ARE YOU RECEIVING ME?
A viable system model (VSM) analysis of purchasing coordination in a firm engaged in offshoring of manufacturing activities

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ABSTRACT

This paper presents an account of the coordination of purchasing activities in a firm that offshored their manufacturing operations which turned problematic. Empirical data is drawn from a single in-depth case study within a large multinational company that was involved in production offshoring in 2009.
The paper draws on the viable systems model (VSM) as the main theoretical lens. First, our findings suggest that purchasing coordination is a loose construct; one in which the role and types of information aggregation in the purchasing process is loosely defined compared to the aggregation of volumes and the effectiveness of sourcing teams. This finding partly explains why many cross-functional sourcing problems occur. Second, that organizational and functional contextual differences can no longer be sidelined in discussions of purchasing coordination because they define how the system's functions interface and therefore are one of the most essential considerations for better purchasing coordination and ultimately organizational viability.

Keywords: *purchasing coordination; purchasing synergy; purchasing integration; cross-functional integration; global sourcing; viable systems model; offshoring; production; manufacturing*

1. INTRODUCTION

With increasing globalization and pressure to reduce costs, many manufacturing firms have taken to offshoring of production. Put briefly, offshoring involves the relocation of domestic manufacturing activities to foreign locations that have a relatively lower cost of labor and present opportunities for market expansion (Johansson & Olhager, 2018; Bals et al., 2013). The establishment of new foreign business units or joint ventures has gaping implications for the firm in terms of the reconfiguration of its capabilities, integration of tasks, modularity,

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managing ongoing communication and so on (Morgan, Paucar-Caceres & Wright, 2014). Most of these implications have been well covered in the literature (Pla-Barber, Linares, & Ghauri, 2018; Mugurusi & de Boer, 2013), yet one important area - purchasing and supply, a notoriously problematic area of the offshoring firm, appears to have received little attention (e.g. den Butter, 2012; Mugurusi & Bals, 2017). We know, for example, that the dispersion of manufacturing operations increases lead-times, purchasing administration and warehousing costs (Lorentz et al., 2012). Tate and Ellram (2012.p.22) concluded that as a result of offshoring, the management of supply competences was more perilous because of increased opportunism and mistrust between the buying firm and its suppliers. Without a doubt, offshoring presents a number of serious concerns for purchasing and supply management (PSM). Yet and by far, the dominant concern seems to be how best to coordinate the purchasing function involving multiple actors with new and somewhat different expectations as a result of the changes brought about by offshoring (den Butter, 2012; Morgan, Paucar-Caceres, & Wright, 2014). This topic therefore deserves more attention, and hence provides the purpose of carrying out this study.

In this paper, we focus our attention on understanding the challenges of coordinating purchasing activities in the offshoring firm. In general, purchasing entails a series of activities and exchanges between the firm and its suppliers (Van Weele & Van Raaij, 2014). The exchanges are embedded in material, information and actor-to-actor transactions. The goal of coordination, also referred to as integration, is to ensure that together, these three exchanges function coherently (Morgan et al., 2014; Trautmann et al., 2009). Furthermore, that the people responsible for purchasing within the firm coordinate internal acquisition routines among themselves, with other organizational functions, and then with suppliers (Foerstl, Hartmann, Wynstra & Moser, 2013). This view presupposes that purchasing coordination is a broader construct than currently presented in the literature (e.g., Faes et al., 2000; Rozemeijer, 2000; Quintens et al., 2006; Smart & Dudas, 2007). This has resulted in a narrative that a broader conceptualization is necessary (Trautmann et al., 2009). Therefore, before we address purchasing coordination in relation to offshoring, our first research question (RQ1) shall seek to examine how the purchasing coordination problem has been conceptualized theoretically.

The literature appears to have extensively documented a number of challenges related to the coordination of a disaggregated firm. For example, problems such as task communication and interdependences (Larsen, Manning, & Pedersen, 2013), infrastructure differences (Lorentz, Kumar & Srai, 2018), information asymmetry (Balakrishnan & Natarajan, 2013), team and contextual differences (Kotabe & Murray, 2018), culture and language problems (Clampit, Kedia, Fabian, & Gaffney, 2015). However, the coordination of purchasing and supply activities of firms involved in production offshoring is not well investigated, despite evidence that purchasing decisions do contribute to the success or failure of the firm's offshoring strategy (Handley & Benton Jr, 2013). We expect that because of offshoring, heterogeneity and uncertainty in the purchasing function increase rapidly (den Butter, 2012). Furthermore, conflicts may occur because internal purchasing interfaces change dramatically as some purchasing capabilities are lost (Mugurusi & Bals, 2017). This deserves closer attention as sourcing decisions become even more complex when internal purchasing interfaces evolve simultaneously both internationally and globally (Kotabe & Murray, 2018). Therefore, our second research question (RQ2) shall seek to examine how purchasing coordination problems arise within the offshoring firm, and to explain why such problems occur the way they do.

