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The evolution of performance measurement systems in a supply chain: A longitudinal case study on the role of interorganisational factors

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Abstract

Supply chain performance measurement systems are important because they are the central managerial mechanisms for achieving efficient and effective supply chain management. Therefore, it is relevant to add to the many conceptual contributions on the subject to explore how such systems unfold and develop in practice. The objective of the present study is to investigate how forces located outside focal firm boundaries influence the evolution of performance measurement systems in supply chains. An evolutionary and dialectic approach is applied, acknowledging that change may be the result of collective action and of opposing influences and forces. Using a longitudinal case study approach, the emergence, proliferation and reconfiguration of three varied yet interrelated performance measurement systems designed to manage a supply chain in the hearing aid industry are explored. The case shows how the evolution of performance measurement systems in supply chains may be informed by multiple influences, some of which are external to the firm. Specifically, 'interconnectivity of performance measures', 'availability and ownership of performance information' and 'performance representations' are all found to be important factors influencing the evolution of the observed performance measurement systems. The framework of the proposed factors here builds on and extends previous research, which has not explicitly incorporated the potential influences of external entities and the supply chain context. Thus, the findings expand our knowledge on how performance measurement systems develop over time in supply chains. With this new knowledge, managers should be better equipped to develop robust and enduring performance measurement systems in supply chains.

Keywords Case study; evolution; supply chain; performance measurement system

Paper type Research paper

1. Introduction

Performance measurement systems (PMS) are important to firms, supply chains and society in general because they are the central mechanisms in the implementation of supply chain management (Laihonen and Pekkola, 2016; Van Hoek, 1998). With proper PMS embedded in a supply chain, supply chain strategy implementation, control, decision making, communication and improvement can be realised (Anthony et al., 2007; Bhagwat and Sharma, 2009; Gunasekaran et al., 2004; Melnyk et al., 2004; Mondragon et al., 2011). However not all measures and performance measurement system designs are equally effective in achieving these beneficial outcomes (Hanson et al., 2011). Therefore, it is important to understand how measures and supply chain performance measurement systems (SCPMS) are designed and used and how they evolve over time when embedded as a practice in a supply chain. This is the overall theme of the current research.

PMS have been explored extensively as part of supply chain management, and several comprehensive literature reviews have now appeared on the subject (e.g., Akyuz and Erkan, 2010; Gunasekaran and Kobu, 2007; Hassini et al., 2012; Maestrini et al., 2017). According to these literature reviews, research on SCPMS have mainly been focusing on measure selection and system design (Barber, 2008; Beamon, 1999; Ganji Jamehshooran et al., 2015; Ganga and Carpinetti, 2011; Gunasekaran et al., 2004; Sellitto et al., 2015). Only to a lesser extent, research on SCPMS have explored how the suggested designs are or can be implemented and made part of a practice (Gulledge and Chavusholu, 2008; Hofmann and Locker, 2009; Mondragon et al., 2011). Very few contributions have extended the research to include an exploration of how SCPMS are used, updated and reviewed in practice (Hald and Ellegaard, 2011; Luzzini et al., 2014; Schmitz and Platts, 2004). Thus, although research on SCPMS has evolved, more empirical and exploratory research with a view toward theory building is needed. One important gap is that according to Maestrini et al. (2017), there is no research exploring the design, implementation, use and review of

SCPMS that would extend the dyadic relationship to incorporate multitiers in the supply chain and over extended periods of time (Maestrini et al., 2017). This is the focus and overall objective of the present research. Specifically, this paper addresses the evolution of PMS in a supply chain.

Exploring the evolution of PMS in a supply chain is relevant because it has the potential to expand current knowledge on at least two grounds. First, and contrary to organisational perspectives, the activities, resources and actors located outside ownership boundaries at supplier or customer facilities may explicitly or implicitly affect the design, implementation, use and reflection of measures and systems, and so far, this has not been explored empirically. Second, SCPMS represent wider scopes of performance representations when compared with representations focusing on the organisation. Such systems often include both downstream and upstream performance perspectives within their scopes and relate to the multiple tiers of different firms' activities in one performance system (Holmberg, 2000). It has been suggested that this wider scope and interrelatedness of measures hold implications for the potential of trade-offs between performance dimensions and the occurrence of different needs and views on the measures located in different parts of the supply chain.

Thus, one important concern is how this wider scope (compared with intraorganisational views) implicates the stability and evolution of the PMS. What, for instance, is the role of external organisational entities such as suppliers and customers? What is the role of the processes, systems, people and culture located outside the focal firm in the supply chain? The purpose of the current study is hence to add to the current understanding of how PMS evolve by exploring their evolution empirically in a supply chain context; therefore, the following research question is addressed: *How do the factors located outside focal firm boundaries influence the evolution of performance measurement systems in supply chains?*

To address this research question, an evolutionary and dialectic approach is applied, acknowledging that change may be the result of collective action, as well as opposing influences and forces. The objective here is to develop a new theory. In relation to the methodology, a longitudinal case study research strategy is employed, and the emergence, proliferation and reconfiguration of three different but interrelated PMS designed to manage a supply chain in the hearing aid industry are explored.

The case analysis shows how evolution was continuously and incrementally informed by multiple influences and adjustments originating outside the focal firm's ownership boundaries. Three major forces are found to influence the evolution of the analysed PMS: 'interconnectivity of performance measures', 'availability and ownership of performance information' and 'performance representations'. As will be highlighted, the identified forces and their subdimensions both corroborate and extend current research on SCPMS and the framework of factors identified by Kennerley and Neely (2002) in an earlier contribution that focused on the evolution of PMS inside organisations.

The remainder of the current paper is structured as follows: This introduction is followed by section 2, a literature review that examines the literature on the development and evolution of PMS and SCPMS. Then, in section 3, the design, methodology and approach are described, and this is followed by section 4, which presents the case study findings. Based on the case study findings, section 5 then develops a framework proposing the factors affecting the evolution of PMS in a supply chain. Section 6 links the case study findings to the literature. Finally, in section 7, the paper concludes and presents research limitations, practical implications and suggestions for future research.

2. Theoretical foundation

Performance measurement can be understood as the process that quantifies the efficiency and effectiveness of past actions (Neely et al., 2002). PMS can be described as a set of performance measures that are jointly considered when making sense of the performance of an organisational entity (Carlsson-Wall et al., 2016). PMS are fundamentally information systems that transform inputs (data) into outputs (performance measures), which are then used to evaluate performance and provide feedback (Burney and Matherly 2007).

PMS are important managerial mechanisms and supports strategy implementation, communication, information and the control of processes (Kaplan and Norton, 2000; Melnyk et al., 2004; Wouters and Sportel, 2005). Because of their standardisation, universality and battery of incentives they provide, PMS are key mechanisms in communicating direction. A measurement system states what is relevant and not; what is congruent and not; and what is to be reviewed and not. It also provides signals for where management has to intervene. Finally, the incentives attached to the measures and targets in the system orients operational efforts toward the areas of responsibility. Based on these grounds, studying change and evolutions in PMS are highly important.

2.1 Evolution of PMS

Studying evolution is analysing the gradual development of something (e.g., PMS) from one form to another (Thompson, 1995). Evolution and change are only imaginable if there is a gap within and between structure and agency, an absence hat can be mobilised and that can mobilise (Busco et al., 2007). One type of gap centres on the misalignments between strategy and PMS (Hanson et al., 2011). Another type of gap centres on the politics of engagements and involvement. To become something to which people can refer to, a performance measurement system needs to offer a possibility for engagement, for becoming what it is not and for being translated into something that is less alien and more familiar to its users (Busco et al., 2007).

Over the last two decades, specific enquiries into the evolution and change of PMS have been few (Gutierrez et al. 2015; Kennerley and Neely, 2002; Kennerley and Neely, 2003; Waggoner et al., 1999; Wouters and Sportel, 2005). Early contributions have called for the importance of understanding the dynamic nature of measurement systems, recognising that they are not simply designed and implemented but that they change and evolve over extended periods of time – they develop gradually (Waggoner et al., 1999). Following this call, studies within operations management have examined the following questions: What shapes the evolution of an organisation's measurement system (Kennerley and Neely, 2002)? What factors affect (facilitate and inhibit) the way in which measurement systems change over time? How can organisations manage their measurement systems so that they continually remain relevant (Kennerley and Neely, 2003)? What is the impact of existing 'informal' performance measures on the development process and the content of formally initiated, integrated PMS (Wouters and Sportle, 2006)? How should a company successfully manage the evolution of its PMS, considering the entire PMS life cycle from design through implementation and use and review (Gutierrez et al., 2015)? Other studies within operations management have examined the factors influencing the success and failure of performance measurement initiatives (Bititci et al., 2005; Bititci et al., 2006; Bourne, 2001; Bourne et al., 2002; Braz et al., 2011). By including this perspective, it is recognised that to understand evolution and change, one must also understand why stability sometimes exists and why evolution and change may only happen slowly and with immense friction (Braz et al., 2011). Still, other contributions focus on the design and development of PMS; these studies often provide a set of criteria that are important for a successful design of a PMS (e.g., Bititci et al., 1997; Bourne et al., 2000; Folan and Browne, 2005; Neely et al., 2000; Neely et al., 2005; Pekkola and Ukko, 2016), and because design and redesign are important elements in change and evolution, these studies are relevant for the research presented in the current paper.

