the agreed global process is followed across locations. There is certainly variation there already, and that makes monitoring challenging*." Another participant (P8) similarly noted that "*How the results are handled differs across cultures. Culture shapes how things are expressed*." It was also noted that differences within the organization's own business

practices influence supplier management. As participant (P5) explained: "*We're not only dealing with different cultures where suppliers are located; we also have different businesses working with those same suppliers. Different businesses have different expectations, requirements, and criteria*." These findings suggest that variations in culture, process discipline, and the organization's own relationship practices may lead to inconsistencies in how performance metrics and management practices are applied and interpreted.

In addition, the organizational structure itself was described as influencing how supplier performance is managed. Within the case company's organization, supplier management responsibilities are largely decentralized and handled through regional procurement hubs. One interviewee (P9) described the operational model as follows: "*Suppliers that belong to a hub have their vendor owner in that hub's procurement*." Another participant (P6) explained that "*Suppliers are under the responsibility of the local regional procurement hub and the quality organization. In that case, the local culture, competencies, ambition level, and workloads vary a lot, which admittedly can lead to a situation where in one region we manage things better than in another*." This suggests that the capabilities, resources, and priorities of local teams may influence how effectively supplier performance is monitored and managed.

Interviewees were asked how the organization balances the need for globally comparable supply chain performance measurement while operating across multiple regions with different operating environments. A commonly identified approach for achieving global comparability in supply chain performance measurement and management is the standardization of processes, procedures, definitions, information systems, and performance measurement practices. For example, one participant (P1) stated that "*Standardizing could be one solution. We could try to standardize and close this gap through standardization, clear definitions, and governance."* Another participant (P9) noted that "*When we have defined procedures and tools, and if everyone follows the same tools and the same procedures, the results will be more comparable and more trustworthy*." A third participant (P8) stated: "*If systems are global and processes run the same way globally, then regional differences shouldn't matter*." While global standardization was widely recognized as necessary, interviewees also emphasized the need to consider regional differences and local operating conditions. As one interviewee (P5) emphasized: "*When we define a global process, we aim for an 'average' that covers everyone. But sometimes we need a local*

deployment—not only for KPIs, but for supplier-relationship management overall—because of these differences." These responses suggest that standardized procedures, processes, common tools, and shared enterprise systems can help ensure consistent measurement practices across regions, while some flexibility may still be required to address regional differences in operating environments.

Interviewees were asked how suppliers should be involved in the measurement and management of supply chain performance. Interviewees consistently emphasized that suppliers must have visibility into their performance results and should be informed about both positive outcomes and performance deviations. Participant (P5) explained that "*We should be more transparent and share results with suppliers on a regular basis, pushing improvement when results are weak and also recognizing suppliers who perform well."* Several participants highlighted that suppliers should not only receive performance evaluations but also be actively involved in discussions regarding the results. According to interviewee (P4): "*We do a post-project evaluation with the supplier. We don't do it alone: we run one internally, then one with the supplier so they can voice concerns and lessons learned."* Periodic performance review meetings were described as an important mechanism for enabling this interaction. As interviewee (P9) stated: "*With larger suppliers, we hold monthly or quarterly meetings where we review how things have gone and what could be improved*." Overall, these findings suggest that supplier engagement in performance management is strongly linked to transparent information sharing and regular dialogue between the organization and its suppliers.

Interviewees also emphasized that supplier capability improvement is closely linked to the level of openness and willingness of suppliers to participate in development activities. In this context, the importance of viewing suppliers as long-term partners in performance development was highlighted. For example, one participant (P3) stated: "*We see our suppliers as partners—not just as vendors. We call them partners, and we are trying to improve them and integrate them into our processes*." The human dimension underlying supplier relationships was also emphasized. As one participant (P5) explained: "*Companies are made of people. People want to participate and be part of something bigger. If we make the relationship meaningful and inclusive, people will be happier with the results*." These findings suggest that collaborative relationships and mutual trust play an important role in enabling effective supplier performance development.

Interviewees also noted that supplier involvement in performance measurement and management should be prioritized for strategic or high-impact suppliers. Given the large size and diversity of the supplier base, it may not be feasible to apply equally intensive performance management practices to every supplier. One interviewee (P6) stated: "*Doing this with every single supplier would be unrealistic, in my opinion—it should focus on the key suppliers*." In this context, framework agreements were mentioned as a potential mechanism for supporting continuous improvement. Participant (P6) explained: "*I know many other companies make framework agreements where they expect the supplier to improve productivity by three percent every year, and then they track whether that happens*." These findings indicate that supplier performance management practices are often focused on a subset of strategic suppliers, and that improvement agreements can help establish shared expectations regarding performance development.

Finally, interviewees highlighted the potential role of real-time digital performance metrics and shared data systems in supporting supplier involvement in performance management. One interviewee (P8) described: "*At best, this works with online metrics. Historically, I have seen practices where if a supplier delivers and a quality deviation is found, it's immediately visible to them—the more transparency, the better, and that helps*." In addition, suppliers themselves may track their own performance indicators, which may sometimes differ from the organization's measurements. As one interviewee (P9) explained: "*Sometimes suppliers present their own KPIs, and there can be interesting differences. For example, On-Time Arrival—it depends on how it is measured. If the supplier measures when the product is finished at their factory, and we measure when it arrives at the site or port, there can be discrepancies*." These observations highlight that near real-time access to performance data can facilitate faster feedback between stakeholders and emphasize the importance of aligning performance metrics and measurement definitions between organizations and their suppliers.

5.3.3 Design requirements for the new framework

This theme aimed to identify the key aspects that should support the development of a new supply chain performance measurement and management framework, particularly regarding how corporate strategy and sustainability should be considered, as well as the most important

dimensions, key success factors, and metrics in supply chain performance measurement and management.

Interviewees were asked how corporate strategies should influence supply chain performance measurement and management. Interviewees emphasized that strategic objectives should guide the development of supply chain metrics and performance indicators. One interviewee (P8) stated: "*Operational metrics should be linked to the strategy*." Several interviewees also described how supply chain or procurement functions develop their own strategies that support the overall corporate strategy. For example, one participant (P6) explained: "*In procurement, we have derived own strategy, so we are very much involved, and it's a cross-business program —and the supply chains must support that."* These findings indicate that corporate strategy plays a key role in defining the direction and priorities of supply chain performance management.

Although strategies may change over time, interviewees indicated that certain fundamental principles of supply chain management remain consistent. One interviewee (P7) explained: "*Regardless of strategy, the same principles apply: on-time delivery, cost efficiency, and defect-free quality, while of course taking customer satisfaction into account. Strategy itself doesn't change the reason and purpose for which a function exists, but the priorities come from the strategy, and we as a function must adapt to it in order to execute it."* This suggests that while strategies may influence the relative importance of different performance areas, the fundamental purpose of supply chain management remains stable.

Interviewees identified challenges like deliberate effort in strategy implementation and dilution of original strategic message related to translating corporate strategies into operational performance measurement and management practices. Participant (P6) said: "*The supply chain is not really considered in the strategy. For example, we might want to go for BBC and at the same time should promote sustainability. Then we also want top-level quality, prices, and delivery times, as well as suppliers with strong finances and long payment terms. In practice, it's just listing all the nice things—but is that really a strategy?*" Another interviewee (P4) stated: "*In my opinion, this still needs work. We may receive high-level requests to do things locally, but the information is passed down through multiple manager layers before it reaches us. The more hands it goes through, the less accurate it becomes*." These observations suggest that improving transparency and communication

between strategic and operational levels of the organization may be necessary to strengthen the alignment between corporate strategy and supply chain performance management.

Interviewees highlighted the need to distinguish between supplier-specific performance evaluation and broader supply chain-level performance monitoring**.** One participant described this distinction by stating: "*If I think in terms of a balanced scorecard or similar, then for a supplier-specific scorecard there are certain elements, and for a supply-chain-level scorecard there are certain elements*." This finding suggests that distinguishing between these two levels of measurement can help organizations better understand both individual supplier contributions and overall supply chain performance outcomes**.**

Interviewees were asked what dimensions a well-functioning performance management system for a global supply chain should include. The interview responses identified several key dimensions that should be included in a well-functioning supply chain performance management system. These dimensions are summarized in Table 4. These findings suggest that a multidimensional approach is required for effective supply chain performance measurement.

Table 4. Supply chain performance dimensions identified by the interviewees.

Dimension	**Description based on interview**	**Example interview answer**
Capability	Refers to continuous improvement of supplier and organizational capabilities, including supplier development, competence development, training, and the utilization of technological capabilities.	P1: "*Learning, training and capabilities… are how we push our supply chain into continuous improvement."*
Customer	Emphasizes aligning supply chain performance with customer requirements and expectations and ensuring supply chain capabilities meet these needs.	P5: "*We should also translate customer needs into this*."
Financial	Includes cost efficiency, on-budget performance, and the financial stability of suppliers, which can influence operational performance outcomes.	P6: "*If a supplier starts to have financial problems, it immediately leads to delivery and quality issues."*
Quality	Relates to the ability of suppliers to deliver products according to agreed specifications while minimizing defects and deviations.	P8: "*For the supplier-specific view, I would highlight the quality aspects."*
Delivery Reliability	Focuses on the ability to meet agreed delivery schedules from the supplier and organization's own perspective.	P7: "*Then there is delivery-time management, with its own dimensions such as the supplier's On-Time Arrival and our On-Time Delivery."*

Interviewees were asked what are the key success factors that must be present to achieve success in supply chain performance. The interview responses also identified several key success factors required to achieve strong supply chain performance. These factors are summarized in Table 5. These findings indicate that achieving strong supply chain performance requires effective cross-functional operational execution and supportive organizational and supply chain structures, capabilities, and collaborative relationships.

Table 5. Success factors for supply chain performance identified by the interviewees.

Success factor	**Description based on interview**	**Example interview answer**
Transparent and well-defined performance measurement	Clear metrics definitions, transparent data availability, and suitable analytics and reporting tools were considered essential for effectively monitoring and improving supply chain performance.	P1: "*Another thing is data transparency. It is a very important factor that needs to be present in order to truly measure performance.*"
Regionally balanced supply chain structure	A geographically balanced supply chain base was seen as important for managing risks, ensuring capacity, and maintaining competitiveness.	P2: "*We want to de-risk the supply chain while maintaining competitiveness.*"
Governance, ownership, and consistent ways of working	Clear governance structures, defined ownership of processes, and consistent global ways of working were emphasized as important prerequisites for achieving supply chain performance.	P8: "*Processes should operate the same way — our way of working should be consistent regardless of where we are.*"
Supplier and internal capabilities and relationship management	Several interviewees highlighted the importance of strong capabilities both within the organization and among suppliers. This includes technical competence, understanding supplier capabilities and risks, effective communication, and close collaboration.	P5: "*We need very clear information related to our supply chain competencies and sub-suppliers, and also our own team members who will affect that scenario.*"
Customer support and customer alignment	Interviewees emphasized that supply chain performance ultimately needs to support customer satisfaction. This includes ensuring that customer expectations are clearly understood, providing appropriate technical support during project execution, and maintaining flexibility to respond to customer needs.	P4: "*During delivery, construction start, mid-construction, pre-commissioning, full commissioning, turnover management — we should be able to give the customer the option to have specialists if needed.*"
Cross-functional alignment	Interviewees emphasized that successful supply chain performance requires strong alignment between different organizational functions, particularly sales, procurement, and supply chain operations.	P6: "*It starts with Sales — how well we have reviewed expectations, promises, and requirements with the customer.*"

Interviewees were asked what performance measures should be monitored in supply chain management. Based on the interview responses, the organization already possesses a relatively solid foundation of supply chain performance metrics. One interviewee (P5) explained: "*The KPIs we already have are the basics, and we should keep them."* Another participant (P9) said: "The metrics we mentioned earlier." This indicates that the current key performance indicators have been felt to provide an adequate basis for measuring supply chain performance and should therefore be retained in the system additionally to the newly mentioned metrics.

Several interviewees emphasized the importance of incorporating risk-related performance metrics into supply chain performance monitoring. These metrics would allow organizations to evaluate potential risks associated with suppliers and the broader supply chain network. One participant (P8) said: "*We should also be able to assess risk levels across the entire chain — financially, politically, regionally, and from an IPR perspective."* Similarly, interviewee (P5) stated: "*We should add a risk-analysis target."* This finding suggests that risk-related metrics could be implemented to provide a more proactive perspective on supply chain resilience, especially considering intellectual property rights.

Some interviewees also emphasized the need for metrics that evaluate the quality production capabilities of suppliers. As one interviewee (P8) explained: "*What I would really like to see is what our supplier can do in terms of quality production capability*." Linked to that, interviewees also emphasized that delivery performance should not be pursued at the expense of product quality. Participant (P4) stated: "*I'd rather be two weeks late than on time with constant complaints."* These findings suggest that the metrics related to quality should be emphasized more, especially on the post-delivery phase and on the underlying production capabilities of suppliers.

It was also highlighted that the well-being and commitment of the supply chain organization itself can influence supply chain performance outcomes. Despite this, such aspects are rarely considered in supply chain performance measurement systems. According to one interviewee (P7): "*When we talk specifically about the supply chain, the well-being and commitment of our own organization usually don't come up — even though they affect how well supply chain management actually works."* This suggests that organizational capability and workforce-related indicators may also play a role in supporting effective supply chain performance.