We answer these two research questions by reviewing relevant literature (RQ1) and next, conduct an in-depth single case study of the purchasing function within a global high-tech manufacturing firm (RQ2). Applying Beer's (1972) Viable System Model (VSM) as our

theoretical lens, we seek to identify the problem areas for purchasing coordination and what triggers them when the firm relocates manufacturing. We postulate that as firms become more geographically disaggregated, the compulsion to exploit purchasing synergies on an ongoing basis rapidly increases (Balakrishnan & Natarajan, 2013; Foerstl et al., 2013; Mugurusi & de Boer, 2013). Therefore, understanding the threats related to cross-functional and cross-business unit dependences is important in order to devise coping strategies beforehand. In addition to answering the two research questions, the paper contributes by developing a VSM based model of purchasing coordination in geographically dispersed organizations.

The paper is organized as follows. First, we review the theory and literature on purchasing coordination and offshoring, then we present the methods section. The case description and discussion of case results follow, before a model of purchasing coordination is presented. The conclusion and implications for researchers and managers are presented in the last section of the paper.

2. THEORETICAL OVERVIEW

In this section, we first give a brief overview of how the purchasing coordination problem is considered in the literature. Next, important attributes of offshoring and the circumstances that generate coordination difficulties in purchasing and supply are highlighted. Finally, we present the viable systems model (VSM) as the theoretical lens for analyzing this problem.

2.1. The purchasing coordination construct – scope and problem.

Initially, Matthyssens and Faes (1997) referred to "purchasing coordination" as the level of centralization/decentralization of the purchasing function in an organization. Over time, slightly different interpretations of the concept have emerged (see table 1). Given our focus on procurement operations within the firm, group sourcing arrangements that are described as "cooperation between two of more organizations…" (Schotanus & Telgen, 2007:53), will not be addressed in this review.

Table 1**:** *The nature and scope of purchasing coordination in the literature*

Perspectives on purchasing coordination	**Form of coordination**	**Themes in the purchasing coordination construct**
Bundling purchase volumes, shared resourcing, and information	Group sourcing (e.g., Schotanus & Telgen, 2007)	Inter-organizational purchasing decisions
Bundling purchase volumes, shared resourcing, and information	Purchasing synergy (e.g., Smart & Dudas, 2007)	Intra-organizational purchasing decisions across; different business units or departments
Aggregation of volumes, processes, technologies, suppliers, and practices	Global sourcing (e.g., Jia, Orzes, Sartor, & Nassimbeni, 2017)	Worldwide sourcing organization; Enabled by horizontal integration
Functional alignment	Purchasing integration (e.g., Paulraj et al., 2006; Foerstl et al., 2013)	Teams, information, tasks and supplier relationships

Today, purchasing requirements and actors in many firms are spread across numerous categories, functions and suppliers. In order to reduce complexity as well as enhance scale, process and information economies (Smart & Dudas, 2007; Trautmann et al., 2009), firms tend to aggregate suppliers and purchase needs. This form of coordination can be described as purchasing synergy (Rozemeijer, 2000).

Another form, analogous to purchasing synergy, is global sourcing (Jia et al, 2017). The proponents of global sourcing view purchasing coordination as optimizing sourcing processes across the worldwide organization (Kotabe & Murray, 2018; Quintens et al., 2006). Therefore, the global perspective rather than the corporate stance underlines the difference between global sourcing and purchasing synergy. In fact, Trautmann et al. (2009, p.57) hint that global sourcing is more "than merely searching for cost savings," as is the case with purchasing synergy.

The third form we distinguish is purchasing integration. This form of purchasing coordination is becoming increasingly prominent, following the growing influence of the purchasing function within firms (Paulraj et al., 2006). The number of purchasing activities being performed across other functions is growing steadily (de Boer et al., 2003), as the involvement of purchasers in other functions such as engineering, operations, marketing increases (Lakemond et al., 2001; Ellegaard & Koch, 2012). Therefore, in order for suppliers to listen to one voice from the firm, some degree of purchasing coordination is required. This form of coordination has been described as cross-functional integration (Foerstl et al., 2013).