In relation to the methodology, some early contributions have applied conceptual approaches (Bititci et al., 1997; Waggoner et al., 1999). Others develop frameworks deductively from theory, which are then subsequently tested in action research programmes (Bourne et al., 2002; Kennerly and Neely, 2003) and in longitudinal action research field studies (Bititci et al., 2006; Braz et al., 2011; Gutierrez et al., 2014). However, longitudinal field studies where PMS are observed with little or no interference from researchers are still rare (Wouters and Sportel, 2005). A common feature underpinning the identified studies is a concern for PMS to stay relevant, dynamically updated and aligned with strategy and the changing business context (Braz et al., 2011). Evolution and change are thought of as a managed process comprised of a set of more or less generic processes, such as design, implementation, use and reflection (Bourne et al., 2000). Thus, in this view, evolution is seen as something designed, and it takes place as instances of deliberate focal firm reflections and reviews of measures (Braz et al., 2011; Kennerley and Neely, 2002).

Outside the realm of operations management, there are a range of other disciplines interested in understanding the processes of evolution and change in organisations and accounting systems (Waggoner et al., 1999). Within organisational research, much of the work has been dedicated to understanding the evolution and change in and of organisations and their processes (e.g., Pettigrew, 1990; Van de Ven and Poole, 1995). Also, within the management accounting literature, the processes of evolution, development and the more general term ‘accounting change’ have been explored extensively (e.g., Andon et al., 2007; Busco et al., 2007; Jazayeri and Scapens, 2008; Johansson and Siverbo, 2009; Malina and Selto, 2004; Munir et al., 2013; Quattrone and Hopper, 2001; Wouters and Wilderom, 2007). Here, change in PMS or, more broadly, management accounting systems are increasingly proposed as not controllable, linear, predictable or exclusively technical. The outcomes of accounting changes cannot be predetermined but rather can be the result of long translations mediating diverse interests (e.g., Andon et al., 2007; Busco et al., 2007;

Johansson and Siverbo, 2009). Quattrone and Hopper (2001) propose accounting change processes as being nonlinear with a view that multiple accounts dislocated across time and space can explain how management accounting devices such as PMS are formed. Drift resembles incomplete attempts at organising rather than a move from and to tangible, definable and reified objects. Drift reflects the inability of change agents to sufficiently control all contextual elements to achieve the desired ends. It is relational in the sense that human and nonhuman configurations harbour the potential for accounting change to emerge in unpredictable ways (Andon et al., 2007, p. 278).

2.2 Supply chain performance measurement systems – stability and change

To study the evolution of PMS in supply chains, a first step is to take stock of the research on SCPMS more generally. According to recent published literature reviews on the subject (Akyuz and Erkan, 2010; Gunasekaran and Kobu, 2007; Hassini et al., 2012; Maestrini et al., 2017), research on SCPMS is dominated by a focus on the design phase (e.g., Beamon, 1999; Ganga and Carpinetti, 2011), internal or supplier focused PMS (e.g., Beamon, 1999; Prahinski and Benton, 2004; Prahinski and Fan, 2007) and conceptual contributions (e.g., Brewer and Speh, 2000; Chan and Qi, 2003; Estampe et al., 2013).

According to Maestrini et al. (2017), four frameworks recur the most often in the literature: the supply chain balanced scorecard (e.g., Brewer and Speh, 2000; Ferreira et al., 2016; Hofmann and Locker, 2009; Shafiee et al., 2014; Sharif et al., 2007); the supply chain operations reference (SCOR) model (e.g., Dweekat et al., 2017; Ganga and Carpinetti, 2011; Holmberg, 2000; Morgan and Dewhurst, 2007; Sellitto et al., 2015); the resource output flexibility model (e.g., Beamon, 1999; Angerhofer and Angelides, 2006; Cai et al., 2009); and process-based frameworks (e.g., Chan and Qi, 2003; Mondragon et al., 2011; Olugu et al., 2011).

Conceptual research on each of these frameworks have provided important new knowledge to the field and progressed current thinking in and around SCPMS. However, importantly for the current

research, some contributions have also explored these frameworks empirically by using an exploratory or theory-building perspective. These contributions provide insights into the implications of embedding SCPMS frameworks in supply chain practice. Table 1 shows a summary of the identified literature.

<<Please insert Table 1 about here>>

2.2.1 *Technical challenges*

The literature highlights technical challenges as one set of explanations for why SCPMS change or stabilise. One challenge is that because of complexity, a lot of supply chain management achievements, such as customer satisfaction and the quality of the relationships with suppliers, are simply not traceable through numbers alone (Hofmann and Locker, 2009). Another problem may stem from the fact that the measures included do not truly represent joint value creation (Jääskeläinen and Thitz, 2018) or are short-sighted and nonstrategic, lacking specific long-term objectives (Bhagwat and Sharma, 2007). The lack of industry standards may also cause problems (Maestrini et al., 2018). Still other technical challenges identified in the literature stem from failed recognition of the interdependencies between supply chain measures (Holmberg, 2000) and between organisation-specific performance measures and SCM-based metrics (Thakkar et al., 2009). Relating key measures to performance drivers by means of cause-and-effect relationships are hence considered as important for SCPMS to stabilise (Bhagwat and Sharma, 2007). The availability of accurate information (Morgan and Dewhurst, 2007) is another force improving the stability of SCPMS. A lack of trust regarding data reliability may be detrimental to the workings of these systems (Maestrini et al., 2018). Finally, if the relation to other systems, such as cost-accounting systems and IT systems, do not function as intended, this has been shown to affect the

design, challenging the operation and life of the embedded SCPMS (Hald and Ellegaard, 2011; Wickramatillake et al., 2007).

2.2.2 Alignment

The explorative literature on SCPMS indicates that another set of explanations for why these systems change or stabilise is concerned with the alignment between SCPMS and the environment in which these systems are embedded. This relates the stability or change of SCPMS to organisational characteristics such as organisational structure (Hald and Ellegaard, 2011) and organisational maturity (Luzzini et al., 2014), which have been found to affect the design, implementation and use of SCPMS. Another issue that has been discussed in the literature on SCPMS is the relation between measures and product characteristics (Park et al., 2005) and strategies (Luzzini et al., 2014; Schmitz and Platts, 2004). When measures are not representative of the strategies or the products they are supposed to help manage, this affects the stability of the embedded SCPMS. Third, when the operational environment is highly dynamic, this has been shown to hold implications for the design of SCPMS (Sillanpää, 2015). Thus, collaborative use of performance measurement has been found to vary in different contexts and even within the operations of single large companies (Jääskeläinen and Thitz, 2018).

2.2.3 Attitudes and commitment

In the emerging explorative literature on SCPMS, involved actors and users are also found to be potentially very powerful and can affect the design, implementation and use of SCPMS (Laihonen and Pekkola, 2016). One challenge is to avoid a self-centred attitude in the involved firms (Holmberg, 2000); this type of attitude may lead to the inability or unwillingness to widen the scope of measurement activities (Thakkar et al., 2009) and to look beyond a company's own firm boundaries (Holmberg, 2000). However, the empirically based explorative literature often shows

that the willingness to share information (Holmberg, 2000; Laihonen and Pekkola, 2016), and the extent of the communication of measurement information between purchaser and supplier remains limited in practice (Jääskeläinen and Thitz, 2018). Therefore, to promote and stabilise SCPMS, the literature indicates that the involved actors must work to understand the value and potential of this information (Laihonen and Pekkola, 2016). Both intra- and interorganisational communication on the contents and rationale for the specific SCPMS must be put in place (Bhagwat and Sharma, 2007). In general, when there is a sense of lack of interest in the system and the performance metrics (Maestrini et al., 2018) and when the supplier's ownership of performance measurement requirements is found to be low (Wickramatillake et al., 2007), establishing incentives linked to performance measurement requirements have been suggested as an important strategy (Maestrini et al., 2018; Wickramatillake et al., 2007).

2.2.4 Conflict and objections

Another way the involved actors and users are found to affect SCPMS stability and change is by raising active concern, objections or resistance (Thakkar et al., 2009). This positions the design, implementation and use of SCPMS in a zone of intra- and intercompany political, social and commercial tensions (Sharif et al., 2007); it further recognises the importance of understanding all involved actors' perceptions and decision making in and around the embedded SCPMS (Hald and Ellegaard, 2011). SCPMS may promote a sense of intra- and interorganisational anxieties about the measuring activity (Sharif et al., 2007). Therefore, a key question is if the performance information embedded in the SCPMS is acceptable to both buyers and suppliers (Morgan and Dewhurst, 2007). When the SCPMS are challenged, the literature indicates that the ability to resolve conflicts between organisational and supply system strategies is important (Morgan and Dewhurst, 2007). The literature also shows that active involvement of supply chain partners in the design and use phase is a valid strategy for resolving conflicts (Luzzini et al., 2014; Maestrini et al., 2018).

Education, ownership, responsibility, sponsorship, openness and collaboration between and among the supply chain participants aid in overcoming barriers (Sharif et al., 2007; Thakkar et al., 2009).

Figure 1 provides a graphical illustration and summarises the four identified explanations for why SCPMS may change or stabilise. In the discussion, the four explanations will be related to the presented case study's evidence.

<<Insert Figure 1 about here>>

2.3 Theoretical approach

As can be seen from the above review, SCPMS operate in structurally different situations when compared with organisational PMS (Bititci et al., 2005; Folan and Browne, 2005). In SCPMS, there is not just one agent, one strategy and one IT-system but potentially many agents and a diverse set of objectives. It is therefore both relevant and interesting to explore how the supply chain may influence how PMS evolve. What additional factors and forces influence SCPMS development in addition to the ones already identified in the mainly internally focused PMS literature? This is the theme of the current research.

To explore this question, the four-phase evolutionary process suggested by Kennerley and Neely (2002) is taken as the starting point. Assuming the availability of an existing designed PMS, there are four subsequent phases to consider in the evolution process cycle (Kennerley and Neely (2003, p. 217-218) (Figure 2).