Interviewees explained that response times can have a significant impact when considering response times towards customer, and supplier responsiveness in request-for-quotation (RFQ) phases. For example, one participant (P2) noted: "*Even though the customers cases would not be major issue but If we don't respond on time, it can be a much bigger impact to them."* Another interviewee said: "*Whether we receive responses during the RFI/RFQ phase. And once we receive orders, we look at whether there are delays in response times."* This indicates that responsiveness-related performance indicators both to customer and from supplier has importance in supply chain performance.

Several participants noted that certain performance indicators are currently treated independently even though they are strongly interconnected. According to interviewee (P1): "*The KPI for the cost of poor quality, or NCR recurrence, should be impacting the KPI for cost. How can you tell me that you have savings when you have a huge number related to the cost of poor quality?*" This highlights the importance of integrating related performance indicators to provide a more comprehensive understanding of supply chain performance.

Interviewees noted that organizations often face challenges in determining which metrics should receive the greatest attention. While modern data systems can generate large volumes of performance data, managing and interpreting this information effectively requires prioritization. As participant (P7) explained: "*We have an enormous amount of data available, and the challenge now is that the ideology says you should have no more than three to five key indicators to genuinely lead a team."* This observation highlights the importance of focusing on a manageable set of strategically relevant performance indicators.

Several interviewees emphasized that sustainability considerations should be embedded into supplier evaluation and sourcing processes. For example, one interviewee (P8) noted: "*Of course, nowadays it has to be included."* Despite this recognition, interviewees also indicated that sustainability does not yet function as the primary driver in supplier selection decisions. Instead, traditional operational criteria such as technical capability, cost, and delivery performance still tend to dominate decision-making. One participant (P7) explained: "*In our function, it's CO_2 emissions that directly affect sustainable development, and those are perhaps not sufficiently considered in decision-making right now, because lead time and cost drive the decisions."* This suggests even though sustainability's weight might be now lower, it must be integrated into supply chain performance measurement and management processes.

Participants were asked how sustainability should be integrated into supply chain performance measurement and management. Interviewees emphasized that sustainability in supply chain management also includes social responsibility, health and safety considerations, and compliance with legal and regulatory requirements. One interviewee (P3) noted: "*Also, when I say sustainability, health and safety is another critical part of the framework."* The interviews also highlighted that suppliers operating in different regions may face varying levels of sustainability understanding, infrastructure availability, regulatory requirements, and operational constraints that makes sustainability management challenging. Participant (P4) stated: "*What makes this difficult in market areas is that expectations cannot be the same as for example a fabricator in Germany—it's impossible. There is lack infrastructure and unreliable electricity."* Interview results indicate that sustainability in supply chain management should be understood broadly, should not be limited only to environmental aspects, and may require flexible implementation approaches that consider regional differences in supplier capabilities and operating environments.

5.3.4 Organizational Control and Individual's role in Performance Management

Under this theme, the aim was to examine how organizational control systems, both technical and social, influence the measurement and management of supply chain performance, how individuals from different organizational levels should be involved in the development of the performance management framework, and how individuals can contribute to achieving supply chain objectives through their own actions and decisions. For contextual clarity, the interviewer also explained the concepts of organizational control systems, technical controls, and social controls to the participants.

Interviewees were asked how organizational control systems, both technical and social, affect the way supply chain performance is measured and managed. Across all interviews, participants emphasized that both technical and social control systems can have either a positive or negative impact on supply chain performance measurement and management, depending on how they are designed and implemented. For example, one interviewee (P5) noted: "*I think that can be very positive if used well, or very negative if it is not."* Additionally, several interviewees highlighted that social control systems often have more complex influence compared to technical controls as they are more difficult to standardize

and manage, particularly in global organizations. One participant (P3) said: "*From my point of view, the social factor is sometimes more influential, especially in global companies. We are a multicultural company, and this affects the way of working on the social aspects — not so much on the technical side*." These findings suggest that both technical and social control systems are necessary for supply chain performance measurement and management, while social control systems may have a more complex and stronger influence due to their dependence on human behavior and cultural differences.

Technical control systems were described as establishing the structural boundaries for performance measurement, including systems, policies, processes, and procedures that define supply chain performance measurement practices and their level of implementation both internally and with suppliers. One participant (P7) noted: "*We are a large global company, and certain decisions about processes and tools do steer how we operate, and in turn define which metrics are feasible to implement. That largely sets the frame*." Cultural differences at both individual and organizational levels were also identified as significant influencing factors. Interviewees noted that individual cultural backgrounds and commitment can affect how processes are followed and that there is variability in how global policies and processes are interpreted across regions. One participant (P6) explained: "*We may not be the best at following processes and guidelines. They exist, but compliance depends on the people who use them, and we haven't built the kind of assurance that ensures everyone follows them."* These findings illustrate that technical controls provide the formal structures, processes, and systems necessary for measurement, while social controls influence how these structures are interpreted, adopted, and executed in practice.

Interviewees were asked how individuals from different organizational levels should be involved in developing the performance management framework and defining performance measures. A dominant concept in the interviews was the importance of involving individuals from different organizational levels and functions in the development of performance management frameworks. Interviewees consistently emphasized that cross-level and cross-functional collaboration enhances the practicality, relevance, and alignment of performance measures and management, particularly in large and complex organizations. For example, one interviewee (P1): "*Cross-level involvement is going to create practicality, bring things closer to reality, and provide more coherence to what we are talking about*." Another participant (P2) stated: "*I do not believe in single, isolated management. We need to make*

sure that every stakeholder participating from different interfaces is involved in a good manner. I believe in overall governance." These findings suggest that effective development of supply chain performance management frameworks requires structured cross-level and cross-functional collaboration, particularly in complex and globally distributed organizations.

Interviewees also emphasized the need for a balanced and competence-driven approach to participation. Not all individuals can or should be equally involved in all aspects of framework development, and the selection of participants should be guided by their ability to contribute meaningful insights. One interviewee (P7) noted: "*Not every frontline employee can add value to every development effort, while others have tremendous expertise — that's the delicate balance. In principle, line managers can bring forward people who have ideas and perspectives, and those people should be included."* Related to this, participants highlighted the existence of varying skill levels within the organization and the importance of recognizing and developing these competencies. Participant (P6) stated: "*It's perfectly fine to have people with different skill levels, but we certainly have very large gaps in skills. As a company, we should understand what each person is capable of and develop those competencies."* This indicates that the effectiveness of performance management framework development depends on a balanced and competence-based selection of participants, ensuring that the right expertise is leveraged while also fostering capability development across the organization.

Interviewees were asked how individuals can influence the achievement of supply chain objectives through their actions and decisions. Several participants highlighted that individuals play a significant role in influencing supply chain performance through their daily actions, decisions, and behaviors. Interviewees emphasized that individual's commitment, engagement, honesty, capabilities, and accountability is crucial. For example, participant (P2) stated: "*Everyone needs to contribute individually. We need to make sure that every team member is fully engaged, fully committed, and capable."* It was also highlighted that it is important to clearly define roles and responsibilities, as well as ensuring that individuals understand how their actions affect performance metrics. As one interviewee (P5) explained: "*When we establish a KPI, it must be very clear to everyone and to the individual employees who can affect it—not only because they will be pushed to achieve the results, but because it is a consequence of their job."* Furthermore, interviewees highlighted

the importance of recognizing and celebrating achievements. These findings suggest that individual influence on supply chain performance is strongly dependent on employee commitment, engagement, honesty, capability, accountability, and clarity of responsibilities, as well as the organization's ability to link individual actions to performance outcomes and reinforce desired behaviors through recognition.

In addition to individual contributions, interviewees emphasized that collaboration plays a critical role in the impact of individual actions. Several participants noted that supply chain performance is in the end a collective outcome, requiring coordination between different teams and functions. As one participant (P3) stated: "*All the teams need to be involved. We need to improve the collaboration between the teams. Yes, one person can have an effect, but for long-term success, teamwork is needed*." In addition, creating a safe environment where individuals feel comfortable seeking support was identified as an important enabler of collaboration. Participant (P4) explained: "*I think for individuals to rise and have a bigger impact on a project, they shouldn't be shy about asking for assistance."* Another interviewee (P6) stated: "*We should also have a culture where people feel safe to ask for help*." These findings indicate that creating a supportive organizational culture that enables teamwork and knowledge sharing, not only supports individual performance but also the overall performance of supply chain management.

5.3.5 Risk, resilience, and future trends in supply chain performance management

In this theme, the aim was to find out how recent disruptions have affected supply chain performance management, how should performance management systems support resilience for supply chain risks and what trends could affect the global supply chain performance management in the future.

Interviewees were asked how recent disruptions or uncertainties have affected supply chain performance management. Several participants highlighted that recent disruptions and uncertainties have had a significant impact on supply chain performance management. Interviewees emphasized that events such as the COVID-19 pandemic, geopolitical tensions, tariffs, regulatory changes, and material shortages have increased risk, reduced flexibility, and made performance management more complex across all organizations. Participants also noted that customer requirements have become more demanding while decision-making has

slowed down, adding further challenges. For example, participant (P1) stated: "*They add a lot of risk, a lot of exposure, and we have very little flexibility*." In addition, disruptions were seen to directly affect logistics performance, particularly on-time delivery, due to delays across multiple supply chain stages. Participant (P7) highlighted that: "*If the supplier is late and the vessel is late, how can logistics still deliver to the customer on time?*" These findings suggest that disruptions increase uncertainty, complexity, and interdependencies, making supply chain performance management more difficult to control and predict.

Interviewees emphasized that recent disruptions have accelerated the shift towards regionalized supply chain structures. It was highlighted that operating more regionally has become necessary to respond to increased uncertainties and customer requirements. This includes a stronger focus on locating suppliers closer to customers and understanding regional demand patterns. For example, participant (P8) noted: "*What has emerged is that regionality is emphasized in supply-chain design. We need to see where our customers are and, strategically, have suppliers closer to them*." At the same time, participants stressed that global balance remains important, as supply chains must still serve worldwide markets effectively. As participant (P9) explained: "*Supply chains are no longer as stable as they used to be. We are a global company, so our supply chain must be balanced globally*." These findings suggest that regionalization, combined with global balance by knowing where your customers are located, are a key response to improve supply chain resilience.

Interviewees were asked how performance management systems should support resilience for supply chain risks. Several participants highlighted that supply chain performance management systems should evolve from being reactive and retrospective towards more preventive and proactive approaches. There is a growing need to incorporate forward-looking elements such as risk anticipation, early warning indicators, and recovery planning. For example, participant (P7) explained: "*We could build metrics so we could red-flag a shipment. For example: the customer's requested delivery date is 1 June; we see the supplier will be ready on 1 May; transport plus handling at both ends requires 45 days. Purely on that basis, we should flag a schedule risk*." In addition, collaboration both internally across functions and externally with suppliers was seen as essential for improving resilience. Participant (P4) stated: "*Collaboration is key. If we collaborate effectively across departments, we can foresee risks*." These findings suggest that effective performance management systems should integrate predictive capabilities, proactive decision-making,

and cross-functional and inter-organizational collaboration to enhance supply chain resilience.

Interviewees emphasized the importance of reducing dependency on single sources and strengthening capacity and risk management practices within the supply chain. As one participant (P6) stated: "*We must have alternatives and not bet everything on a single option. For example, if we rely too much on China and suddenly cannot do business there, we'll be in trouble*." Participants stressed the need for improved capacity visibility, monitoring tools, and balanced volume allocation across suppliers to avoid bottlenecks and over-reliance on specific sources. For example, interviewee (P3) explained: "*Capacity analysis is important. We should have a warning system about capacity, and we should be aware of delays and possible quality issues*." These findings suggest that supply chain resilience requires systematic multi-sourcing strategies, improved capacity management, and greater visibility across the supply network.

Participants were asked to define what trends they are observing now that could affect the global supply chain performance management. The interviewees identified several key future trends that are expected to influence global supply chain performance measurement and management. These trends are summarized in Table 6. The findings indicate that supply chain performance management will increasingly be affected by technological advancements, evolving supply chain structures, sustainability requirements, and continued uncertainty.

Table 6. Future trends for supply chain performance management identified by the interviewees.

Future trend	**Description based on interview**	**Example interview answer**	**Number of Participants Mentioning**
Artificial intelligence	The ability to adopt and utilize Artificial Intelligence (AI) effectively was emphasized as a key future capability.	P6: *"AI needs to be adopted by our own team and company, and it will be one of the future trends."*	5 of 9
Integrated information systems	Improved integrated information systems, automation, and data transparency across supply	P7: *"How we connect information systems and exchange data with suppliers can bring more*	5 of 9

	chains was seen as an important capability.	*transparency and thereby improve efficiency."*	
Regionalization	Supply chains are expected to become more regionally focused while maintaining flexibility through alternative sourcing options.	P1: *"I believe that regionalization and near-shoring strategies are another trend."*	3 of 9
Sustainability	Sustainability will play an increasingly important role in supply chain performance management, particularly through metrics and regulatory requirements.	P3: *"Sustainability will also become very mandatory for KPIs.*	3 of 9
Uncertainty continues	Uncertainties are expected to continue. This requires organizations to be more prepared for disruptions.	P8: *"Future trends indicate that uncertainty will continue."*	3 of 9
Reduction of China dependency	A growing trend is reducing dependency on China which is challenging due to cost competitiveness, as alternative sourcing locations may not match China's price and quality levels.	P9: *"Reducing dependence on China is certainly one of the priorities. That's not an easy equation, because China is fundamentally one of the cheapest places to obtain good-quality industrial products."*	1 of 9

5.3.6 Additional insights from interviewees

The final interview question provided participants with an opportunity to highlight any additional aspects of global supply chain performance management not previously discussed. A clear and consistent theme that emerged from the responses was the importance of collaboration, organizational culture, and people-related factors as fundamental enablers of effective performance management, especially in global large companies. For example, participant (P1) highlighted: "*We need to bring the social point of view and the cultural point of view to the table to create cooperation. It is a huge global company, which makes it very difficult to handle."* Participant (P5) emphasized: "*Behind the companies there are people, and we should understand the culture."* In addition, the importance of personal interaction and knowledge sharing was raised, with participant (P4) suggesting: "*At least once a year, all peers globally in the same role and scope should get together face-to-face to share experiences."* Furthermore, participants pointed out challenges related to functional silos and fragmentation within supply chain organizations, which may lead to sub-optimization.