Our review of the purchasing literature suggests that purchasing coordination is a loosely structured construct that is often studied as an "either/or" problem in the literature, thus answering RQ1. For example, on the one hand, there is purchasing coordination as synergy (e.g. Smart & Dudas, 2007) and on the other hand, there is cross-functional purchasing coordination (e.g. Ellegaard & Koch, 2012). Recently, Foerstl et al., (2013) made this distinction even more discernible by suggesting there are different performance outcomes from each side of the divide.

In the next section, we suggest that the establishment of a new operation or business unit through offshoring further amplifies the problem of managing the purchasing activities across the different dispersed functional teams.

2.2. Offshoring as the challenge for purchasing coordination

The literature suggests that many organizations have embraced offshoring in order to exploit locational differences in the cost of labor, gain access to new foreign markets and reduce domestic capacity bottlenecks (Bals et al., 2013). Despite the benefits, firms are also finding it extremely difficult to organize or manage thereafter (Morgan et al, 2014).

The creation of a new operation and the effort involved in coordination of heterogeneous tasks is daunting enough (Lampel & Bhalla, 2011: Mugurusi & de Boer, 2013). In the purchasing context, offshoring means finding the most appropriate configuration in which both new and existing dependencies are aligned and function effectively (den Butter, 2012). With offshoring, the risks and uncertainties the firm faces increase significantly because of geographical distance, cultural distance and customer expectations that differ by location (Handley & Benton Jr, 2013). Therefore, it is not surprising that the organization can expect to encounter strategic tensions among the business units and across functions.

Specifically within the purchasing function, these tensions affect and slow down decision making within and cross functions (Jia et al., 2017). To begin with, the purchasing process is an information dependent federate. Each player in the process has varying information needs and contributions. To add geographical dispersion, market, culture and language differences into the picture, the complexity increases dramatically (Larsen et al., 2013; Kotabe & Murray, 2018).

Several authors discuss why problems in coordination tend to occur in the purchasing function. Moses and Åhlström, (2008) identified three causes of problems. They include functional dependencies, strategy complications and misaligned goals; all are self-reinforcing.

Functional dependences require reciprocated information needs, which are practically difficult to attain when functional goals are not aligned. Also when strategies are not clear, neither goal alignment nor functional dependences will occur. Smirnova et al. (2011) argue that coordination failure may be a case of perception. As an illustration, purchasing personnel will tend to view most organizational goals from a cost (saving) perspective, while marketing will take a more customer centric view. Bals et al. (2009) view coordination to be a function of internal marketing. They suggest that as long as other functions are not aware that purchasing has the skills they need, they are not organizationally motivated to involve purchasing staff in their activities, or no opportunities to interact exist, cross-functional efforts will fail.

In addition, some studies have suggested that the role of information and communication in global purchasing synergy is an overlooked aspect of coordination. Faes et al. (2000) posit that if local purchasing staff have insufficient information about the advantages of global synergies, they are less inclined to fully participate in such corporate activities. Lorentz et al., (2012) identify the communication complexity that comes with coordination of global purchasing. Suppliers, business analysts, and worldwide purchasing teams need frequent information in order to make the right purchase decisions. However, because they are often not co-located or are in different locations, real-time communication is difficult, hence coordination complexity increases. Further so, the offshoring literature has long viewed team dependences as means of achieving better performance (Morgan et al, 2014). In sum, we expect that the offshoring of production complicates the coordination of purchasing activities in the firm, at least in the short term because over time the firm learns, adapts and optimizes their processes to ensure purchasing efficiency and effectiveness across activities, categories, geographies, and customers. In the final part of the literature section of this paper, we present the theoretical lens within which we subsequently analyze the empirical case.

2.3. The theoretical lens – the viable systems model (VSM)

The idea of the purchasing and supply activities being theorized holistically is quite appealing (Woodside, 2006). As a result, more comprehensive and holistic analytical studies are being undertaken (Toprak & Torlak, 2018: Batista, Davis-Poynter, Ng & Maull, 2017). In this paper, we adopt the viable systems model (VSM) which has been used extensively to study organizational complexity (Leonard, 2009; Burgess & Wake, 2013; Mugursi & de Boer, 2014). Importantly, the VSM is a potent framework for analyzing how organizations coordinate complex procurement processes that span across various business units, involve many actors and functions, and are embedded in both internal and external relationships (e.g. with suppliers, customers, regulatory bodies, and so on). So the VSM is highly relevant to the purpose of this paper.