<<Insert Figure 2 about here>>

This implies that the analysis is looking for instances of reflection on the existing PMS. In addition, the analysis will also be looking for instances of modification to an already embedded PMS and subsequent deployment of a new or changed PMS. The theoretical approach can be characterised as evolutionary in the sense that it adopts a logic of natural selection among competing designs and redesigns of PMS over time. The theoretical approach can further be characterised as dialectic because it acknowledges that change may be the result of collective action and opposing influences and forces (Van de Ven and Poole, 1995), which, in the case of the present study, may be located not only within the firm, but also with customers and suppliers.

3. Methodology

The objective of the current research was to facilitate an understanding of how the factors located outside focal firm boundaries influence the evolution of PMS in supply chains. To do this, a study of the emergence, proliferation and reconfiguration of three PMS designed to manage a supply chain within the hearing aid industry was conducted.

Case study research was chosen because the objective was to gather data on the process of developing and implementing systems in a real-life setting (Voss et al., 2002). In addition, the case study approach enabled an in-depth examination of the dynamics that were present in the single and unique setting that was explored (Eisenhardt and Graebner, 2007). A longitudinal field study was chosen to help explore subjective meaning systems and social processes, hence capturing the dynamics and complexities of the involved interactions and developments over time (Smith et al., 1995). In addition, the longitudinal approach enabled the collection and linking of evidence in the dynamic process across time. This revealed the temporal patterns, causes and movements from continuity to change and vice versa (Pettigrew, 1990), allowing the researchers to grasp the evolution of the involved PMS (Esposito and Passaro, 2009). The method enabled the examination

of continuous processes in context and provided the opportunity to pinpoint the multiple sources and loops of causation and connectivity that are crucial for identifying and explaining patterns in the process of change (Pettigrew, 1990). The unit of analysis was the individual PMS that emerged in the supply chain. The dyadic and dynamic relationships between the actors involved in the change of the involved SCPMS were further made an embedded subunit of analysis. Moreover, the supply chain connecting the three tiers of firms was the system entity in which the actors and developments were observed (see Figure 3).

3.1 Case selection

A supply chain in the hearing aid industry was selected because the leading manufacturers of the global hearing aid market are focused on innovative capacity, market consolidation and the expansion of their product portfolios (Verona and Ravasi, 2003). This provided a dynamic and interconnected supply chain context where key suppliers are shared among the major hearing aid manufacturers. Further, the industry is characterised by a need for a diverse set of buyer–supplier relationships that can both provide technological knowledge and innovation to the expanded product portfolio, but also can give standard components focused on cost minimisation. These industrial characteristics provided an industrial environment that was both dynamic and heterogeneous, and this was ideal for studying evolution and change (Pettigrew, 1990). The specific research site was selected because the development and transformation of a new PMS that related both to downstream and upstream performance perspectives within its scope were already in progress. The supply chain was global and complex, and the measures included represented both suppliers and customers; this took the distributed nature of the supply chain into account. Developments were further characterised by processes where the focal original equipment manufacturer (OEM) and multiple suppliers, as well as customers, became involved in the development of the PMS.

3.2 Case research protocol

A case study protocol was prepared prior to entering the field (Barratt et al., 2011). The protocol included a clear overview of the project and its status, a clear unambiguous research question, a description of the unit of analysis and an updated description of the field procedures. The protocol helped frame the research process (Yin, 2003) and facilitated a systematic way to gather the required information (McCutcheon and Meredith 1993). The protocol was updated and improved with each observation or interview. Therefore, the protocol also included updated and broadly framed categories of interview questions and guidelines to be used when selecting and observing meetings. In the protocol, a list of already performed interviews and meeting observations and other relevant collected data were maintained. Thus, the protocol provided an overview of the total dataset and its preliminary analysis. In this way, the protocol helped provide a logic or links between the research question, interview questions and data. It further provided a structure from where the criteria for interpreting the findings could be updated. To achieve triangulation of the data, the dataset included multiple data sources, such as different types of meeting observations, face-to-face interviews and different types of documents (see Table 2).

3.3 Data collection

As part of an ongoing study of the way supply networks and supplier relationships evolve, the empirical research process started in March 2003. Data collection continued until March 2015. The relevant data for the current study included 22 interviews, 23 internal meeting observations and 15 meeting observations from meetings between the focal buying firm and supplier representatives. Because evolution was followed as it progressed over time, observing the involved actors and their decision-making processes in meetings were a central feature of the method. Two types of meetings were observed. First, there were internal meetings where only the managers and employees of the focal firm AudioCom (pseudonym) participated. Many of these meetings were project meetings

where one or more of the analysed PMS and their functions were discussed. In addition, there were internal performance review meetings where data from the involved PMS were discussed. Second, there were meetings between AudioCom and its suppliers and customers. These meetings, often annual or biannual, focused on contract negotiations or performance reviews. These meetings often resulted in valuable observations in the form of meeting dialogues with direct reference to one or more of the involved PMS. Secondary data in the form of PowerPoint presentations, implementation plans, strategy formulations and printouts from the involved PMS were also included in the analysis. Table 2 provides an overview of the collected data. As can be seen, most of the data for the current study were collected between March 2003 and June 2010. Following the recommendations from Pettigrew (1990), it was decided to stop data collection in June 2010 after a period of about 7.25 years. At that time, data had reached a saturation point and was able to provide consistent explanations related to the temporal patterns, causes and movements from continuity to change and vice versa. To further increase data validity, two additional meeting observations from meetings between AudioCom and the supplier TeleTech (pseudonym) (October 2011) and AudioCom and the transport service supplier ShipCorp (pseudonym) (October 2012) were included in the dataset. Finally, one follow-up interview was conducted with the supply chain manager from AudioCom in March 2015. The purpose of this the final interview was to understand if the analysed PMS had evolved further since the last observation. It was concluded that the involved systems had remained stable, thus unchanged, in the period where no data had been collected.

<<Please insert Table 2 about here>>

3.4 Data analysis

In relation to the data analysis, the process progressed in an iterative fashion involving observation, induction, deduction, verification and further observation (Pettigrew, 1990). Specifically, data were

collected and analysed using a three-step approach. First, a storyline on the history of the already emerged PMS was traced back in time. This was an interactive process applying the principle of snowball sampling. The action and activity related to the development of the PMS led to the identification of more actors and interview respondents involved in the forming and shaping of these developments. Second, the analysis progressed as a continuous cycle between the observed developments of the involved systems and identification of new meetings and interviewees. Interview themes were informed broadly from the literature review. However, following the cycle of observation, induction, deduction, verification and further observation, the interviews were characterised as semistructured and open ended. The interviewees were hence allowed to structure the dialogue and discuss freely about the broad themes. A central theme in most interviews was the identification of perceptions, reasoning and past events related to the observed evolution process of the involved PMS. Questions of the 'why', 'how' and 'when' form were repeatedly formulated during the interviews. After asking for permission to record interviews and meeting dialogues, most were recorded before being transcribed and coded (Bryman, 2015). Based on the initial analysis, individual positions and how the involved actors sought to legitimise their modification and redeployment plans or sought to problematise already in place PMS were identified. As a result, follow-up questions addressed to specific interviewees were formulated. Each interviewee's responses were then triangulated with the answers from other actors, minutes from performance review meetings and printouts from the involved PMS. At the final stage of analysis, the researchers applied the principles recommended by Miles and Huberman (1994) and looked for common themes and relations between variables that could help explain why the three PMS in the supply chain had evolved. Given the exploratory nature of the research, initial constructs from the literature did not provide complete guidance. Therefore, our categorisation required multiple iterations for them to emerge (Glaser and Strauss, 1967). As a first iteration, and based on the outcome of the

initial analysis and subsequent triangulation and clarification, each involved researcher coded the accumulated case evidence. This produced a comprehensive list of narratives explaining how forces outside AudioCom's boundaries influenced the evolution of the three PMS. Subsequent debates among the researchers and iterations with interview respondents helped transform and shape the list of narrative explanations into a list of individual factors. As a final step, the relevant literature was incorporated to conceptually understand the emerging factors, which also provided an additional source of validation (Eisenhardt, 1989). This, together with further debates among the researchers, led to the formation of the three broad clusters of factors identified in the present research.

4. Case study findings

The focal firm AudioCom manufactured and sold advanced high-tech products, and according to product engineers' characteristics, size, artificial intelligence and calculation microchip capacity were central in ambitions to win market shares. Competition was increasingly focused on the ability to innovate, develop and deliver new products to the market. Because of the innovative character of the involved products, the supply chain was characterised by a continuous flow of product introductions and new products with short life cycles.

The supply chain department included purchasing; supplier performance; inbound and outbound transportation; goods receipt; raw, work in progress and finished goods inventories; production planning; and customer service. The department was organised into three different functions: the customer service function, the purchasing function and the supply chain support function.

Downstream, AudioCom had three tiers of customers: sales companies and distributors; shops and retailers; and the final consumer. The transport service supplier – ShipCorp – was responsible for delivering shipments to the sales companies and distributors, thus connecting AudioCom to its customers based on the sales orders and the products they delivered to them.

Upstream from AudioCom, suppliers fell into two main types. First was the strategic component in the technology suppliers who had special innovative and technology capabilities and delivered unique competencies in the supply marked. Second was the capacity and commodity supplier that secured volume, delivery and low cost via standard components.

During the time of the current study, three different PMS emerged and evolved in the supply chain. For convenience, easy reference and to conceal the identity of AudioCom, these systems are labelled PMS1, PMS2 and PMS3, respectively. Figure 3 presents the supply chain and the location and scope of the central firms involved, as well as the three PMS in the chain. Table 3 further provides details in relation to the performance measures included in the three systems.