As participant (P7) noted: "*In my view, we need more open discussion and tighter linking across the entire supply chain. I'm talking about the traditional "supply functions": Procurement, Quality, Expediting, Logistics."* This reinforces earlier findings and suggests that cooperation and cultural aspects play a major role in enabling effective performance management, and that cross-functional collaboration is essential in large global companies.

6 Developed supply chain performance measurement and management framework

The aim of this study is to develop a performance management and measurement framework for a company that outsources the manufacturing of its supply through global supply chains and has a nominated expert organization responsible for managing and measuring the supply chain's performance while especially considering effects of the current turbulent environment and future trends. In this chapter, a performance measurement and management framework will be proposed for the supply chain management based on the previously presented theoretical background and the data collected from interviews conducted within the case company.

Appendix 2. presents a holistic view of the proposed framework model for global supply chain performance measurement and management, outlining its key sections, their main aspects, and the linkages between them. The framework sections are as follows:

- Procurement and supply chain performance concept
- Performance management system
- Performance measurement system
- Strategic alignment
- Cause-and-effect relationships and strategy maps
- Organizational control
- Design principles
- Key success factors
- Framework characteristics
- Metrics characteristics
- Procurement and supply chain performance dimensions
- Supplier relationship management
- Sustainability performance models
- Supply chain performance models
- Changing environment
- Risks in supply chain

6.1 Procurement and supply chain performance concept

The first section, illustrated in Figure 9, is titled “Procurement and Supply Chain Performance Concept.” It comprises the conceptual foundations of procurement, supply chain management, and performance, particularly within the procurement and supply chain context. This section is positioned at the top of the framework, as a comprehensive understanding of these concepts is essential for effective supply chain performance measurement and management. All components in this section are connected by the large black arrows to illustrate that they should be understood from a holistic conceptual perspective.

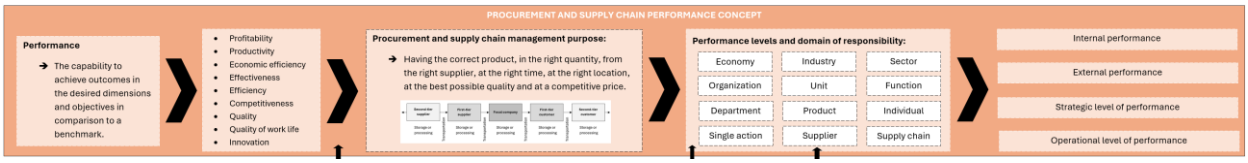

Figure 9. “Procurement and supply chain performance concept” -section in the framework.

The first component within this section, labelled “Performance”, explains the concept of performance. According to Rantanen and Holtari (1999, 3), citing Laitinen (1998), performance refers to the capability to achieve outcomes in desired dimensions and objectives. In contrast, Lebas and Euske (2007, 125–134) define performance as encompassing the action itself, the resulting outcome, and the success of that outcome in comparison to a benchmark. Based on these theoretical perspectives, performance is defined in this framework as the capability to achieve outcomes in desired dimensions and objectives in comparison to a benchmark.

Based on the theoretical section, the following aspects were identified as commonly used to assess organizational performance. These are presented in the second component of this section to illustrate the key elements linked to the performance concept at a general level:

- Profitability – capability to create profit (Ukko et al. 2007, 4-6).
- Productivity – capability to create more outputs from the inputs (Ukko et al. 2007, 4-6).

- Economic efficiency - capability to create outputs with lower costs or more output with existing costs (Ukko et al. 2007, 4-6).
- Effectiveness – capability to achieve desired objectives (Ukko et al. 2007, 4-6).
- Efficiency – capability to achieve desired objectives in the wanted time frame (Ukko et al. 2007, 4-6).
- Competitiveness – capability to compete and remain in the markets (Ukko et al. 2007, 4-6).
- Quality – capability to fulfil end user's or customer's expectations and needs (Rantanen & Holtari 1999, 8-9, adapting Sink 1985)
- Quality of work life – capability to create satisfaction and motivation to organizational members (Rantanen & Holtari 1999, 8-9, adapting Sink 1985).
- Innovation – capability to create innovations (Rantanen & Holtari 1999, 8-9, adapting Sink 1985).

The third component within this section is labelled "Supply Chain Management Purpose and Position," and it introduces the conceptual background of procurement and supply chain management within the framework. In the framework, the purpose of procurement and supply chain management is defined as having the correct product, in the right quantity, from the right supplier, at the right time, at the right location, at the best possible quality and at a competitive price (Prater & Whitehead 2013, 11; Merkert & Hoberg 2023, 8; van Weele and Rozemeijer 2022, 49; 371). This component also illustrates the position of the focal company within the supply chain, based on Grant et al. (2017, 10) from the theoretical part.

According to Rantanen and Holtari (1999, 3), performance can be analyzed at different levels, while Lebas and Euske (2007, 133) emphasize that performance is linked to a domain of responsibility. For this reason, the fourth component is labelled "Performance Levels and Domain of Responsibility", highlighting that performance measurement and management can be conducted across multiple levels and domains. Rantanen and Holtari (1999, 3) identified following performance levels and domains of responsibilities: economy, industry, organization, sector, unit, department, product, function, individual and single action. Additionally, in the empirical section, the interviewees highlighted the need to distinguish between supplier-level and supply chain-level performance evaluation. These observations

form the performance levels and domains of responsibility presented in the framework, illustrating where performance can be analyzed.

The final components within this section highlight the internal, external, strategic, and operational perspectives of performance, emphasizing that performance can be analyzed both internally and externally, as well as at strategic and operational levels. According to Rantanen and Holtari (1999, 11–12), internal performance refers to an organization's self-assessment, focusing on its internal operations, whereas external performance concerns the evaluation of performance in relation to the external environment. Furthermore, van Weele and Rozemeijer (2022, 370–371) emphasize that performance measurement should distinguish between internal and external metrics and be conducted at both strategic and operational levels of the supply chain, where the strategic level focuses on building strong relationships with best-in-class suppliers, and the operational level emphasizes effective procurement processes, systems, and capabilities.

6.1 Performance measurement and management system

According to Melnyk et al. (2013,175), performance measurement and management systems consist of two integrated elements which are the performance measurement system and the performance management system. The next sections of the framework are titled "Performance Measurement System" and "Performance Management System", illustrated in Figure 10. These sections comprise the conceptual foundations of performance measurement, performance measures, management, systems, organizational control, as well as technical and social controls. This section is positioned in the middle left of the framework to emphasize its role as a core element that connects other sections, as a lack of understanding of these concepts would make effective supply chain performance measurement and management challenging.

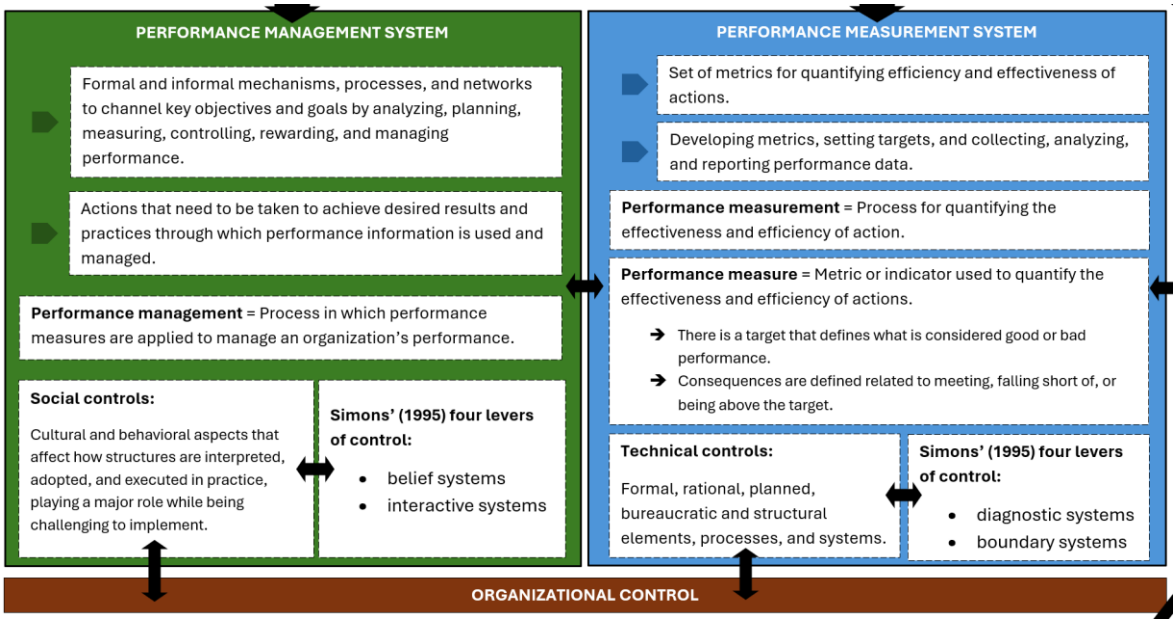

Figure 10. "Performance Measurement System" and "Performance Management System" - section in the framework.

The top components, illustrated with blue and green arrows within the sections, explain the concepts of both the performance measurement system and the performance management system. A performance measurement system is described as a set of metrics employed for quantifying efficiency and effectiveness of actions (Neely et al. 2005, 1228; Nudurupati et al. 2021, 2) while Smith and Bititci (2017, 1208–1209) describe it as developing metrics, setting targets, and collecting, analyzing, and reporting performance data. According to Ferreira & Otley (2009, 264), performance management systems are formal and informal mechanisms, processes, and networks that organizations use to channel key objectives and goals selected by the management while supporting strategic process, daily management and organizational learning and change by analyzing, planning, measuring, controlling, rewarding, and managing performance. Additionally, Saunila et al. (2015, 374) says that according to Brudan (2010) performance management systems concentrates on the actions that needs to be taken to achieve desired results and according to Smith and Bititci (2017, 1208–1209), it includes practices through which organizational performance is used and managed. The concepts presented in these components are derived from these theoretical perspectives.

The next components within these sections are labelled "Performance Management," "Performance Measurement," and "Performance Measure" to provide definitions for these

concepts. Performance measurement is defined by Neely et al. (2005, 1229) as the process for quantifying the effectiveness and efficiency of action. A performance measure, in turn, is a metric used to quantifying the effectiveness and efficiency of actions (Neely et al. 2005, 1228; Nudurupati et al. 2021, 2) that has a target which defines what is considered good or bad performance and consequences are defined related to meeting, falling short of, or being above the target (Melnyk et al. 2013, 175). According to Bititci (2015, 25), performance management refers to the process in which performance measures are applied to manage an organization's performance. These theoretical perspectives structure the definitions of these components.

The final components within these sections are labelled "Technical Controls" and "Social Controls," which are linked to the "Organizational Control" section with black arrows. This is because organizational control consists of two types: technical and social control (Tessier & Otley 2012, 179; Smith and Bititci 2017, 1208). According to Smith and Bititci (2017, 1209), performance measurement is associated with technical control, while performance management is associated with social control. Nudurupati et al. (2021, 2) states that Simons' (1995) four levers of control are linked to technical and social control, as belief and interactive systems are associated with social control, while diagnostic and boundary systems are associated with technical control. For these reasons, the component "Simons' (1995) four levers of control" was added to these sections, and the linkage to each respective control is illustrated with black arrows.

According to Nudurupati et al. (2021, 2), technical controls refer to rational, planned, bureaucratic, and structural elements within an organization. In the empirical phase, the interviewees emphasized that these provide the formal structures, processes, and systems necessary for performance measurement. Based on these descriptions, the following definition was developed for the "Technical Control" component: Formal, rational, planned, bureaucratic, and structural elements, processes, and systems. Social controls, in turn, refer to the cultural and behavioral aspects within an organization (Nudurupati et al. 2021, 2). In the empirical phase, the interviewees highlighted that this influences how structures are interpreted, adopted, and executed in practice, emphasizing their significant role in enabling effective performance management while also being more challenging to implement. Based on these findings, the following definition was formulated for the "Social Control" component: Cultural and behavioral aspects that affect how structures are interpreted,

adopted, and executed in practice, playing a major role while being challenging to implement.

6.1 Design principles

The second core section of the framework is titled “Design Principles,” as illustrated in Figure 11, and serves to connect all sections of the framework. These linkages are illustrated with black arrows. According to Ukko et al. (2007, 12), the development of a performance measurement system consists of four main phases: design, deployment, usage, and maintenance. Based on this framework, the main components of this section are labelled “Design Phase”, “Deployment Phase”, “Usage Phase”, and “Maintenance Phase.”