The VSM (Beer, 1972; 1979; 1985) is a management cybernetics tool whose central idea is that any system – an organization, a function, a department, or human being – is viable only if it is capable of independent existence. Independent existence is measured by stability, growth or better performance for that matter (Oliver et al., 2008).

To attain viability, two conditions must be met. First, the system (e.g. firm operations(O) and its management(M) must have requisite variety (Ashby, 1960) in order to manage all demands thrust upon it by external environment(E) (e.g. suppliers, customers and so on), or else, the system will fail (Beer, 1985). This condition is summarized by the equation $V_E = V_O = V_M$ in Table 2. Variety is the measure of complexity, that is, "the number of possible states of the system" (Hoverstadt, 2010, p.90). A viable system obtains the requisite variety by deploying attenuators of external, incoming variety from the environment and by

simultaneously using amplifiers to increase its internal variety. For example, seen from the perspective of a company, external variety is attenuated by focusing only on certain customers, certain geographical markets, limiting the number of product options, and so on. The company's internal variety may be amplified by employing ICT in order to quickly spread knowledge and practice from one place in the company to its regional outlets.

Second, the system must consist of a minimum set of crucial subsystems, each playing a role in the viability of the system. Without one or any, the system will not function effectively (Beer, 1985). More specifically, Beer states that any viable system must comprise 5 subsystems which are shown in Figure 1 and summarized in Table 2. The ontological details of the model can be found in Beer (1966). The paper by Leonard (2009) explains the 5 subsystems and their interrelationships in more detail. More specific applications of the model in organizations can be found in Burgess and Wake (2013), Mugurusi & de Boer (2013) and Mugurusi & de Boer (2014).

Since this paper focuses on purchasing coordination, we shall focus on subsystem 2, which is the subsystem responsible for coordination among the value-creating operations (system 1).

Table 2**:** *Components of the Viable Systems Model (VSM)*

Sub-system	**Role description**	**Areas of Variety Engineering** $V_E = V_O = V_M$	
System 1	Plays the value creation, tactical operations and transaction role	Operations (O)	Environment (E)
System 2	Plays the balancing role to minimize instability as a result of conflicts among the components of system 1.		
System 3	Plays the resource allocation role and controls operational performance	Management (M)	
System 4	Provides strategic options and positioning for the system.		
System 5	Provides corporate management and ensures system cohesion and direction (balancing systems 3 and 4)		

The basic relationships between the five subsystems are shown in Figure 1 below.

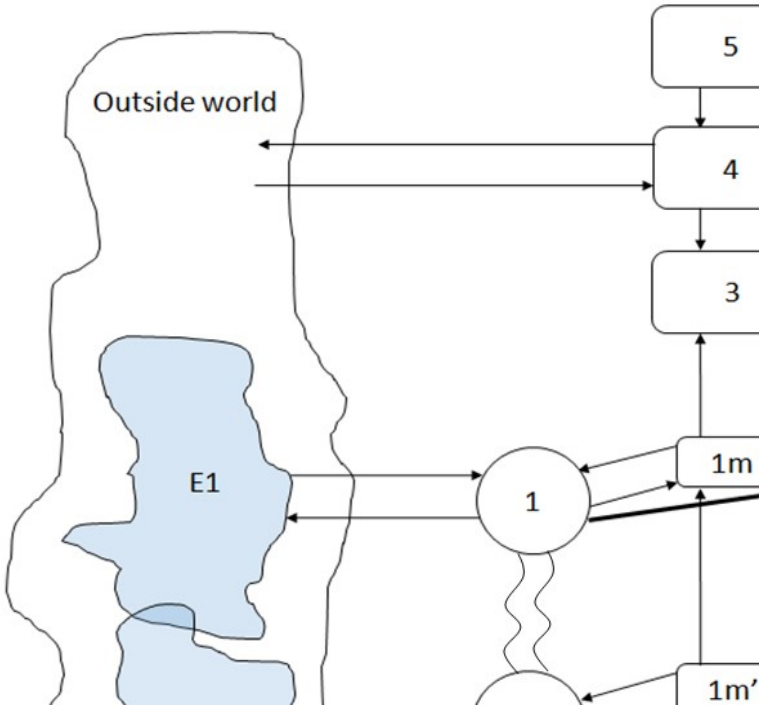

Figure 1: A modified viable systems model (VSM) (adapted from Beer, 1985:p.136)