<<Please insert Figure 3 about here>>

4.1 The emergence and evolution of the supply chain balanced scorecard (PMS1)

Traditionally, AudioCom did not have a formalised SCPMS. A few performance measures were used to highlight the performance of some areas in the supply chain; however, they were only used irregularly, not as part of a collected whole. Eventually, however, AudioCom formulated a need for improved performance transparency in the supply chain; therefore, a supply chain balanced scorecard (PMS1) was introduced.

The ambition of PMS1 was to be able to develop a comprehensive view with multiple aspects of supply chain performance, so it included four different performance perspectives: the customer perspective; the supplier perspective; the internal business process perspective; and the learning and growth perspective. The data in Table 3 highlight the measures that were included in PMS1. PMS1 was supposed to be able to answer all relevant questions related to current supply chain performance. The ambition of PMS1 was to use it internally at AudioCom, but also together with

customers and suppliers. In practice, it was used by AudioCom internally to provide information for decision making, specifically to identify areas in the supply chain in need of improvement. It was used together with strategic suppliers and with the transport service supplier ShipCorp to facilitate dialogue on current performance and to incentivise improvements in supplier performance. Finally, it was used with customers to inform them about current performance and provide explanations when performance did not live up to expectations.

<<Insert Table 3 about here>>

However, despite the ambition to do so, customers and suppliers were only sparsely involved in the use of PMS1, and only extracts from the system were shared with them. One major reason behind why this happened was that PMS1 contained too many types of performance information, and it was not all deemed relevant for customers and suppliers. In addition, PMS1 contained confidential supplier and customer information; specific supplier and customer names were visible in the system, and this made it difficult to share PMS1 as an entity without additional work being taken to conceal performance information. Therefore, in the case of suppliers, only a particular supplier's individual performance on delivery and quality was shared. Customers were informed about performance but did not get access to the system.

In relation to the measures that had been included in PMS1, AudioCom's enterprise resource planning system (ERP system) was highly influential. As the AudioCom supply chain manager explained in one interview:

> *We did not start by saying which measures do we actually want, instead we discussed which data could be pulled from the system.* (AudioCom supply chain manager)

Criteria such as measurability and accessibility were formative for the final format of PMS1, and strategy-derived measures only came in as a second option. As such, a formalised supply chain

strategy was not available at the time of the introduction of the system; hence, PMS1 helped formalise strategy in AudioCom.

PMS1 stayed in AudioCom's supply chain for 4 years; however, over time, the usefulness and relevance of the measurement system was challenged both from inside AudioCom and from the outside by suppliers. As a consequence, the system evolved into two new separate PMS. One – PMS2 – focused on downstream supply chain performance, and the other – PMS3 – focused on upstream supply chain performance (see Figure 3).

4.2 The evolution of PMS1 into PMS2

PMS2 emerged and evolved to have a dedicated focus on downstream supply chain activities, the effect of the collaboration between AudioCom and ShipCorp. PMS2 differed from its predecessor PMS1 by its dedicated downstream focus and its objective to measure performance in the chain by linking AudioCom to its customers. It only had two perspectives, both related narrowly to the downstream supply chain. The first was a 'customer service perspective', reflecting the effectiveness of the downstream supply chain. Customer service was calculated as the percentage of shipments delivered on time to each individual sales company or distributor location worldwide. The second was 'the cost perspective', and it was entirely focused on the transportation costs accumulated in the downstream supply chain as measured by the average period transportation cost per kilo per customer location worldwide (see Table 3).

Although some of the measures that were included in PMS2 were identical to the ones originally included in PMS1, AudioCom found it necessary to develop and implement an entirely new system for managing the downstream supply chain in a more dedicated manner. Two challenges especially helped evolve PMS1 into PMS2.

4.2.1 Interconnectivity of performance measures

The first challenge that helped PMS1 evolve into PMS2 was an issue with the interconnectivity of performance measures. The customer perspective, which included relevant downstream performance measures, was part of PMS1 and could not be moved; it was locked into PMS1. This made it impossible to exchange performance measures with ShipCorp because these measures would contain some measures that could not be shared with this legally external party because of confidentiality. Another issue emanating from the interrelatedness of performance measures in PMS1 was that this interrelatedness was found to be a problem when performance measures that were unrelated to the downstream supply chain's activity had to be included. These performance measures were deemed irrelevant for interaction but had to be activated before performance related to this unique part of the supply chain and this particular relationship could be highlighted. This disturbed the local setting when performance measures were presented in the relationship between AudioCom and ShipCorp. A final issue was that the performance interconnectivity in PMS1 also made it difficult for the performance system to support the notion of a close, strategic buyer–supplier relationship. This notion is highlighted from a quote taken from an interview with the AudioCom customer service manager:

> *In order for a relationship like the one we have with ShipCorp to work and blossom we need to have something that is uniquely ours, that shows we are connected.* (AudioCom customer service manager)

In summary, the case analysis shows how too much connectedness, where performance perspectives and performance measures work as an inseparable package, can lead to issues related to confidentiality and, hence, reluctance to share performance information across the supply chain. The case analysis also shows how connectedness can constrain opportunities for interaction between buyers and suppliers. As highlighted above, a major factor in the transition from PMS1 to PMS2 was the ambition to be able to discuss only the relevant performance measures in the

relationship between AudioCom and ShipCorp, and this was not possible with PMS1. A final observation from our case analysis highlights a desire to create a symbol for a partnership, something that was unique and dedicated and could demonstrate the relationship between the two firms. This symbol had to be undisturbed by other irrelevant supply chain performance areas, measures and relationships.

4.2.2 Ownership of performance information

The second challenge that helped PMS1 evolve into PMS2 was an issue of the ownership of performance information. Specifically, this issue was related to performance information that connected AudioCom to its sales companies and distributers. ShipCorp was in charge of delivery to these customers. When a delivery had taken place, the supplier registered the precise delivery time. Registrations were made in real-time and then stored directly in the IT system. ShipCorp, however, was reluctant to share information because the company was already part of a global delivery tracking and performance system. ShipCorp preferred keeping all relevant delivery performance information with its system; this was explained by one of the suppliers' managers as follows:

> *There is a risk of cannibalising our global information service package, and then, we cannot guarantee the performance of data consistency anymore.* (Manager at ShipCorp – the transportation service supplier)

However, for AudioCom, it was extremely important to get a hold of precise and updated on-time delivery information. Previously, in PMS1, on-time delivery was an estimate and calculated as shipping time from the warehouse plus the planned transportation lead time. However because of unplanned delays and other types of uncertainties in the downstream supply chain, this most often was a flawed estimate. As a consequence, AudioCom had been badly equipped to discuss supply chain performance with its customers.

A compromise was found that helped PMS1 evolve into PMS2. Each of the supply chain partners supplied one portion of the performance information needed to develop PMS2. Information for the customer service perspective was supplied by ShipCorp, and information for the cost perspective was supplied by AudioCom. In addition, AudioCom agreed to involve ShipCorp when discussing downstream supply chain performance. As a result, PMS2 was discussed at monthly performance review meetings between the two firms. Another effect of PMS2 was that with PMS1 in place, AudioCom had been incapable of simulating downstream customer performance with any confidence. Now that both the effectiveness and efficiency of performance data per customer location worldwide had been made available, performance through the eyes of the customer could be observed. Therefore, PMS2 enabled AudioCom and its customers to make trade-offs between cost and service in downstream supply chain operations. As an effect, the frequency of AudioCom's contacts with customers increased. When delivery performance was low or decreasing, customers were informed about initiatives suggested to improve performance, and when cost was high, customers were asked to consider concrete lead times and cost trade-offs (e.g., replacing air freight with a cheaper but slower modes of transportation).

In summary, the case analysis shows how ShipCorp owned important on-time delivery information; how this information was integrated into the supplier's own IT system; and how the supplier was reluctant to share it so as not to be influenced on how it should be used. As a result, PMS2 emerged, and a new approach toward performance interaction between the two firms was instigated. This shows how the ownership of relevant performance information, which may potentially be spread across multiple tiers of the supply chain, can be an important factor in the evolution of PMS in supply chains.

4.3 The evolution of PMS1 into PMS3

The second of the two PMS that evolved from PMS1 was PMS3. PMS3 was different from PMS1 in its dedicated upstream focus and its objective to measure and manage supply chain performance issues linking AudioCom to its suppliers. Previously, before PMS1, there has been limited, if any, structured supplier evaluation practice. After the emergence of the supplier perspective in PMS1, interest in measures for evaluating suppliers had increased via the supply chain balanced scorecard's supplier perspective, but the measures included had all been selected via availability from the ERP system. The new PMS3 developed qualitative-based measures arranged into five separate dimensions. Suppliers capabilities focused on 'relationship management', 'general management', 'technology', 'delivery' and 'quality'. A total of 25 measures were grouped under the five dimensions (see Table 3). A Likert-type scale was used with the following rankings: 0 (not relevant); 1 (very low performance); 2 (low performance); 3 (high performance); and 4 (very high performance). Two major challenges helped evolve PMS1 into PMS3.