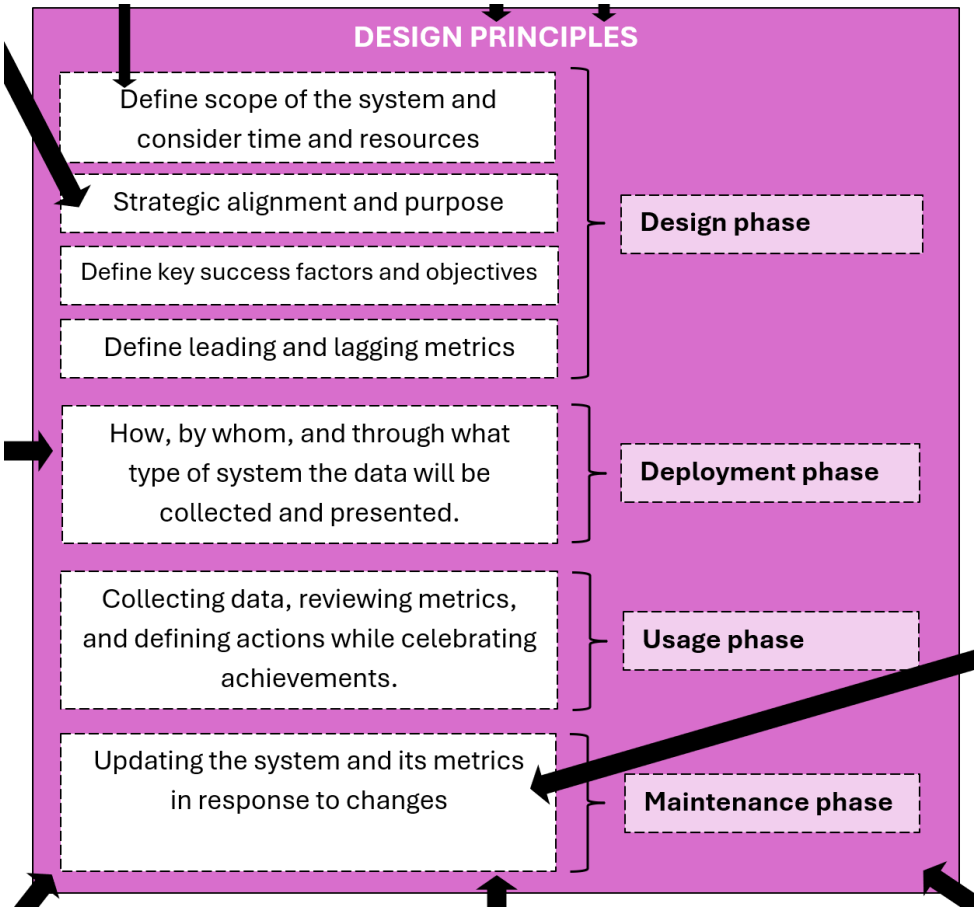

Figure 11. “Design principles” -section in the framework.

In the design phase, it is important to decide the scope of the measurement system in the organization as it can involve the whole organization or only one specific function (Rantanen & Holtari 1999, 24). The interviewees also noted that performance measurement and management should be prioritized for strategic or high-impact suppliers, as the size and diversity of the supplier base may make it impractical to apply equally intensive practices to all suppliers when considering available time and resources. For these reasons, the "Design phase" begins with the component labelled "Define scope of the system and consider the time and resources." This component should consider the aspects presented in the "Performance levels and domain of responsibility" component under the "Procurement and Supply Chain Performance Concept" section, and this relationship is illustrated with a black arrow between the components.

The second component of the "Design phase" is labelled "Strategic alignment and purpose", as according to Ukko et al. (2007, 57), the organization's vision, strategy, and the purpose of the performance measurement system must be defined. Given the importance of strategic alignment, a separate section titled "Strategic Alignment" has been developed and is presented later in the framework. The connection between the "Strategic alignment and purpose" component and the "Strategic Alignment" section is illustrated with a black arrow.

The third component, "Define key success factors and objectives", is also based on Ukko et al. (2007, 57), who emphasize the importance of identifying key success factors and main objectives. Furthermore, Rantanen and Holtari (1999, 44) state that performance measurement should encompass the key success factors along with their leading and lagging indicators. In addition, Ukko et al. (2007, 13) highlight that metrics should be selected and aligned with the organization's overall objectives, from top management to operational levels. These theoretical perspectives form the basis of the fourth component, "Define leading and lagging metrics" within the "Design phase."

According to Ukko et al. (2007, 13), the deployment phase of a performance measurement system addresses how, by whom, and through which systems data are collected and presented, emphasizing the importance of presenting performance information in a clear and comprehensible format. Based on this perspective, the component labelled "How, by whom, and through what type of system the data will be collected and presented" was developed under the "Deployment phase."

The usage phase of the performance measurement system includes collecting performance data and reviewing the selected metrics within the organization (Ukko et al. 2007, 13) and planning improvement actions based on the results (Rantanen & Holtari 1999, 37). Furthermore, interviewees highlighted the importance of recognizing and celebrating achievements to reinforce desired behaviors. These perspectives form the component "Collecting data, reviewing metrics, and defining actions while celebrating achievements" under the "Usage phase."

Finally, the maintenance phase of the performance measurement system involves updating the system and its metrics in response to changing objectives (Ukko et al. 2007, 13; Rantanen & Holtari 1999, 14). This theoretical foundation forms the component "Updating the system and its metrics in response to changes" under the "Maintenance phase", which also has significant implications for the "Changing environment" section, discussed later in the framework. This relationship is illustrated by a black arrow connecting the two.

6.2 Strategic alignment

Ferreira & Otley (2009, 267) says that purposes and objectives are the starting point for performance management, while Rantanen & Holtari (1999, 44) emphasize that performance measurement and management systems are based on organization's strategy and objectives. In addition, the interviews indicated that corporate strategy plays a key role in defining the direction and priorities of supply chain performance management. For these reasons, this section is titled "Strategic Alignment", as illustrated in Figure 12. Furthermore, this section is positioned between the "Procurement and Supply Chain Performance Concept", "Performance Measurement System", and "Performance Management System" sections to highlight its strong connection to these areas, which is also illustrated through black arrows linking the sections. Additionally, the section "Design Principles" and the component "Strategic Alignment and Purpose" within the "Design Phase" have a strong link to this section, which is illustrated by a black arrow.

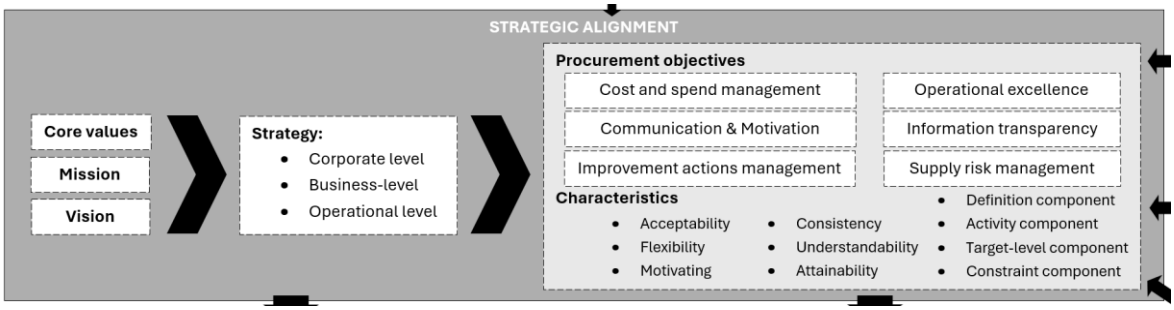

Figure 12. “Strategic alignment” -section in the framework.

Organizations need convincing core values, mission, vision, strategy, and objectives that motivates employees, customers, suppliers (Johnson et al. 2008, 9-11; 163) to achieve the orientation and direction that the organization desires (Ferreira & Otley 2009, 268; Kaplan & Norton 2004, 43). Accordingly, the components within this section are labelled “Core Values”, “Mission”, “Vision”, “Strategy”, and “Procurement Objectives” to emphasize their importance for performance measurement and management. These components are interconnected, as illustrated by the two large black arrows within the section. Additionally, according to Johnson et al. (2008, 7), strategy can be divided into three levels: corporate, business, and operational. These levels are included within the “Strategy” component to emphasize the importance of understanding the level at which performance measurement is conducted.

According to van Weele and Rozemeijer (2022, 49), the objectives of procurement and supply chain management are operational excellence, cost and spend management, supply risk management and innovation. In the empirical phase, the interviewees also emphasized the importance of risk management in procurement. Additionally, the literature identifies several purposes for procurement and supply chain performance measurement:

- To identify procurement success, progress on improvement plans and if customer needs are achieved (Gunasekaran & Kobu 2007, 2820) by increasing transparency to results and objectives (van Weele and Rozemeijer 2022, 369).
- To support procurement to understand its processes and revealing what they know and what they don’t know. (Gunasekaran & Kobu 2007, 2820).
- To identify supply chain problems, bottlenecks, waste and where improvements are needed (Gunasekaran & Kobu 2007, 2820) to have greater value creation from procurement activities (van Weele and Rozemeijer 2022, 369).

- To have improved decision on supply chain (van Weele and Rozemeijer 2022, 369) by basing them on facts and not on emotion, faith, or intuition (Gunasekaran & Kobu 2007, 2820).
- To have enhanced communication between procurement departments and higher levels of motivation (van Weele and Rozemeijer 2022, 369).
- To achieve cost reductions, lower material prices, and fewer rejections on supply chain (van Weele and Rozemeijer 2022, 369).

Based on these theoretical perspectives, the following procurement objectives were developed for the framework: "Cost and spend management", "Operational excellence", "Communication and Motivation", "Information transparency", "Improvement actions management", and "Supply risk management."

It is also important to understand how to develop effective objectives. Therefore, a subsection of characteristics was included under the "Procurement Objectives" component. Ukko et al. (2007, 26) outline several key factors that should be considered when formulating objectives including acceptability, flexibility, motivation, consistency, understandability, attainability, as well as definition, activity, target-level, and constraint components. These factors form the basis of the characteristics included in this component, serving as guidance for developing procurement and supply chain objectives.

6.3 Cause-and-effect relationships and strategy maps

Performance measurement and management can be used to communicate strategies and objectives to organizational members (Ferreira & Otley 2009, 270-271) through cause-and-effect relationships, meaning that each metric should form part of this chain and reinforce the strategic priorities of the organization (Ukko et al. 2007, 16). These cause-and-effect links from bottom to top can be shown visually with strategy maps (Kaplan & Norton 2004, 41-43) which illustrate the connections between different dimensions and metrics (Ukko et al. 2007, 16). In addition, the interview results highlighted that metrics should be integrated and interconnected to provide a more comprehensive understanding of supply chain performance. Based on these perspectives, the section "Cause-and-Effect Relationships and Strategy Maps", illustrated in Figure 13, was developed, including the components "Performance Levels", "Dimensions", and "Metrics." This section is strongly influenced by

the “Strategic Alignment” section, and this relationship is illustrated with a black arrow between them.

Figure 13. “Cause-and-effect relationships and strategy maps” -section in the framework.

In the empirical stage, the interview results also indicated that improving transparency and communication between strategic and operational levels could strengthen the alignment between corporate strategy and supply chain performance management. For this reason, the components “Transparency” and “Communication” were included to emphasize their importance. Finally, according to Ukko et al. (2007, 16), the cause-and-effect links can be structured with lagging and leading metrics by forming a hierarchical structure from top to bottom (Ukko et al. 2007, 16). This further demonstrates that the “Cause-and-effect relationships and strategy maps” section is linked to the “Design Principles” section through the development of metrics, and this connection is illustrated by a black arrow between the two sections.

6.4 Key success factors

Performance measures should focus on the key success factors that enable the organization to remain viable (Bititci, 2015, 25). Ferreira & Otley (2009, 269) says that according to Thompson and Strickland (2003) activities, attributes, competencies, and capabilities that are crucial for the success of the organization in specific time periods, are the key success factors. Furthermore, Ukko et al. (2007, 16) emphasize that key success factors are linked to organization’s strategy and represent the areas in which the organization must prevail to achieve success. Based on these theoretical perspectives, a section labelled “Key success factors” was developed for the framework, as presented in Figure 14. As seen from the theory, this section is influenced by the sections “Design principles and “Strategic alignment”, which is demonstrated with the black arrows linking each other together.

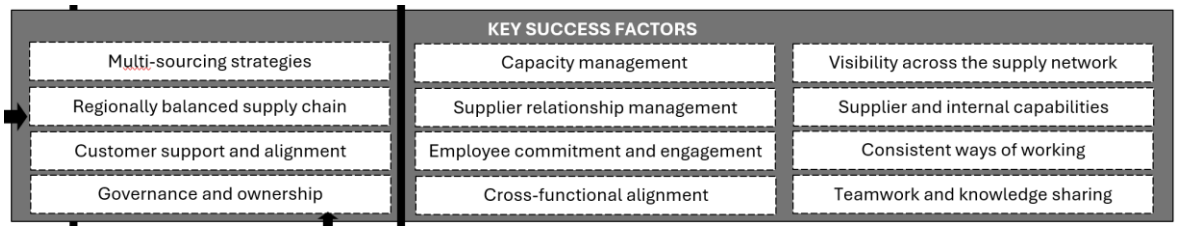

Figure 14. “Key success factors” -section in the framework.