System 1 represents the core activities of the system under consideration. Each system 1 consists of two parts: an operative part (the actual "operations") and a management part. In Figure 1, two operative systems 1 are shown (1 and 1') each with their respective management part (1m and 1m'). Each system 1 deals with its own local environment (E1 and E1' respectively). Typically, the two operative systems interact with each other as a result of physical and information dependencies between themselves, e.g. operations 1 supplying material inputs to operations 1'. Beer (1985) referred to this as "matter-of-fact interaction", indicated by the squiggly lines in figure 1.

2.3.1. The role of system 2: coordination in order to maintain stability

In Figure 2 a more detailed model of system 2 is shown. It intended to show more precisely how system 2 functions in relation to the other subsystems. In our explanation we use the terminology and coding as used in Beer (1972, p. 216).

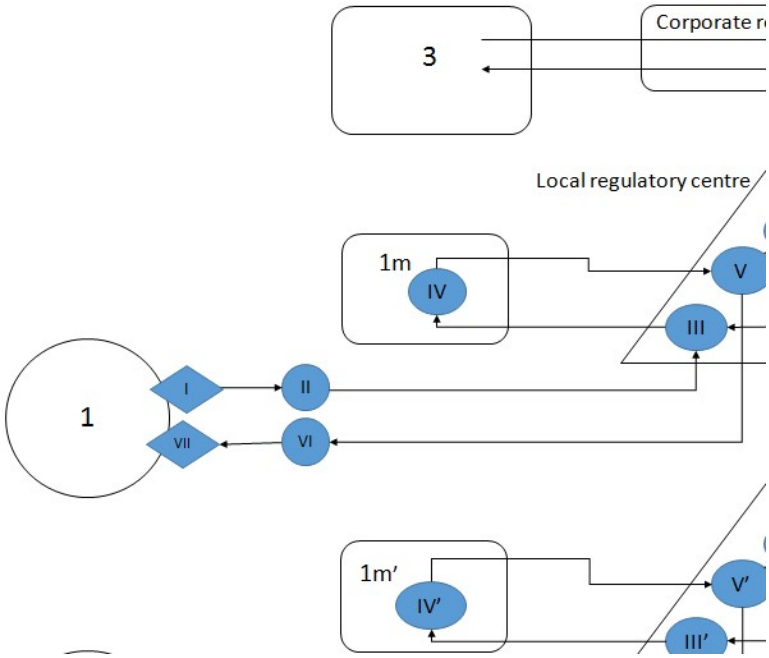

Figure 2: The organization of system 1s, in relation to system 2 (adapted from Beer, 1972:p.216)

In Figure 2 we assume a viable system consisting of two systems 1 (shown as 1 and 1'). These could for example be two divisions or productions units in a concern or two faculties of a university. The number of systems 1 is not important for explaining how system 2 works, but for the sake of simplicity we limit the number to two. Figure 2 shows that system 2 consists of two types of so-called regulatory centers (Beer, 1972): local regulatory centers for each system 1 and a corporate regulatory centre which acts as the central contact point with system 3.

Each regulatory center observes the system 1 it is assigned to. It requires the presence of a sensor (I in figure 2) which, in Beer's terms, codifies actuality on a continuous basis (1972, p. 216). The observations of whatever actually goes on in the operations must be converted (transduced) into raw data. This is the process of "sensory transduction". Next, a so-called "input synapse[1]" (1972: p. 216), shown in figure 2 as II takes samples of these raw data and transmits these samples to the local regulatory center whenever a certain threshold level of intensity occurs. By taking samples and only transmitting data above a certain threshold, the input synapse contributes to reducing the variety that must be handled by system 2. Upon arrival at the local regulatory center (III) the data received from the synapse are classified, analyzed and compared to expected values. In the case of significant deviations, the information about these is passed on to the respective management of the system 1 under consideration (IV in Figure 2). Here, "system 1 management" must decide how to respond to the deviation. This response is sent back to system 1 through the continuous planning and programming generator (V) and from there on the response is transmitted by an output synapse (VI) and converted into actual change in the actuality of system 1's operations (VII).