4.3.1 Supplier objections to performance representations

The first challenge that helped PMS1 evolve into PMS3 was supplier objections to the role allocated to them, as represented in PMS1. Case data show how some of the strategic suppliers complained that the definition of supplier performance was wrong. This was an issue of objecting to the performance measures used to evaluate their performance. As an example, the key account manager at the strategic supplier MicroCorp (pseudonym) explained in a meeting with AudioCom's purchasing representative the following:

> *We do not see ourselves as solely delivering products and components to your factories. Where we create the most value to you is via our component innovations and technology cooperation…Why are these activities not measured as part of your evaluations?* (Key account manager at strategic supplier MicroCorp)

This was a case of perceived misrepresentation, where several of the strategic important suppliers had objected to the 'much too superficial' performance portrayals of them and their performance in PMS1. It was important for these suppliers that AudioCom recognised their value-added contributions. If areas related to innovation and technology were not included in the performance evaluations, this would lead to a misalignment of understandings of the buyer–supplier relationship and its purpose.

4.3.2 Supplier concern that performance representations could travel

The second challenge that helped PMS1 evolve into PMS3 was supplier concern that the measures and performance in PMS1 – because PMS1 was comprehensive and included many different perspectives – could be read by entities far removed in the supply chain, hence being misunderstood or misinterpreted. In principle, everyone with access to PMS1 could see all performance information, along with supply chain performance that was completely unrelated to their area of the supply chain. The high level of performance transparency increased some of the suppliers' concerns. As a consequence, the strategic suppliers requested influence and involvement in the modification and redeployment of performance measures. To exemplify this concern, the key account manager at the strategic supplier TeleTech stated the following in an interview:

> *It would have been useful to have been involved in the project that recently defined the parameters for our performance. We have done that with other of our customers, and it has worked fine.* (Key account manager at strategic supplier TeleTech)

In summary, the case analysis shows how modifications in the studied PMS were also instigated by a set of reflections of the *performance representations* included in them. The case highlights how these reflections came from outside AudioCom, here from suppliers. The strategic suppliers objected to what they considered too simplified performance measures. These objections related to

the paucity of suggested performance measures to incorporate important types of value delivered by the suppliers to AudioCom beyond delivery and quality-related performance. There was also a concern that the 'misrepresenting' performance information could easily spread to other parts of the supply chain that would not know of the 'true' value delivered from TeleTech and MicroCorp and other strategic suppliers to AudioCom.

5. Framework of factors affecting the evolution of PMS in supply chains

The previous section presented the main findings of the case study. The findings illustrate how three PMS emerged and evolved in the same supply chain and how a diverse set of both internal and external factors helped in this evolution. Specifically, the use of PMS1 prompted a set of triggers and reflections leading to modifications and the deployment of two new systems: PMS2 and PMS3. These triggers and reflections came not from within AudioCom; instead, they were, to a great extent, initiated and performed from the outside. The case analysis highlights how three clusters of factors influenced the evolution of the observed PMS.

5.1 Interconnectivity of performance measures

The connectedness of performance measures was a force that made PMS1 fragment and reconfigure into two separate systems. The ambition with PMS1 was to increase performance transparency in the supply chain; therefore, the supply chain managers wanted a SCPMS that could manage multiple aspects of supply chain performance. This required greater connectedness of performance measures. The case analysis shows how connectedness, where both internal, upstream and downstream supply chain performance measures were included in the same system, made the existing SCPMS weak and was an important force in its transformation into a new SCPMS with a different scope and different set of measures. Based on the case evidence, it is suggested that this factor is important for explaining the evolution of PMS in supply chains. PMS focused on the

supply chain network can operate under an assumption of the widest arc of integration (Frohlich and Westbrook, 2001), often defining a supply chain as containing three or more firms (Mentzer et al., 2001). In principle, every entity should be incorporated in the PMS because every entity can affect supply chain performance. Performance measurement for the supply chain operating under these requirements must be concerned with multiple aspects of supply chain performance and put them in proximity; doing this will lead to high level of connectedness of performance perspectives and measures. In the case study, PMS1 is a highly connected PMS, which had the ambition of promoting a systems view (Holmberg, 2000) with high levels of supply chain transparency. However, as the case demonstrates, highly connected PMS operating under the ambition to see and monitor wider scopes of supply chain performance may also meet resistance and objection because of issues related to confidentiality. Constrained or disturbed opportunities to interact in relationships and the inability to use the PMS as a symbol in relationship management all worked to destabilise PMS1. This shows how relational views (Dyer and Singh, 1998) promoting stronger opportunities to interact based on PMS sometimes may be in direct opposition to systemic views promoting stronger and wider supply chain representations (Mentzer et al., 2001). This observation may help explain why so few wide-scoped SCPMS exist in practice.

5.2 Availability and ownership of performance information

The availability and ownership of relevant performance information was another major trigger and subsequent instance of reflection that influenced the modification and redeployment of new measurement systems. First, PMS1 was designed mainly based on what was available in the ERP system, rather than on a set of strategic assumptions and arguments of alignment with strategy. This pragmatic approach, however, led to objections and questions related to the relevance of the included measures, both from within AudioCom and from suppliers. Based on case evidence, it is therefore suggested that the availability and ownership of relevant performance information is an

important factor for explaining the evolution of PMS in supply chains. Previous studies have identified the excessive influence of *data availability* in already embedded IT systems, as well as the IT support structure of PMS (Braz et al., 2011). ERP systems have also been found to limit the opportunity of the organisation to reflect on already embedded performance measures (Kennerley and Neely, 2002). The findings presented here corroborate the importance of IT systems as central entities in the construction of PMS. Here, however, the current study highlights that in the case of PMS embedded in supply chain, these central and formative IT systems may also be owned by customers or by suppliers. *The ownership of relevant performance information* has not previously been identified in the literature as influencing the evolution of PMS. Because supply chains extend beyond legal boundaries, all relevant performance information may not necessarily be owned by the focal company. As a result, performance information in this case may turn into an arena around which negotiations between a focal company and a supplier may take place (Pfeffer and Salancik, 1978). The case study presented here illustrates how the transportation service supplier was positioned in a network structure that provided opportunities for brokerage and negotiation; the transportation service supplier was positioned in a structural hole and profited from linking the focal firm to its customers (Burt, 1992). This profit influenced the modification, redeployment and use of the involved PMS and its use.

5.3 Performance representations

The case analysis shows how suppliers' perceptions, objections and concerns related to performance representations, as portrayed and already embedded in the existing SCPMS, were a force that made the system fragment and reconfigure into a new version. Based on case evidence, it is suggested that external actors' (e.g., suppliers or customers) perceptions related to performance representations are important for explaining the evolution of PMS in supply chains. Performance representations focus on the set of performance measures that completely define an entity's

performance as presented in the PMS. Here, the case shows how strategic suppliers objected to their performance representation. This was an instance of a misalignment between the buyers' and the suppliers' understandings of the nature of the relationship (Giannakis, 2007). In a relational view (Dyer and Singh, 1998), this illustrates how understandings of the properties of the relationship (Giannakis, 2007) and the values delivered between the involved firms (Ulaga, 2003) are important. These understandings concern the potential of the relationships, influencing the dynamics of alignment and realignment (Bourne et al., 2000; Hanson et al., 2011). Therefore, the current study shows that such relational alignment and realignment influence the stability and evolution of PMS in supply chains.

5.4 Interrelations between identified factors

Looking across the identified triggers and points of reflections, it is proposed based on the case evidence that these triggers are related and thus influence each other. First, high levels of connectedness of performance measures, as in PMS1, raised concerns about the ability of perceived misrepresented supply chain performance travelling farther into the supply chain. This also indicates the importance of the availability and ownership of performance information. The case also illustrates how the availability and ownership of performance information are related. Specifically, the downstream-focused PMS2 exemplifies how a modification and redeployment of PMS1 helped AudioCom make a more meaningful representation of their customers' supply chain performance, in turn leading to new interactions with ShipCorp about customers. The identified framework of factors affecting the evolution of PMS in supply chains is illustrated in Figure 4.

<<Insert Figure 4 about here>>

6. Discussion

By using a longitudinal case study, the current research investigated how PMS develop over time in supply chains. The analysis shows that the evolution of PMS in supply chains is a fragile and complex process that is hard to engineer and how change cannot be attributed completely to either structure or agency, but instead, it must be thought of as diffused across a net of relationships (Busco et al., 2007). The current study contributes to a small but growing amount of literature oriented toward the study of how PMS evolve (Bourne et al., 2000; Bourne et al., 2002; Gutierrez et al., 2015; Kennerley and Neely, 2002; Neely et al., 2005; Waggoner et al., 1999; Wouters and Sportel, 2005). The current study also adds new insights into empirical practices in and around SCPMS.

In relation to Kennerley and Neely's (2002) framework of factors on the evolution of PMS, the present study corroborates and extends their framework. It corroborates the evolution of PMS as performed via four phases – use, reflection, modification and deployment – and it extends it by providing a set of additional factors that are proposed to be particularly relevant and influential in the evolution of PMS in supply chains. In a supply chain, no single strategy or manager from which to request commitment exists, and this makes it difficult to align SCPMS with strategy. Therefore, multiple understandings of what constitutes a set of relevant and useful measures may coexist. Evolution may be understood not only as 'effective evolution' (Kennerley and Neely, 2003, p. 217), but rather as a planned process designed to realign measures with strategy or a changed environment (Bourne et al., 2000). Evolution could also be thought of as a process designed to get access to performance information and negotiate how PMS should be modified and used across the boundaries of involved firms. In this view, the evolution of PMS is a process that is not necessarily intuitively effective, but rather, it is a complex process infused with multiple influences, one that is continuous and incremental and that never entirely stops (Andon et al., 2007; Quattrone and Hopper, 2001). Reflections are not necessarily planned or managed by the focal firm, but also

emerge as objections or suggestions from external organisational entities, such as suppliers that request influence on modifications and joint redeployment and use of the involved SCPMS. This understanding adds a new evolutionary and dialectic view, one where change is understood as the result of collective action and of opposing influences and forces (Van de Ven and Poole, 1995).