The interview responses identified several key success factors required to achieve effective supply chain performance, including:

- transparent and well-defined performance measurement
- regionally balanced supply chain structure
- governance, ownership, and consistent ways of working
- supplier and internal capabilities and relationship management
- customer support and customer alignment
- cross-functional alignment
- employee commitment, engagement, honesty, capability, accountability, and clarity of responsibilities
- a supportive organizational culture that enables teamwork and knowledge sharing
- multi-sourcing strategies, improved capacity management, and greater visibility across the supply network

These factors form the components within this section, labelled “Multi-sourcing strategies”, “Capacity management”, “Visibility across the supply network”, “Regionally balanced supply chain”, “Supplier relationship management”, “Supplier and internal capabilities”, “Customer support and alignment”, “Employee commitment and engagement”, “Consistent ways of working”, “Governance and ownership”, “Cross-functional alignment”, and “Teamwork and knowledge sharing”, to demonstrate the key success factors that should be considered for successful supply chain performance management.

6.5 Framework characteristics

Another core section of the framework is titled “Framework Characteristics”, as illustrated in Figure 15. This section was developed based on interview findings, where participants highlighted several aspects that should be considered in the performance measurement and management of supply chains and procurement. The aspects in this section should be considered in the “Design principles”, “Metrics characteristics”, and “Procurement and supply chain performance dimensions”, as they play a crucial role in the development of the performance measurement and management system. These relationships are illustrated with black arrows connecting the respective sections.

Figure 15. “Framework Characteristics” -section in the framework.

The interview findings indicate that the performance measurement and management system should incorporate predictive and preventive capabilities to support more proactive supply chain control and risk mitigation. Several participants highlighted that supply chain performance management systems should evolve from being reactive and retrospective

towards more preventive and proactive approaches. There is a growing need to incorporate forward-looking elements such as risk anticipation, early warning indicators, and recovery planning. Based on these observations, the components “Include predictive and preventive capabilities” and “Integrate risk mitigation approach” were added to the section. In addition, interviewees emphasized that performance metrics can be used to highlight areas requiring corrective actions within the supply chain and to support supplier performance improvement. As a result, the components “Highlight areas requiring corrective actions” and “Utilize in supplier performance improvement” were included.

The interview participants also noted that performance measurement and management should reflect the characteristics of project-driven supply chains within their organization. Consequently, the system should account for the underlying business model in which supply chain management operates, leading to the inclusion of the component “Reflect the characteristics of the business model.” Furthermore, the interview data suggest that structured supply chain performance frameworks, which include predefined dimensions and metrics, are perceived as conceptually valuable and can be leveraged when developing organization-specific systems. Based on this observation, the component “Capture benefits of existing frameworks if possible” was added.

Interviewees highlighted the difficulty of maintaining consistent performance measurement practices across regions and suppliers. Differences in working practices, cultural approaches, and process discipline were identified as factors influencing supply chain performance measurement and management. In addition, the organizational structure itself was described as affecting how supplier performance is managed, as the capabilities, resources, and priorities of local teams may influence the effectiveness of monitoring and management practices. For this reason, the component “Understand the organization’s culture, resources, and capabilities globally” was added to emphasize the importance of these aspects for successful global supply chain performance management.

Observations from the interview results indicate that supplier engagement in performance management is strongly linked to transparent information sharing and regular dialogue between the organization and its suppliers, as well as to viewing suppliers as long-term partners. Interviewees also emphasized that supplier capability development is closely related to the level of openness and willingness of suppliers to participate in development activities, highlighting the importance of collaborative relationships and mutual trust in

enabling effective performance improvement. Furthermore, interviewees consistently noted that cross-level and cross-functional collaboration enhances the practicality, relevance, and alignment of performance measurement and management, particularly in large and complex organizations, helping to avoid functional silos and fragmentation that may lead to sub-optimization. Based on these findings, the component “Integrate cross-level and cross-functional collaboration with internal and external stakeholders” was added to emphasize this critical aspect.

Interviewees also emphasized the need for a balanced and competence-driven approach to participation. Not all individuals can or should be equally involved in all aspects of framework development, and the selection of participants should be guided by their ability to contribute meaningful insights. This indicates that the effectiveness of performance management framework development depends on a balanced and competence-based selection of participants, ensuring that the right expertise is leveraged. For this reason, the component “Balanced and competence-based selection of participants” was added.

Managing and measuring the performance of all suppliers and supply chains is challenging, as it requires consideration of product complexity, supply chain length, and the number of suppliers and customers involved (Lambert & Knemeyer 2007, 86). This requires making deliberate decisions about which products and suppliers should be prioritized (van Weele and Rozemeijer 2022, 385) while balancing the organization’s capabilities with their significance to the organization (Lambert & Knemeyer 2007, 86). These aspects were also reflected in the interview findings, where participants emphasized that performance measurement and management should be prioritized for strategic or high-impact suppliers, given the size and diversity of the supplier base. Furthermore, interview data indicated that although modern data systems can generate large volumes of performance data, effective management and interpretation of this information require prioritization. This highlights the importance of focusing on a manageable set of strategically relevant performance metrics. Based on these perspectives, the final component in this section, labelled “Maintain manageable metrics and supplier focus”, was included in the framework.

6.6 Metrics characteristics

The section "Metrics Characteristics," as illustrated in Figure 16, was developed to highlight the criteria that should be considered when defining metrics for the performance measurement system. This section is closely linked to the "Design Principles" and Framework Characteristics" sections, as illustrated by the black arrows, as these criteria should be considered in the aspects presented in those sections.

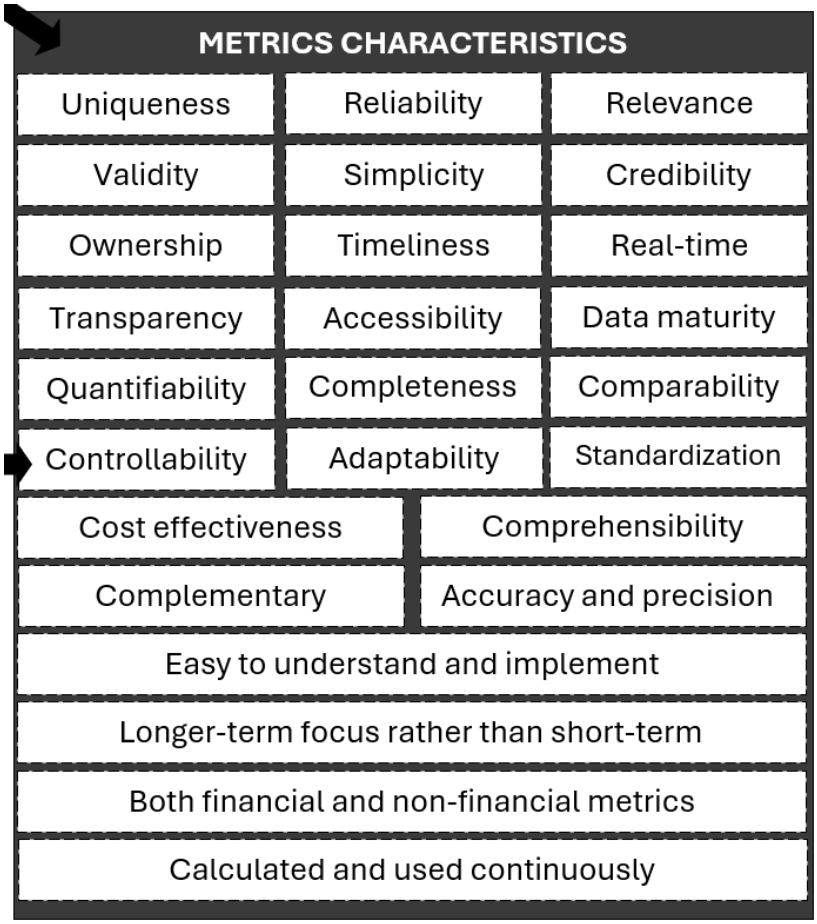

Figure 16. "Metrics Characteristics" -section in the framework.

Rantanen & Holtari (1999, 20), says that according to Sink (1985) and Laitinen (1998), metric's design criteria should be:

- Uniqueness – one metric for each item to be measured.
- Reliability – the results must be the trustworthy with every measurement instance.

- Relevance – the results must matter in decision-making.
- Validity – measuring exactly the thing from which information is desired.
- Simplicity – the metrics must be easy to use.
- Credibility – decision-makers can trust the results.
- Timeliness – the results must express the current operations.
- Quantifiability – the results must be presented as easily perceptible values.
- Completeness – selected metrics must provide a balanced picture of the operations.
- Controllability – it must be possible to control the metrics.
- Adaptable to changes in the production process.
- Cost effectiveness – the benefits must be higher than the sacrificed resources.
- Comprehensibility – the metrics must be simple enough for everyone to comprehend.
- They complement other performance metrics.
- Accuracy and precision – the results are close to one another.
- Simple and easy to understand and implement.
- They measure longer-term rather than short-term performance.
- Both financial and non-financial.
- They are calculated and used continuously.

Based on the interview responses, participants emphasized the importance of credibility, reliability, and relevance of metrics, supported by data accuracy, consistency, and applicability. Interviewees noted that users must have access to relevant information and that clear data ownership is required for effective performance management. Furthermore, the organization's level of data maturity should be considered when developing metrics, as emphasized by the participants. The interview data also indicated that comparing supplier performance can be challenging when suppliers operate under significantly different conditions and capability levels, highlighting the need for a certain level of comparability. In addition, standardized metrics were seen as important for ensuring consistent measurement practices across regions, while transparent and near real-time access to performance data was identified as enabling faster feedback between stakeholders.

The theoretical perspectives and empirical insights form the components listed in this section of the framework, which include: "Uniqueness", "Reliability", "Relevance", "Validity", "Simplicity", "Credibility", "Ownership", "Timeliness", "Real-time", "Transparency",

“Accessibility”, “Data maturity", "Quantifiability”, “Completeness”, “Comparability”, “Controllability”, “Adaptability”, “Standardization”, “Cost effectiveness", “Comprehensibility”, “Complementary”, “Accuracy and precision”, “Easy to understand and implement”, “Longer-term focus rather than short-term”, “Both financial and non-financial metrics”, and “Calculated and used continuously.”

6.7 Procurement and supply chain performance dimensions

The section “Procurement and supply chain performance dimensions”, as illustrated in Figure 17, was developed to define the key dimensions on which performance management and measurement should focus, and to which metrics should be aligned. This section is also closely linked to the “Design principles” and “Framework characteristics” sections, as it represents a key consideration within those areas.

Figure 17. “Procurement and supply chain performance dimensions” -section in the framework.

Balfaqih et al. (2016, 144) made a literature review and identified the following as the most typical dimensions in procurement and supply chain performance management: financial, customer, internal processes, learning, innovation, flexibility, reliability, time, responsiveness, quality, asset management, efficiency, resource, output, information, sustainability, Human Resource, integration, and risk. Van Weele and Rozemeijer (2022, 256; 351–352; 366; 371–375; 378; 383-384; 386) propose the following dimensions for measuring procurement and supply chain performance:

- Price, cost and spend

- Product quality and innovation
- Delivery and logistics
- Sustainability and compliance
- Organizational
- Supplier relationship
- Risk management

The interview responses identified several dimensions that should be included in an effective supply chain performance measurement and management system. When asked directly, the interviewees listed the following dimensions:

- Capability
- Customer
- Financial
- Quality
- Delivery Reliability

These dimensions largely align with those identified in the literature, except for "Capability," which emerged from the empirical data. All identified dimensions were incorporated into the framework as components, with some combined with similar dimensions from the literature. Furthermore, insights from other interview questions supported and reinforced the relevance of the theoretical dimensions. Several interviewees emphasized the importance of incorporating risk-related performance metrics, linking empirical findings to the risk dimension identified in the literature. In addition, the importance of quality-related metrics was highlighted, particularly in the post-delivery phase and in relation to suppliers' production capabilities, reinforcing the quality dimension.

The interview data also suggested that organizational capabilities and workforce-related indicators contribute to effective supply chain performance, aligning with the resource-related dimensions identified in the literature. Responses further highlighted the importance of responsiveness, both toward customers and from suppliers, which corresponds to the responsiveness dimension identified in prior studies. Additionally, the importance of integrating performance indicators to provide a comprehensive view of supply chain performance was emphasized, linking to the integration dimension. Finally, although

sustainability may currently have a lower emphasis within the organization, interviewees noted that it should be incorporated into performance measurement and management processes, consistent with the literature.

The theoretical contributions from the literature and the empirical findings from the interviews structure the components listed in this section of the framework, which include: “Financial”, “Customer”, “Organizational”, “Internal processes”, “Innovation”, “Asset management”, “Resource”, “Information”, “Learning”, “Human Resources”, “Agility”, “Efficiency”, “Risk”, “Reliability”, “Responsiveness”, “Flexibility”, “Capability”, “Delivery and logistics”, "Quality”, “Output”, “Supplier relationship”, “Compliance”, “Sustainability”, and “Integration.”

Additionally, Gunasekaran & Kobu (2007, 2835) and Shepherd et al. (2006, 248-251) list performance dimensions for supply chain management according to older version of supply chain operations reference (SCOR) phases which were plan, source, make, deliver, and return or customer satisfaction. This perspective was incorporated into the framework as a separate dimensional approach labelled “Dimensions by supply chain phases”, with the components “Plan”, “Source”, “Make”, “Deliver”, and “Return or Customer Satisfaction.” This was included to demonstrate that performance measurement and management can also be structured according to the phases of the supply chain.