In relation to empirically based explorative research on SCPMS, the interconnectivity of performance measures as identified here expands the existing research. The existing research highlights the importance of recognising the interdependencies between supply chain measures (Bhagwat and Sharma, 2007; Holmberg, 2000) and of establishing links between organisation-specific performance measures and SCM-based metrics (Thakkar et al., 2009). The research presented in the current paper shows how interdependencies of performance measures in highly integrative and holistic SCPMS can also be a destabilising force because they may hinder local usability. This is consistent with the reflections highlighted in Schmitz and Platts (2004). Another contribution is that the availability and ownership of performance information is shown to be a highly importance force in the evolution of SCPMS. It corroborates with previous research that has identified the willingness of supply chain partners to share performance information as an important factor (Holmberg, 2000; Laihonen and Pekkola, 2016). However, the current study also extends previous research by showing how performance information owned by suppliers can be a tool of power (Maestrini et al., 2018) and a force helping suppliers establish themselves as the codesigners of SCPMS. The final factor identified here also adds to the existing body of literature on SCPMS. The findings show how performance measures, here understood as representations of supplier identity, may raise anxieties and trigger tensions and objections (Morgan and Dewhurst, 2007; Sharif et al., 2007).

The findings highlight that supply chain relationships have a very important role in the evolution of PMS in supply chains (Cousins et al., 2008). The findings from the present study highlight how

supply chain relationships were a major driver in the evolution of the observed PMS. All the identified factors relate to supply chain relationships. First, the connectedness between performance measures became a reflection and trigger for PMS modification because connectedness was related to issues of confidentiality and relational trust, constraining the development of relationships. Second, availability and ownership of the relevant performance information became an important trigger for PMS modification because the focal company wanted to build stronger relationships with its customers and because the transportation service supplier saw ownership of performance information as an opportunity to forge a process that brought it closer to its customer, the focal company. Finally, performance representation was found to be another trigger in the ongoing modification of the involved PMS because of issues related to misalignment between the buyers' and the suppliers' perceptions of the nature of the relationship (Giannakis, 2007).

A final reflection is warranted, and it relates to the methodological learning that can be gained from the present research. Drawing on organisational theory (Pettigrew, 1990; Van de Ven and Poole, 1995), the evolutionary and dialectic approach applied in this research acknowledges the distributed nature of SCPMS and that change may be the result of collective action, as well as opposing influences and forces dislocated across time and space in the wider supply chain. Therefore, the current study challenges the existing view of how performance measurement systems emerge and evolve in supply chains. Here, we show how the factors located outside focal firm ownership boundaries are extremely influential in affecting the trajectory of PMS that often are considered as originating and owned by a single autonomous organisational actor. From the present study, it is clear that a SCPMS – although potentially originating mainly from inside a single organisation – should be thought of as truly embedded in and constructed by a diverse set of supply chain actors, interests and agendas in the wider supply chain. Another central implication of the current study is that the extensive longitudinal study applied here, with data covering 12 years of practice, shows

how such a method is strong in providing and linking data and evidence in the dynamic process across time. The method applied here progresses our understanding of how SCPMS may emerge, stabilise, change and stabilise again over extended periods of time. It reveals the temporal patterns, causes and movements from continuity to change and vice versa (Pettigrew, 1990). We argue that such insights could not have been obtained using alternative methods.

7. Conclusion

The case study shows how the development process of PMS in a supply chain may be understood as continuous, incremental and informed by multiple influences and adjustments. Specifically, 'connectedness of performance measures', 'availability and ownership of performance information' and 'performance representations' were all found to be important factors influencing the evolution of PMS in supply chains.

The current research has found a series of new important factors that can lead to two new avenues for research. One is testing the generalisability of these factors. The findings are important in this particular case, but it would be interesting to learn whether they would also be relevant in other settings or across firms and supply chains. Another avenue is searching for additional factors and processes that influence the effectiveness of performance management; this would direct attention to other case studies that could take a longitudinal approach. Therefore, before any attempt for statistic generalisation is made, future research is urged to do more empirical research, exploring how SCPMS evolves in different industries and different supply chains to see if more factors will be found. Future survey-type research is also urged to formulate and test a set of hypotheses to confirm and extend the framework of factors presented here.

Three additional opportunities for future research are proposed. First, more research is needed to investigate the relation between PMS and supply chain relationships. How do different types of

supply chain relationships affect the evolution of PMS in supply chains? How can different PMS enable or constrain the development of supply chain relationships? The answers to these questions may prove helpful for the continued expansion of supply chain management. Second, more research adopting longitudinal case studies are needed. The present study has shown how longitudinal case studies may identify important relations between the different PMS and the different performance measures that emerge in the same supply chain over time. Finally, future research could explore the potential of further applying the resource dependence theory, the relational view theory and the systems theory to further increase the current understanding of PMS and the evolution of PMS in supply chains. Links to management accounting research on accounting change should also be explored further (Andon et al., 2007; Hald and Ellegaard, 2011).

Like in any other research study, the present research has its limitations. The focus here was on theory development. Further investigations need to be done to explore evolution processes in other industries and supply chains. In addition, survey research can be added in an attempt to make the findings more generalisable.

The results presented in the current paper are highly relevant for practitioners. The paper bridges the gap between theory and practice, and the research might be used in practice in terms of gaining awareness about the transition of PMS over time. Specifically, the framework of factors affecting the evolution of PMS in supply chains may help supply chain managers understand how their PMS evolves. It may also help managers understand under which circumstances SCPMS may be held stable and under which they will trigger critical reflections, modifications and change. Specifically, the list of identified factors and associated details may provide inputs to managers on the areas where attention should be high. For instance, the results indicate that supply chain managers should be particularly interested in issues related to the ownership of performance information. Another implication for practitioners is the relation between PMS and supply chain relationships. Supply

chain managers should be aware of the potential constraining, even destabilising effects, that PMS may have on the further development of buyer–supplier relationships and vice versa. Thus, adopting an approach where the intended supply chain relationships are central to the design of the SCPMS may prove highly beneficial.

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Table 1 - Theoretical positions identified in the literature.

ARTICLE	SCOPE	SCPMS LIFECYCLE	METHOD	MAIN TOPIC OF THE STUDY	IDENTIFIED FORCES AFFECTING SCPMS STABILITY AND CHANGE
Holmberg (2000)	Supplier PMS	Design Implementation	Single case study	The paper adopts a systems perspective to explain the challenges and opportunities related to applying supply chain measurements.	• Avoiding self-centred attitude • Willingness to look beyond firm boundaries • Willingness to share information • Recognition of interdependencies between SC measures
Schmitz and Platts (2004)	Supplier PMS	Use	Multiple case studies	The paper presents empirical insights into the use of supplier PMS. It further establishes a perspective on the functions of supplier PM.	• Usability • Struggle to fulfil different functional needs • Power structure within the organisations • Culture within the organisations
Park et al. (2005)	Internal PMS Supplier PMS Customer PMS	Design	Multiple case studies	The paper proposes a BSC for SCM. A comparative case study explores the effect of product characteristics on measure importance and design.	• Product characteristics • Company characteristics
Bhagwat and Sharma (2007)	Internal PMS	Design Implementation	Multiple case studies	The paper develops a BSC for SCM and illustrates the ways in which the BSC was developed and applied in small- and medium-sized enterprises (SMEs).	• Including long-term objectives • Relating key measures to performance drivers • Intra- and interorganisational communication
Morgan and Dewhurst (2007)	Internal PMS Supplier PMS	Design	Single case study	The paper aims to explore the application of statistical process control (SPC) methods to measure the performance of a national supermarket chain's problem suppliers.	• Ability to resolve conflicts between organisational and SC strategies • Availability of accurate information • Availability of acceptable information • Availability of understandable information • Using more than one PMS framework
Sharif et al. (2007)	Internal PMS Supplier PMS Customer PMS	Design	Single case study	The paper analyses key business drivers of SCPMS design.	• Intra- and intercompany political/social/commercial tensions • Anxieties about measuring • Education, ownership, responsibility, sponsorship, openness and collaboration between and amongst the SC participants
Wickramatillake et al. (2007)	Supplier PMS	Design Implementation	Single case study	The paper explores the PM methodology used by a company to measure performance of the supply chain of a large-scale project.	• Supplier ownership of requirements • Supplier incentives linked to requirements • Alignment with cost-accounting systems • Understanding supplier agreements
Hofmann and Locker (2009)	Internal PMS Supplier PMS Customer PMS	Design Implementation	Single case study	The paper explores the development of a value-based PM concept in SC. Uses a case study from the packaging industry.	• SCM achievements not traceable through numbers alone.

Thakkar et al. (2009)	Internal PMS Supplier PMS	Design	Multiple case studies	The paper develops a SCOR/BSC-based, SCM-based PMS for the case of small- and medium-scale enterprises (SMEs).	• Linkage between organisation-specific measures and SCM-based metrics • Inability or unwillingness to widen the scope of measurement activities • Cultural resistance • Attitude and perception of involved actors
Hald and Ellegaard (2011)	Supplier PMS	Design Implementation Use Review	Multiple longitudinal case studies	The paper investigates how performance information travelling between the evaluating buyer and the evaluated suppliers is shaped and reshaped in the evaluation process.	• Involved actors' perceptions • Involved actors' decision making • Organisational structure • IT systems • Available data sources
Luzzini et al. (2014)	Supplier PMS	Design Implementation Use	Multiple case studies	The paper develops an encompassing research framework to investigate vendor evaluation systems by means of 13 case studies. The paper investigates how various elements of supplier PMS affect company satisfaction with the PMS.	• Organisational maturity – purchasing function • Early involvement of relevant departments in the design process • A clear and shared vision of system objectives • Measures and system alignment with strategy
Sillanpää (2015)	Internal PMS Customer PMS	Design	Single case study	The paper creates a SC measurement framework for the manufacturing industry and verifies the measurement framework in the case company's SC.	• Very challenging to carry out the measurements because of the operational environment being highly dynamic
Laihonen and Pekkola (2016)	Internal PMS Customer PMS	Design Implementation Use Review	Longitudinal case study	The paper examines how the utilisation of a new PMS influences SCM and what kind of impacts the new system has on the performance of the SC.	• Willingness to share information • Communication ambiguity • Intraorganisational capabilities restricting communication • Management culture
Maestrini et al. (2018)	Internal PMS Supplier PMS Customer PMS	Design Implementation Use Review	Multiple case studies	The paper provides a conceptual framework of the SCPMS life cycle and investigates how the different actors involved in the SCPMS perceive the system and can act to allow for an effective adoption.	• Lack of industry standards • Lack of trust regarding data reliability • SCPMS understood as a tool of power • Lack of interest in the system • Engaging supply chain partners in the design phase • Establishing incentive/disincentives plans
Jääskeläinen and Thitz (2018)	Supplier PMS	Design Use	Multiple case studies	The paper explores the prerequisites for PMS supporting purchaser–supplier relationships and value cocreation.	• Technical prerequisites for collaborative PMS • Extend of communication of measurement information between purchaser and supplier • Nonfinancial performance measurement truly representing joint value creation

Table 2 – Overview of data

Companies	Interviewees/Observations	Data collection period
AudioCom Employees: 3,000 Revenue: 1,100 mill. EUR	Supply Chain Department (23 meeting observations) Supply Chain Manager (4 interviews) Customer Service Manager (3 interviews) Purchasing Manager (3 interviews) Supply Chain Manager (1 follow-up interview)	March 2003 – June 2010 April 2004; Nov. 2006 & May 2010 April 2005; May 2007; April 2006; Oct. 2006 & Sep. 2008 March 2015
ShipCorp Employees: 39.500 Revenue: 8 bill. EUR	Key Account Manager (3 interviews) Customer Service Employee (3 interviews)	Dec. 2005; May 2006 & June 2008 Dec. 2005; May 2007
TeleTech Employees: 7,000 Revenue: 725 mill. EUR	Key Account Manager (3 interviews)	Feb. 2004; Nov. 2005; April 2007
MicroCorp Employees: 5,000 Turnover: 510 mill. EUR	Key Account Manager (2 interviews)	Feb. 2004; May 2007
AudioCom and ShipCorp	Performance Review meetings (5 observations)	Nov. 2005; April 2006; April 2007; Oct. 2012
AudioCom and strategic suppliers	Annual contract negotiations (3 observations) Biannual performance review meetings (5 observations)	Nov. 2006; Dec. 2007; Nov. 2009; June 2006; May 2007; June 2009; Oct. 2011
AudioCom and customers	Performance review meetings (2 observations)	Nov. 2005; Oct. 2008
Documents	Printouts from performance measurement systems PowerPoint presentations Strategy documents E-mails from AudioCom to/from suppliers and customers Contracts Minutes from performance review meetings	March 2003 – June 2010

Table 3 – High-level content of the three supply chain performance measurement systems

THE SUPPLY CHAIN BALANCED SCORECARD (PMS1)	
TIME PERIOD	Implemented October 2002 and stayed in the AudioCom supply chain until October 2006.
FOCUS	Represented performance delivered to customers from suppliers and internal performance. Was used with customer, suppliers and internally in AudioCom.
PERFORMANCE MEASURES REUSED IN PMS2 (Downstream)	On-time delivery to customers (however, more detailed and with more accurate data in PMS2); distribution costs.
PERFORMANCE MEASURES REUSED IN PMS3 (Upstream)	Delivery performance from suppliers; quality performance; order confirmation performance
THE CUSTOMER PERSPECTIVE	
DELIVERY PERFORMANCE (Overall weight: 75%)	
Delivery confirmation (Weight: 33.3%)	The customer service departments' ability to deliver inside the dates promised to the sales companies
On-time delivery (Weight: 33.3%)	The customer service departments' abilities to deliver (respond) inside 2 days in Europe and inside 7 days in the US.
Completeness of delivery (Weight: 33.3%)	The customer service departments' ability to deliver orders in full.
SERVICE CLAIMS (Overall weight: 25%)	
Service claims (Weight: 100%)	(#Missing goods) + (#Damaged goods) + (#Mistakes on invoice) + (# Packaging mistakes)
THE SUPPLIER PERSPECTIVE	
SUPPLIER PERFORMANCE (Overall weight: 70%)	
Delivery performance (Weight: 45%)	Supplier's ability to deliver what was confirmed (percentage of orderliness delivered inside agreed time frame).
Quality performance (Weight: 30%)	Supplier's ability to deliver quality (number of components found in quality control inspection (parts per million).
Order confirmation performance (Weight: 15%)	Suppliers ability to confirm orders (percentage of orderliness confirmed).
BACKORDERS IN PRODUCTION (Overall weight: 30%)	
Backorders (Weight: 100%)	Percentage of scheduled and due work orders not executed because of missing components
THE INTERNAL BUSINESS PROCESS PERSPECTIVE	
THE INBOUND PROCESS (Overall weight: 50%)	
Delivery performance from production (Weight: 30%)	Percentage of work-order lines delivered on promised date.
Stock turn raw material (Weight: 30%)	(Value annual usage raw materials) / (Value inventory ram materials).
Stock turn finished goods (Weight: 30%)	(Value annual usage finished goods) / (Value inventory finished goods).
Scrap (Weight: 10%)	Value of inventory that cannot be used.
THE OUTBOUND PROCESS (Overall weight: 50%)	
Salary cost in warehouse (Weight: 25%)	Actual salary costs payed out to employees at the warehouse against budgeted salary cost.
Warehouse efficiency (Weight: 50%)	25% (Salary costs / # Hearing aids handled) + 25% (Average hours used per hearing aid) + 25% (Salary cost / # Inventory picks) + 25% (Average hours used per Inventory pick).
Distribution costs (Weight: 25%)	Index for budgeted distribution costs against actual distribution costs.
THE LEARNING AND GROWTH PERSPECTIVE	
Adherence to planned development activities (Weight: 30%)	Percentage of total development activities completed on time.
Employee satisfaction (Weight: 70%)	Assessment of AudioCom employees' opinions as to the way they perceived their current jobs and, here especially, the climate on the job.
THE DOWNSTREAM FOCUSED PERFORMANCE MEAUREMENT SYSTEM (PMS2)	
TIME PERIOD	Implemented November 2005. Lived in parallel with PMS1 for 1 year and 1 month. Still in operation in 2015
FOCUS	Represented performance delivered to customers with a focus on delivery performance and cost in distribution processes provided by ShipCorp the transportation service supplier. It mainly worked in the relationship between the two firms AudioCom and ShipCorp but was also used with customers when discussing performance.
THE CUSTOMER SERVICE PERSPECTIVE	
ON-TIME DELIVERY PERFORMANCE (Delivered from the ShipCorp system)	
On-time delivery performance per country	Percentage of shipments delivered on time in full as promised. Is calculated, displayed and traced over time per country.
On-time delivery performance per customer location	Percentage of shipments delivered on time, in full as promised. Is calculated, displayed and traced over time per customer location.
TRANSIT TIME PERFORMANCE (Delivered from the ShipCorp system)	
Transit time per country	A measure of the average actual transit time it took to deliver from the factory location to the final customer location. Is calculated, displayed and traced over time per country.
Transit time per customer location	A measure of the average actual transit time it took to deliver from the factory location to the final customer location. Is calculated, displayed and traced over time per customer location
THE COST PERSPECTIVE	
AVERAGE PERIOD TRANSPORTATION COST	
Transportation cost per kilo	(Prise payed by AudioCom to ShipCorp)/(Total weight transported in period)

Transportation cost per kilo per customer location	(Price payed by AudioCom to ShipCorp for customer location)/ (Total weight transported to customer location in period).
Transportation cost per kilo per transportation mode	(Price payed by AudioCom to ShipCorp for sea freight deliveries)/ (Total weight transported by sea in period). (Price payed by AudioCom to ShipCorp for air freight deliveries)/ (Total weight transported by air in period). (Price payed by AudioCom to ShipCorp for road regular freight deliveries)/ (Total weight transported by road regular in period). (Price payed by AudioCom to ShipCorp for road express freight deliveries)/ (Total weight transported by road express in period).
THE UPSTREAM FOCUSED PERFORMANCE MEAUREMENT SYSTEM (PMS3)	
TIME PERIOD	Implemented in April 2006. Lived in parallel with PMS1 for 6 month. Still in operation in 2015.
FOCUS	Represented performance delivered from strategic suppliers. It was used in relationships between AudioCom and strategic suppliers.
SCALE	Each performance dimension was assessed using a scale ranging from 1 to 4: 0 (not relevant); 1 (very low performance); 2 (low performance); 3 (high performance) and 4 (very high performance).
DELEVERY CAPABILITIES	**Assessment of supplier's performance related to component delivery**
On-time delivery	On-time delivery performance.
Order confirmation	Order confirmation performance.
Spontaneous part deliveries	Ability to avoid spontaneous part deliveries.
Invoicing	Ability to make accurate invoices.
QUALITY CAPABILITIES	**Assessment of supplier's performance related to component quality**
Measurement capabilities	Ability to measure within given quality tolerances.
Process control capabilities	Ability to control quality in own processes.
Inspection procedures	Quality of supplier's inspection procedures.
Quality report	Quality report performance (number and severity of reports).
Answers to CAR	Ability to respond to quality reports.
TECHNOLOGY CAPABILITIES	**Assessment of the supplier's abilities to deliver new technologies and interact with AudioCom in the product development phase**
Fast prototypes	Ability to provide fast prototypes.
Master and prove new technologies	Ability to master and prove new technologies.
Master simulations/virtual prototyping	Ability to use simulation and virtual prototyping in product development.
Responsibility/new component	Ability to take on responsibility for new component development.
RELATIONSHIP CAPABILITIES	**How suppliers acted in the interests of the relationship**
Key account management	Ability to perform in relation to key account management.
Commitment	An assessment of the level of supplier commitment to the relationship.
Communication	Ability to communicate clearly and timely.
Project management	Ability to manage projects.
Confidentiality	Ability to handle confidential information.
Code of conduct	Ability and willingness to sign and control aspects in AudioCom's code of conduct.
MANAGEMENT CAPABILITIES	**A broad assessment of the supplier's management capabilities**
Professionalism	An assessment of the level of supplier professionalism in managing the business.
Inquiry reaction time	Ability to respond to inquiries.
New ideas	An assessment of the amount and quality of new ideas coming from the supplier.
IT Set-up	An assessment of the quality of the supplier's IT set-up and data availability.
Economic development	An assessment of the financial stability and power of the supplier.
Proactive	Ability to act proactively when appropriate.