6.8 Supplier relationship management

Suppliers should support the strategies and objectives of their customers, as customer growth typically translates into growth opportunities for the supplier as well (van Weele & Rozemeijer 2022, 125). For this reason, supplier relationship management was identified as a key dimension in procurement and supply chain performance measurement and management. Consequently, it was developed as a separate section labelled “Supplier Relationship Management,” as illustrated in Figure 18, to emphasize its importance. This section is directly linked to the “Supplier Relationship” dimension, as illustrated by the black arrow connecting them.

Figure 18. “Supplier relationship management” -section in the framework.

According to van Weele and Rozemeijer (2022, 238-40), supplier relationship management consists of four management activities:

1. Supplier control
2. Supplier management
3. Supplier development
4. Supplier innovation

Supplier development activities were also highlighted by the interview participants as an important aspect of supplier relationship management. Based on the literature and the interview findings, the following components were included in this section: “Supplier control”, “Supplier management”, “Supplier development”, and “Supplier innovation.”

In addition, the interview data revealed aspects not explicitly addressed in the theoretical framework. Interviewees emphasized that selecting capable suppliers through structured evaluation processes, as well as managing supplier capacity, are critical for effective supplier relationship management, performance, and supply chain risk mitigation. Based on these insights, the components “Supplier Selection” and “Capacity Management” were added to the section.

Furthermore, interviewees highlighted that significant differences exist between suppliers across regions in terms of reliability, competence, and operational maturity, which should be considered in supplier relationship and performance management. Cultural differences between regions, and even within countries, were also identified as important factors

influencing how supplier relationships are managed globally. In addition, language barriers and geographical distances may complicate communication and coordination between the organization and its suppliers. These insights informed the inclusion of the final components in this section, labelled “Supplier Differences” and “Cultural and Geographical Contexts.”

6.9 Sustainability performance models

The literature indicates that sustainability is an increasingly important dimension in supply chain performance management. According to van Weele & Rozemeijer (2022, 18; 283), procurement must address all these sustainability trends and expectations throughout the supply chain and pursue sustainable procurement which can improve profitability and enable companies to outperform less sustainable competitors. In addition, widely used sustainability frameworks and ratings can be leveraged to develop measures for supplier sustainability performance evaluation, such as the Dow Jones Sustainability Index, EcoVadis, ISO standards (van Weele & Rozemeijer 2022, 289) and the Global Reporting Initiative (GRI) as they already provide comprehensive coverage of supply chain–related topics (Beske-Janssen et al. 2015, 675). Furthermore, the Science Based Targets initiative (SBTi) was frequently mentioned by interviewees as an important model for supply chain performance management.

These theoretical insights and empirical findings informed the development of the section labelled “Sustainability performance models”, as illustrated in Figure 19, to emphasize that leveraging existing sustainability frameworks can add value to supply chain performance management. The components included in this section, based on the identified models, are “EcoVadis”, “Dow Jones Sustainability Index”, “ISO Standards”, “Global Reporting Initiative (GRI)”, and “Science Based Targets Initiative (SBTi).” This section is directly linked to the sustainability dimension presented in the “Procurement and Supply Chain Performance Dimensions” section, as illustrated by a black arrow connecting the two.

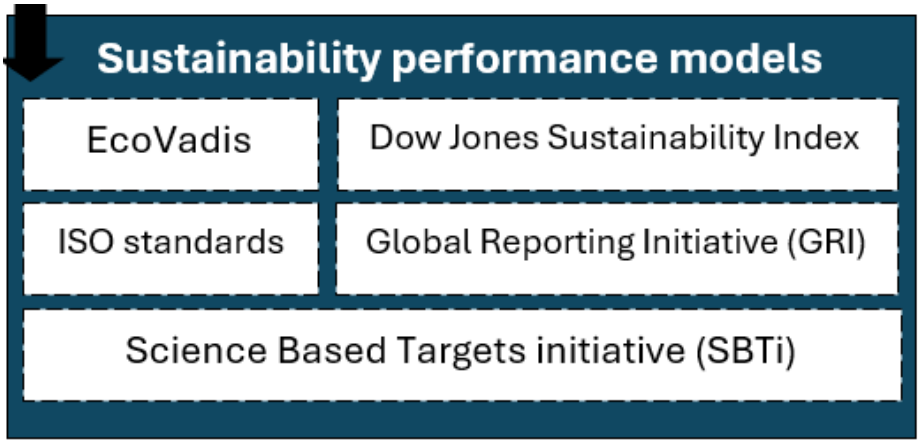

Figure 19. “Sustainability performance models” -section in the framework.

6.10 Supply chain performance models

Interviewees identified potential benefits associated with structured supply chain performance frameworks. Participants highlighted the potential of such frameworks to improve the structure, transparency, and systematic use of performance data. Based on these observations, the section “Supply chain performance models”, as illustrated in Figure 20, was incorporated into the framework to emphasize that best practices can be derived from existing frameworks. This section is linked to the “Procurement and supply chain performance dimensions” section, as such frameworks typically provide predefined dimensions and metrics. It is also connected to the component “Capture benefits of existing frameworks if possible” within the “Framework characteristics” section. These relationships are illustrated with black arrows connecting the respective elements.

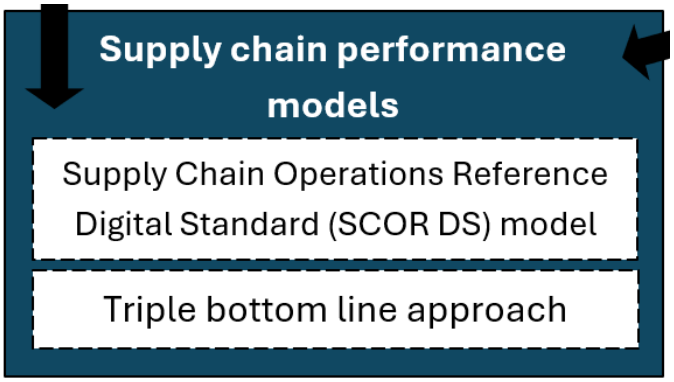

Figure 20. “Supply chain performance models” -section in the framework.

According to Akyuz & Erkan (2010, 5152), the SCOR model is one of the most important and most widely used approach in the supply chain performance measurement literature. For this reason, the component “Supply Chain Operations Reference Digital Standard (SCOR DS) Model” was included in this section to highlight its relevance and to encourage its consideration as a valuable reference for supply chain performance measurement and management.

It has been also suggested that for achieving sustained supply chain performance, it requires the application of the triple bottom line approach which involves evaluating supply chain performance in terms of economic, environmental, and social perspectives (Grant et al. 2017, 259). Furthermore, the interview results indicated that sustainability in supply chain management should be understood broadly and not limited to environmental aspects alone. Interviewees emphasized that supply chain management should also incorporate social responsibility, including health and safety considerations and compliance with legal and regulatory requirements. Based on both theoretical contributions and empirical insights, the component “Triple bottom line approach” was added to this section to emphasize that economic, environmental, and social aspects must be considered in supply chain performance measurement and management to achieve sustainable performance.

6.11 Changing environment

Several participants highlighted that recent disruptions and uncertainties have significantly impacted supply chain performance management by increasing risk, complexity, and interdependencies, thereby making performance more difficult to control and predict. Furthermore, according to Prater & Whitehead (2013, 34-35; 156), the current and future drivers of change will impact all levels of the supply chain management which results that it is important to always assess the drivers of changes and its impacts. Changes in the business environment or strategy within the current turbulent and dynamic context may create a need for new or revised measures and metrics (Melnyk et al. 2013, 173; Ukko et al. 2007, 10). Ferreira and Otley (2009, 275) further argue that such changes should be reflected in both the design of the performance measurement system and the use of the performance management system.

Based on these perspectives, a section labelled “Changing environment”, as illustrated in Figure 21, was developed to highlight the importance of monitoring current and future trends and incorporating their implications into supply chain performance measurement and management systems. This section is linked to the component “Updating the system and its metrics in response to changes” within the “Design principles” section, as illustrated by a connecting black arrow.

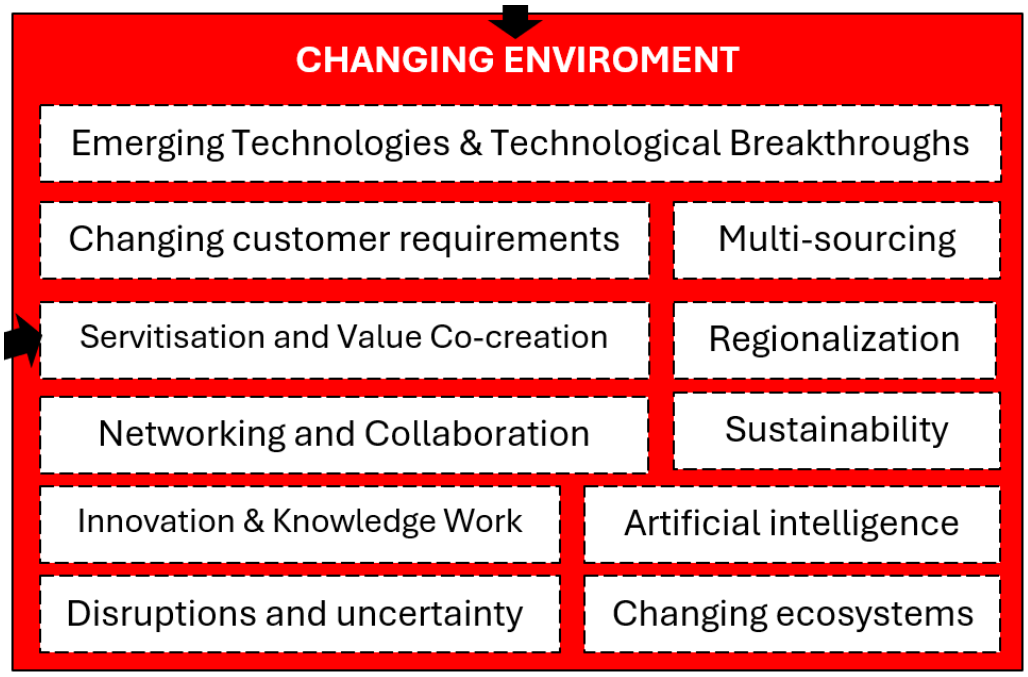

Figure 21. “Changing environment” -section in the framework.

Nudurupati et al. (2021, 4 & 10) have recognized five key trends that are affecting performance measurement systems’ and performance management’s usage, purpose, strategic objectives, deployment, measuring and assessments, which are: emerging technologies, networking & collaboration, servitisation & value co-creation, innovation & knowledge work, and environment & sustainability. Merkert & Hoberg (2023, 43-44) further identify four key trend categories that will affect the future of supply chain management: technological breakthroughs, changing ecosystems, changing customer requirements, climate & resource security, that is sustainability. In addition, interview data indicated that improved integrated information systems, automation, and data transparency across supply chains was seen as an important capability for the future. Interviewees also emphasized that

sustainability considerations should be embedded in supply chain performance measurement and will play an increasingly significant role in performance management.

Based on the literature review and empirical findings, the following components were included in this section to capture key trends relevant to the development of supply chain performance measurement and management systems: “Emerging Technologies & Technological Breakthroughs”, “Changing customer requirements”, “Servitisation and Value Co-creation”, “Networking and Collaboration”, “Sustainability”, “Innovation & Knowledge Work”, and “Changing ecosystems.”

Furthermore, additional change drivers were identified in the empirical findings. Interview responses indicated that uncertainties and disruptions are expected to continue which require organizations to enhance their preparedness and resilience. Recent disruptions were described as accelerating the shift toward more regionalized supply chain structures and reducing dependency on specific geographic regions, such as China. Participants also emphasized the importance of maintaining a balanced global supply chain by aligning sourcing strategies with customer locations and ensuring flexibility through multi-sourcing. Finally, the ability to adopt and effectively utilize artificial intelligence in supply chain and procurement performance measurement and management was highlighted as a key future capability. These empirical insights informed the inclusion of the following additional components in this section: “Multi-sourcing”, “Regionalization”, “Disruptions and uncertainty”, and “Artificial intelligence.”

6.12 Risks in supply chain

Interview data suggested that risk-related metrics can provide a more proactive perspective on supply chain resilience. In addition, supply risk management was identified as a key procurement objective, highlighting the importance of understanding the various types of risks in supply chain management. Therefore, a section labelled “Risks in supply chain”, as illustrated in Figure 22, was incorporated into the framework to emphasize this aspect. This section is closely linked to the “Changing environment” section, as previously it was identified that environmental turbulence increases risk levels. This relationship is illustrated by a black arrow connecting the two sections.

Figure 22. “Risks in supply chain” -section in the framework.

According to Grant et al. 2017, (212–213), risk in a supply chain context refers to unforeseen events that disrupt the normal flow of goods and may result in losses related to productivity, revenue, customer relationships, or even human lives. Furthermore, Grant et al. (2017, 214–215) identify following types of risk in global supply chains that require monitoring and mitigation:

- Demand risk
- Supply risk
- Operational risk
- Competitive risk
- Security risk
- Macroeconomic risk
- Policy risk
- Reputational risk
- Criminal risk
- Resource risk

In addition, interviewees highlighted that organizational complexity may create challenges in the implementation and use of supply chain performance measurement and management

systems. The theoretical perspectives from the literature, together with the empirical insights, form the components included in this section, which are: “Demand risk”, “Supply risk”, “Operational risk”, “Competitive risk”, “Security risk”, “Macroeconomic risk”, “Policy risk”, Reputational risk”, “Criminal risk”, “Resource risk”, and “Organizational complexity.”

6.13 People

For a successful performance measurement, people must be involved in the development of the performance measurement system and as well in the measurement itself since desired objectives can’t be achieved without individuals and their input or output (Ukko et al. 2007, 7; 12). Ukko et al. (2007, 12) further explain, citating to Uusi-Rauva (1996), that performance measurement can also affect organizational members by highlighting the value of what is being measured and directing effort towards the right actions. In addition, with performance measurement, the organization can clarify its vision and objectives to the organizational members (Ukko et al. 2007, 12) and influence them (Ferreira & Otley 2009, 271) by increasing commitment, motivation, and creativity of the individuals (Ukko et al. 2007, 7).

A clear and consistent theme that emerged from the responses was the importance of collaboration, organizational culture, and people-related factors as fundamental enablers of effective performance management, especially in large global companies. These insights from both the literature and empirical data led to the development of the final, and perhaps the most critical section of the framework, labelled “People”, as illustrated in Figure 23. This section is positioned at the top of the framework, as all previously described sections and components are ultimately managed by organizational members, who have the greatest influence on the success or failure of supply chain performance measurement and management.

Figure 23. “People” -section in the framework.

7 Results, conclusions, and recommendations

7.1 Research results and conclusions

This research had two main objectives. The first objective was to develop a performance measurement and management framework for global supply chains in a case company that outsources its manufacturing operations and operates through a nominated expert organization responsible for managing and measuring supply chain performance. The second objective was to identify suitable supply chain strategies that consider the current turbulent business environment and future trends affecting supply chain management. The outcome of the study is a proposed framework for procurement and supply chain performance measurement and management, designed for organizations operating in turbulent global supply chain environments.

The study was conducted through a literature review and an empirical interview phase. The framework was developed by integrating theoretical perspectives on procurement, supply chain management, performance measurement, and performance management with the practical insights gathered from interviews within the case company. The research focused on the design of the framework, while the actual implementation, testing, and construction of the performance measurement system with specific key performance indicators were excluded from the scope of the study.

To achieve the research objectives, three research questions were formulated. These are presented below and addressed individually in the following sections.

How can a performance management system framework be designed to measure and manage the performance of globally outsourced manufacturing supply chain?

It is a demanding duty to manage an organization and its performance since it requires a lot of data, skill, and competence (Rantanen & Holtari 1999, 1). This challenge becomes even more complex in global and highly interconnected supply chain environments, where uncertainty, interdependencies, and operational diversity increase the difficulty of effective performance management. To address this challenge and answer the research question, this

study proposes a framework for procurement and supply chain performance measurement and management that incorporates the following aspects:

- People
- Procurement and supply chain performance concept
- Strategic alignment
- Cause-and-effect relationships and strategy maps
- Key success factors
- Performance management system
- Performance measurement system
- Organizational control
- Design principles
- Risks in supply chain
- Changing environment
- Framework characteristics
- Metrics characteristics
- Procurement and supply chain performance dimensions
- Supplier relationship management
- Sustainability performance models
- Supply chain performance models

Consistent with earlier studies, the findings emphasize that people play a central role in successful performance measurement and management. Previous literature highlights that individuals must be involved both in the development and use of performance measurement systems (Ukko et al. 2007, 7; 12). The empirical findings reinforce this perspective by identifying collaboration, organizational culture, and people-related factors as fundamental enablers of effective performance management, particularly in large global organizations. This extends earlier research by highlighting that social and behavioral aspects may have an even stronger practical influence on performance management effectiveness than usually emphasized.

The findings also contribute to the existing literature by introducing a dedicated conceptual foundation for procurement and supply chain performance within the framework. While

previous studies provide definitions for performance measurement and management concepts and present existing frameworks, they often focus primarily on dimensions and metrics. In contrast, the framework developed in this study emphasizes the importance of establishing a shared conceptual understanding of procurement, supply chain management, and performance as a prerequisite for effective performance measurement and management. This broadens the traditional perspective by positioning conceptual alignment as a core design element.

The results further reinforce the importance of strategic alignment in performance management system design. Earlier studies identify organizational purposes and objectives as the starting point for performance management (Ferreira & Otley 2009, 267) and emphasize that performance measurement systems should be based on organizational strategy and objectives (Rantanen & Holtari 1999, 44). The empirical findings support this view by demonstrating that corporate strategy strongly influences the direction, priorities, and objectives of supply chain performance management.

The findings are also aligned with previous literature regarding cause-and-effect relationships and strategy maps. Earlier studies suggest that performance measurement and management can be used to communicate strategies and objectives to organizational members (Ferreira & Otley 2009, 270-271) through cause-and-effect relationships (Ukko et al. 2007, 16) which can be shown visually with strategy maps (Kaplan & Norton 2004, 41-43). The empirical findings support this by highlighting the need for integrated and interconnected metrics to provide a more comprehensive understanding of supply chain performance.

In line with Bititci (2015, 25) and Ukko et al. (2007, 16), the findings confirm that performance measures should focus on key success factors that support organizational viability and strategic success. The empirical findings extend this understanding by identifying several practical supply chain-specific key success factors that are relevant in globally outsourced manufacturing environments. These include transparent and well-defined performance measurement practices, a regionally balanced supply chain structure, governance and ownership supported by consistent ways of working, strong supplier and internal capabilities, effective supplier relationship management, customer support and alignment, cross-functional alignment, employee commitment, engagement, accountability, clarity of responsibilities, supportive organizational culture that enables teamwork and

knowledge sharing, multi-sourcing strategies, improved capacity management, and enhanced visibility across the supply network.

Earlier studies emphasized that performance measurement and management systems consist of two integrated elements which are the performance measurement system and the performance management system (Melnyk et al. 2013,175). A thorough understanding of the relationship between these two elements is essential for effective system design, which in this study led to the inclusion of a conceptual foundation covering performance measurement, performance measures, performance management, organizational control, as well as technical and social control mechanisms within the framework. The empirical findings extend this understanding by highlighting that, while technical aspects of performance systems are relatively well-structured and formalized, the implementation of social control elements presents significantly greater challenges in practice.

The design principles of the framework are also strongly supported by previous studies. Literature identifies four main phases in performance measurement system development: design, deployment, usage, and maintenance (Ukko et al. 2007, 12). Similarly, Rantanen and Holtari (1999, 24) emphasize the importance of defining the scope of the system. The empirical findings extend this by highlighting the practical need to prioritize strategic or high-impact suppliers due to time and resource limitations, which adds a pragmatic prioritization perspective to the framework design process.

Regarding metric design, the findings are consistent with the criteria identified by Rantanen and Holtari (1999, 20), drawing on Sink (1985) and Laitinen (1998). The empirical findings reinforce these criteria by emphasizing credibility, data accuracy, consistency, and applicability. In addition, the findings extend previous literature by identifying ownership, accessibility, comparability, data maturity, and standardization as important practical criteria for metric development, particularly in global supply chain contexts.

The empirical findings further contribute to the framework by identifying additional framework characteristics that are not strongly emphasized in earlier literature. These include the need for predictive and preventive capabilities to support proactive risk mitigation, the importance of aligning performance management with the characteristics of the organization’s business model, and the challenges of maintaining consistent performance measurement practices across regions and suppliers due to cultural, operational, and process-

related differences. The findings also highlight the importance of understanding organizational culture, resources, and capabilities on a global level, fostering transparent supplier collaboration, ensuring cross-level and cross-functional cooperation, involving balanced and competence-based participants in framework development, and maintaining a manageable set of strategically relevant metrics. These findings contribute to the literature by strengthening the contextual and practical dimensions of supply chain performance management framework design.

Which performance management system dimensions and performance measurement indicators are most suitable for global supply chain management?

Previous literature identifies a broad set of performance dimensions relevant to procurement and supply chain management. The empirical findings of this study largely confirm the relevance of these dimensions in global supply chain contexts as financial, customer, quality, delivery reliability, risk management, workforce, responsiveness, integration, and sustainability were identified as key dimensions. One new dimension was identified by the interviewees which was capability dimension, extending the theorical contribution on the research field which was not explicitly emphasized in prior theoretical frameworks.

The findings coincide with prior research in highlighting the importance of supplier relationship management as a core dimension of supply chain performance management. van Weele and Rozemeijer (2022, 238-40), emphasize supplier control, supplier management, supplier development, and supplier innovation as important supplier relationship management activity. The empirical findings support this view, while extending it by highlighting the importance of selection on the suppliers, supplier capability management, regional supplier differences, and cultural and geographical contexts as important practical considerations in globally outsourced supply chains.

The literature consistently indicates that sustainability is an increasingly important dimension in supply chain performance management as procurement must address all these sustainability trends and expectations throughout the supply chain and pursue sustainable procurement (van Weele & Rozemeijer 2022, 18; 283). Existing literature further suggests that established sustainability frameworks and rating systems can be effectively utilized to support supplier performance evaluation where practitioners list Dow Jones Sustainability

Index, EcoVadis, ISO standards (van Weele & Rozemeijer 2022, 289) and the Global Reporting Initiative (Beske-Janssen et al. 2015, 675). The empirical findings of this study support the increasing relevance of sustainability in global supply chain performance management while boarding the field by providing Science Based Targets initiative (SBTi) as a key reference framework.

The results further highlight the importance of utilization of existing supply chain performance models as according to the interviewees, it can bring improvements to the structure, transparency, and systematic use of performance data. From a theoretical perspective, Akyuz & Erkan (2010, 5152) identify the Supply Chain Operations Reference (SCOR) model as one of the most widely recognized and utilized frameworks in supply chain performance measurement literature while Grant et al. (2017, 259) emphasizes triple bottom line approach. The empirical findings of this study support and extend this view by empathizing that supply chain management should incorporate social responsibility, including health and safety considerations and compliance with legal and regulatory requirements.

Although one of the objectives of the question was to identify individual performance metrics and include these on the framework, the literature review revealed a broad range of potential supply chain measures, making the selection highly context dependent. For this reason, the study does not prescribe a fixed set of metrics for the case company. Instead, the framework incorporates the principles, criteria, and dimensions for metric design and selection, supported by the extensive set of metrics presented in the literature review, that can be utilized if appropriate.

How should the current turbulent environment and future trends be considered in global supply chain performance management and measurement?

The empirical findings indicate that supply chain performance management frameworks must be designed to operate in continuously changing and increasingly turbulent business environments. These findings are consistent with earlier studies, which suggest that current and future drivers of change affect all levels of supply chain management and therefore require continuous assessment and adaptation (Prater & Whitehead 2013, 34–35; 156). Similarly, Ferreira and Otley (2009, 275) emphasize that such changes should be reflected

both in the design of the performance measurement system and in the use of the performance management system.

Previous literature has identified several key trends affecting both performance measurement systems and supply chain management in current and future business environments. The empirical findings strongly reinforce these theoretical trends, particularly by emphasizing the increasing importance of integrated information systems, automation, data transparency, and sustainability as essential future capabilities in supply chain performance management. While earlier literature broadly recognizes technological development as a major driver of change, the empirical findings specifically highlight the growing role of artificial intelligence in improving data analysis, performance visibility, predictive capabilities, and decision-making processes. This extends previous theoretical discussions by identifying artificial intelligence as a strategically relevant capability in supply chain performance management.

The empirical findings further extend previous literature by identifying practical change drivers that are particularly relevant in globally outsourced manufacturing environments. Interviewees highlighted that ongoing disruptions are accelerating the transition toward more regionalized supply chain structures and reducing dependency on individual geographical regions. This suggests that supply chain resilience increasingly depends on geographical balancing and diversified multi-sourcing strategies to mitigate supply-related risks and improve operational flexibility.

The integration of risk management into supply chain performance measurement and management systems emerged as a key solution for addressing challenges related to the current turbulent business environment and future supply chain uncertainties. The findings indicate that risk-related metrics can provide a more proactive perspective on supply chain resilience by improving visibility into potential disruptions and enabling earlier intervention. In addition, supply risk management was identified by interviewees as a key procurement objective, reinforcing the importance of understanding and managing supply chain risks as an integral part of performance management practices.

Grant et al. 2017, (212–213) define supply chain risks as unforeseen events that disrupt the normal flow of goods and may result in losses related to productivity, revenue, customer relationships, or even human lives. Furthermore, Grant et al. (2017, 214–215) identify

multiple types of risks in global supply chains that require monitoring and mitigation. The findings of this study reinforce the relevance of these theoretical risk categories and support their integration into supply chain performance management frameworks.

The empirical findings also extend previous studies by identifying internal organizational complexity as an important risk factor affecting the implementation and use of supply chain performance measurement and management systems. Large organizational structures, unclear responsibilities, and varying regional practices were found to increase the difficulty of implementing consistent and effective performance management practices across global supply chains. This highlights that, in addition to external supply chain risks, organizations must also recognize internal structural complexity as a critical factor influencing supply chain performance management effectiveness.

It can be concluded that this study fulfilled its two primary research objectives which were:

1. develop a performance measurement and management framework for global supply chains in a case company that outsources its manufacturing operations and operates through a nominated expert organization responsible for managing and measuring supply chain performance.
2. identify suitable supply chain strategies that consider the current turbulent business environment and future trends affecting supply chain management.

First, the study developed a performance measurement and management framework for global supply chains in the case company context, where manufacturing operations are outsourced and managed through a nominated expert organization responsible for supply chain performance measurement and management. Second, the study identified suitable supply chain strategies and strategic considerations for operating in the current turbulent business environment and for responding to future trends affecting supply chain management.