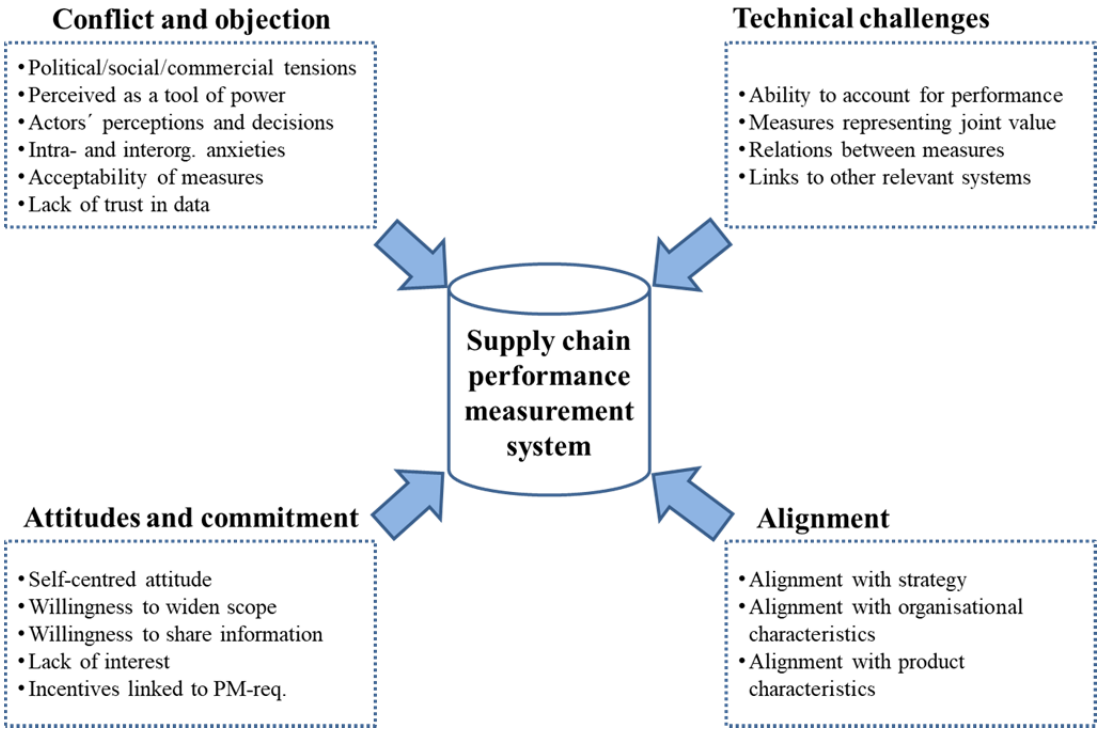

Figure 1 – Forces affecting stability and change in SCPMS identified from the literature

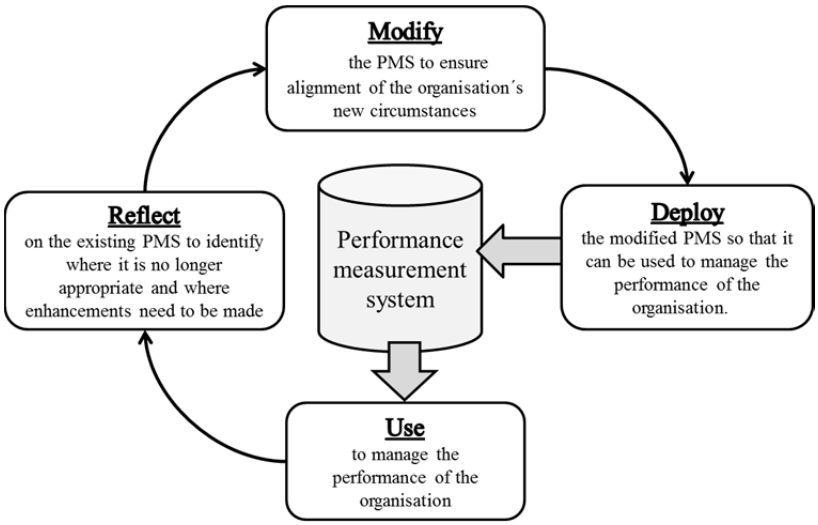

Figure 2 - Four phase evolutionary process suggested by Kennerley and Neely (2002)

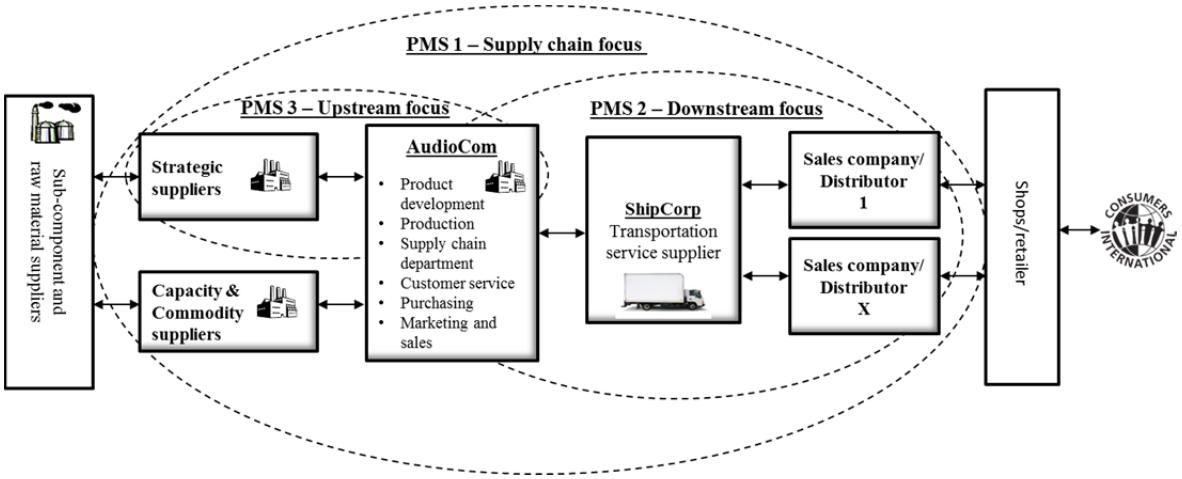

Figure 3 – The AudioCom organisation, supply chain and the three PMS

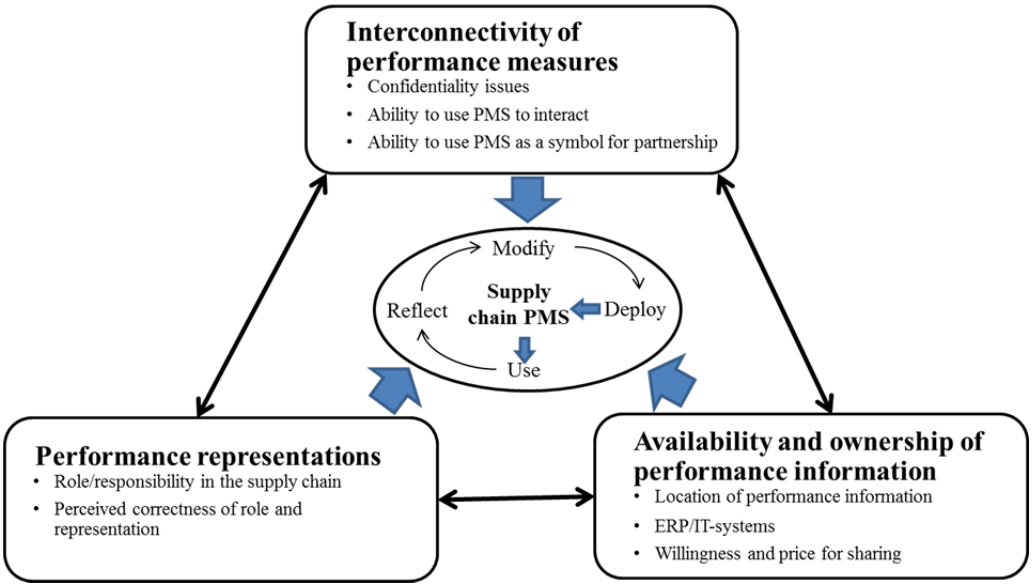

Figure 4 – Framework of factors affecting the evolution of PMS in supply chains