It can also be concluded that the research questions were largely answered. The study successfully addressed the design principles, key dimensions, strategic considerations, and turbulent environment factors relevant to global supply chain performance measurement and management. However, the research did not provide direct or definitive answers regarding the specific performance dimensions or metrics that should be utilized in the case organization. This was primarily due to the extensive variety of metrics identified in the

literature and the context-specific nature of metric selection, which requires organizational prioritization based on strategic objectives, operational realities, and available resources. Instead, the developed framework offers a foundation for the future construction, implementation, and continuous development of a supply chain performance measurement and management system in the case organization.

7.2 Future research opportunities and recommendations

Although this study provides a structured framework for global supply chain performance measurement and management, several opportunities for future research emerged during the research process.

First, future research should focus on a more detailed analysis of supply chain performance dimensions and individual performance metrics. The literature presents a broad range of possible dimensions and indicators for supply chain performance measurement, but this study identified that effective performance management requires a manageable and strategically focused set of metrics. Therefore, further research is needed to evaluate which specific performance dimensions and indicators provide the highest practical value for effective supply chain performance management in different organizational contexts.

Second, future studies should examine how performance measurement should be practically conducted and analyzed in global supply chain environments. While this study focused on framework design, the practical implementation of measurement processes, including data collection methods, analysis practices, reporting structures, and decision-making processes based on performance data, remains an important area for further investigation.

Third, the practical functionality and effectiveness of the developed framework should be tested under real organizational conditions. According to Oyegoke (2011, 591–592), a study can be categorized as constructive research only when all six phases are completed: problem identification, demonstration of in-depth understanding of the topic, construction of the solution, justification of the construct, highlighting both theoretical and practical contributions, and examination of the scope of applicability. In addition, Kasanen et al. (1991, 246) also emphasize that it must be demonstrated that the innovativeness and the construction work under actual conditions. While this study fulfils the early phases of

constructive research by identifying the problem, establishing theoretical understanding, and constructing the framework, the practical implementation and validation of the framework remain outside the scope of this research. Therefore, future research should focus on implementing the framework in the case organization and evaluating its practical applicability, effectiveness, and impact on supply chain performance management under real-world conditions.

Fourth, the case study nature of this research creates limitations regarding broader generalizability. As Jari Metsämuuronen (2006, 90–91) notes, findings from a single case cannot be directly generalized, although they may reveal common features applicable to similar cases. Similarly, Louis Cohen et al. (2007, 254) argue that case study findings may be extended to broader groups of similar cases or applied to contexts sharing comparable characteristics. For this reason, future research should test and refine the framework in different organizations, industries, and supply chain environments to assess its transferability and broader applicability.

Finally, the empirical findings highlighted the noteworthy influence of the business model on supply chain performance measurement and management system design. In the case organization, the project-driven business model appeared to shape performance management priorities, measurement needs, and operational complexity. This indicates that business model characteristics may influence framework design and implementation. Future research should therefore examine more closely how different business models affect supply chain performance measurement and management practices and whether business model-specific adaptations are required.

8 Summary

The purpose of this research was to develop a performance measurement and management framework for global supply chains in a case company that outsources its manufacturing operations and operates through a nominated expert organization responsible for managing and measuring supply chain performance. In addition, the study aimed to identify suitable supply chain strategies and strategic considerations for operating in the current turbulent business environment and in future supply chain contexts.

The study was empirical, utilizing qualitative research practices and a case study as its research strategy. Additionally, the research followed constructive research methodology, where the construct is a new framework for procurement and supply chain performance measurement and management, designed to support the case company in managing globally outsourced manufacturing supply chains.

The research process consisted of two main phases: a literature review and an empirical interview phase. The literature review examined performance measurement and management systems, procurement and supply chain management, and performance measurement and management in procurement and supply chains. The empirical phase consisted of semi-structured interview with a thematic approach conducted within the case organization to identify practical needs, challenges, and organizational perspectives related to supply chain performance measurement and management.

The findings of the study resulted in the construction of a comprehensive framework for procurement and supply chain performance measurement and management. The framework integrates conceptual foundations of procurement, supply chain management, and performance, strategic alignment, key success factors, performance measurement and performance management systems, design principles, framework characteristics, metric characteristics, supply chain performance dimensions, supplier relationship management, sustainability performance models, supply chain performance models, supply chain risks, and changing environmental conditions. A key practical finding was that effective supply chain performance management requires not only technical structures and systems, but also strong people-related factors such as collaboration, organizational culture, employee accountability, and cross-functional alignment.

The study confirmed that many performance dimensions identified in previous literature remain highly relevant in global supply chain management, including financial performance, customer-related performance, quality, delivery reliability, risk management, sustainability, and supplier relationship management. In addition, the empirical findings identified capability as an important performance dimension, emphasizing the role of supplier and organizational competencies in achieving supply chain performance. The findings also highlighted that performance metrics should be selected carefully to ensure they remain manageable, strategically relevant, and aligned with organizational priorities.

The findings further demonstrated that current business turbulence, supply chain disruptions, sustainability requirements, technological development, and increasing complexity significantly influence supply chain performance management. In particular, the increasing role of integrated information systems, automation, artificial intelligence, regionalization, multi-sourcing strategies, and proactive risk management were identified as important future capabilities. The study also identified organizational complexity as an internal risk factor affecting the implementation and effectiveness of supply chain performance management systems.

It can be concluded that the study fulfilled its primary research objectives by developing a structured supply chain performance measurement and management framework and by identifying strategic considerations for managing supply chain performance in changing business environments. The research questions were largely answered, although the study did not define a finalized set of performance metrics for the case company. Instead, the study provides a structured framework, performance dimensions, and metric design principles to support the future selection and implementation of suitable performance indicators based on the organization’s strategic priorities and operational needs.

The study contributes both theoretically and practically. The theoretical contribution lies in integrating established performance management theories with empirical findings from global supply chain practice into a comprehensive framework. The practical contribution lies in providing the case organization with a structured foundation for developing, implementing, and maintaining its future supply chain performance measurement and management system. Future research should focus on testing the framework in practical organizational settings, refining the selection of performance metrics, and evaluating the framework’s applicability in other organizational and business models.

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Appendix 1. Interview themes and questions

Theme 1: Current practices in Performance Measurement and Management

1. **Can you describe how supply chain performance is currently measured and managed in your organization?**

   Sub-questions (if needed):
   a. What works well?
   b. What do you find challenging or insufficient?

2. **How is performance information actually used in decision-making and daily supply chain management?**

   Sub-questions (if needed):
   a. When does performance measurement fail to support management?
   b. Can you describe a situation where performance data influenced a decision?

3. **How do you think your organization could implement established frameworks, such as Supply Chain Operations Reference Digital Standard (SCOR DS) model, in supply chain performance management?**

   Sub-questions (if needed):
   a. What challenges or adaptations would be necessary for global implementation?

Theme 2: Supplier Relationship Management in Performance Management

4. **How does differences between regions or suppliers influence the way you measure and manage supply chain performance?**

   Sub-questions (if needed):
   a. How do cultural, geographical, or organizational differences show up in performance management?

2. **How do you balance that performance measurement and management of supply chain is globally comparable with each other in different regions.**

   Sub-questions (if needed):
   a. Have you experienced conflicts between global metrics and local realities?

5. **In your view, how should suppliers be involved in the supply chain performance measurement and management?**

   Sub-questions (if needed):
   a. What level of transparency or data sharing is effective?
   b. How do collaborative relationships affect performance measurement?

Theme 3: Design requirements for the new framework

6. **How are corporate strategies and objectives translated into supply chain performance measures and management practices in your organization?**

   Sub-questions (if needed):
   a. Which mechanisms ensure alignment between strategy and operational performance measures?

7. **From your experience, what dimensions should a well-functioning performance management system for a global supply chain include?**

   Sub-questions (if needed):
   b. Should the dimensions come from strategy, or should it be different in operational levels?

8. **What performance measures should be measured in supply chain management?**

   Sub-questions (if needed):
   a. Who should be responsible for defining and using performance metrics?
   c. Are there indicators you collect but do not really use?

9. **In your opinion, what are the key success factors that must be present to achieve success in supply chain performance?**

10. **How should sustainability be integrated into supply chain performance measurement and management?**

    Sub-questions (if needed):
    d. Which sustainability indicators are most relevant?
    e. How does sustainability influence decisions and operational practices?

Theme 4: Organizational Control and Individual's role in Performance Management

11. **How do organizational control systems, both technical and social (culture, behaviors), influence the way supply chain performance is measured and managed?**

    Sub-questions (if needed):
    a. Can you give examples of technical controls that support or hinder performance measurement?
    b. How does organizational culture or employee behavior affect the use or success of performance measures?

12. **How should individuals from different organizational levels be involved in developing the performance management framework and defining the measures?**

    Sub-questions (if needed):
    c. How can these individuals' input improve or decrease the relevance or usability of performance measures?

13. **In your experience, how can individuals influence the achievement of supply chain objectives through their actions or decisions?**

    Sub-questions (if needed):
    d. How do personal incentives (bonus), skills, or knowledge contribute to performance outcomes?

Theme 5: Risk, Resilience, and Future Trends in Supply Chain Performance Management

14. **How have recent disruptions or uncertainties affected supply chain performance management?**

    Sub-questions (if needed):
    a. Did existing performance measures support or hinder management during these situations?

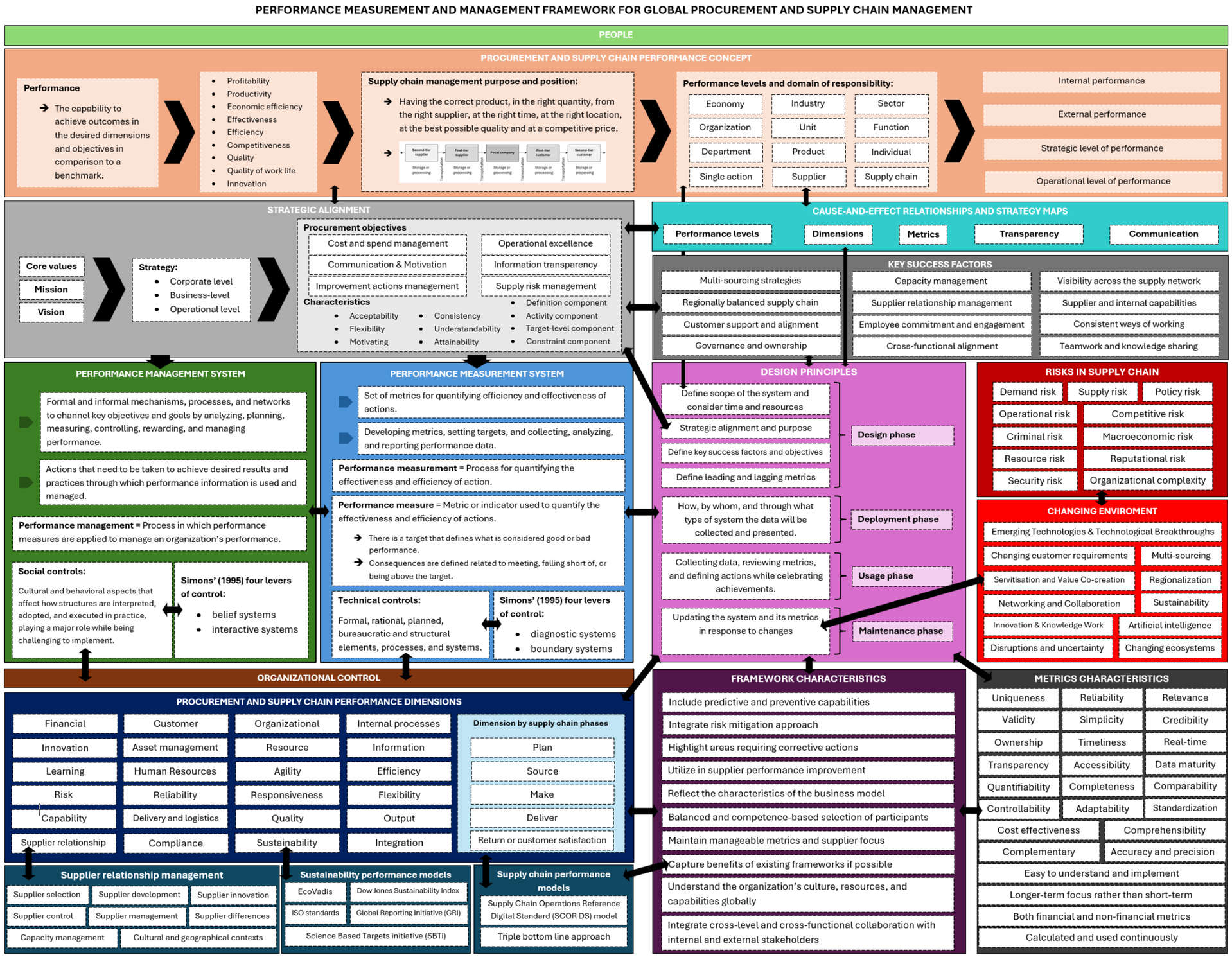
15. **In your view, how should performance management systems support resilience for supply chain risks?**

    Sub-questions (if needed):

    b. How should risk mitigation and resilience incorporated into the performance measurement framework?

16. **Looking ahead, what trends you are observing now that could affect the global supply chain performance management?**

    Sub-questions (if needed):

    c. What capabilities will organizations need in the future regarding performance measurement in supply chain?

Appendix 2. Performance measurement and management framework for global procurement and supply chain management