The information that was sent from the local regulatory center (III) to system 1's management is also simultaneously sent to the regulatory center of the other system 1, via the information relay IIIA in Figure 2. This relaying of information about a significant deviation

[1] A synapse is a link or joint (Oxford dictionaries)

from the plan observed in one system 1 to the other system 1 (system 1' in figure 2) is a key part of the coordinating function of system 2. At system 1', this information is passed on via relay IIIA' to its local management (IV'), which subsequently can initiate appropriate corrective action via V', VI' and VII'. Similarly, information about any significant deviation from the plan for system 1' will be sent from relay IIIA' to relay IIIA connected to system 1.
Furthermore, both system 1 and system 1' pass on the information about the corrective measures taken in relation to their operations to the corporate regulatory centre. This takes place via relays VA and VA' respectively. The corporate regulatory centre collects this information and passes it on to system 3, which can take additional measures in relation to the systems 1, and if necessary, take things further all the way up to system 5. System 3 may also request additional information about the systems 1 via the corporate regulatory centre, and from there on to each local regulatory center.

2.3.2. Possible sources of system 2 failure

Rios (2012) discusses typical signs of system 2 failure, including (p.159) "..a lack of collaboration among the operational units, no solidarity in competition for common resources, coordination problems among its activities, or the lack of a continuous process flow, when linked, from certain units to others". Analyzing Beer's detailed model of system 2, as shown in Figure 2, we can more precisely hypothesize about possible failures of system 2, as the absence or presence of failure in each of the components (relays, synapses and channels) may cause the entire system 2 to malfunction. Not being able to properly sense what actually goes on at the operations and transducing this into data would be a first source of failure.

Next, a poorly functioning or absent input synapse may hamper system 2's performance. If absent, the next stages in system 2's operation will not be able to handle the amount of variety coming in. If the synapse is present but taking too few samples or operating with thresholds set too high, critical deviations observed in the operations may be ignored.
The next crucial component of system 2 is the local regulatory centre. Both the "achievement monitor" (III) and the information relay to the other operations (IIIA) must be present and function properly. A malfunctioning filter in the achievement monitor may lead to wrongful suppression of vital information that should have been sent to the other operations (through relay IIIA) and to its local management (IV). The information relays IIIA and VA may also be a source of failure if not present or functioning poorly.

Finally, the capacity of the channels connecting the various synapses and relays is finite. As discussed in Mugurusi and de Boer (2014), increasing the geographical distance between systems 1 may reduce this system 2 channel capacity, as face-to-face communication may become more difficult. Furthermore, the synapses and relays used in one country may not be as effective when applied in another country due to cultural and language differences and incompatible technology systems. For the most part, the channels must satisfy the second principle of organization, i.e., that the channels must have higher capacity to transmit any sort of variety at any *given time* than the originating system has to generate it in that *time*. The other principle concerns the transduction process and is the third principle of organization, i.e., that the variety of the transducer must be at least equivalent to the variety of the channel (Beer, 1985). These two principles are fundamental for the functioning synapse function and hence ultimately viability of the system. We shall use these possible sources of system 2 failure as a point of references when analyzing our in-depth case study.

3. METHOD

This paper presents a single in-depth case study (Ketokivi & Choi, 2014). We elected to use the case study approach for two main reasons. First, to gain a deeper understanding of

how the purchasing coordination problem occurs, at least from the perspectives and experiences of organizational members who were involved in the problem (Yin, 2018; Gioa et al., 2012). Second, although a lot is known about the coordination of purchasing activities generally, little is known about how the coordination problem "becomes" when the firms manufacturing operations go offshore. Therefore, this case study serves to both generate and elaborate on theory about the purchasing coordination problem (Ketokivi & Choi, 2014).
Case studies can take on many forms depending on their purpose. The taxonomy of Yin (2018) suggests cases can be used for descriptive, explanatory or exploratory purposes. This paper is situated in the instrumental and exploratory case domains.

The goal of this study was to understand the purchasing coordination problem faced by the production offshoring firm. To do this, the study was carried out in a firm that had recently moved manufacturing activity from one business unit to another. The unit of analysis was the purchasing process and the nature of interactions the actors in the process encountered. At this point, it is evident that we do not necessarily aim to generalize the findings of this study, but attempt to highlight the learning points from the case and develop propositions for future theoretical exploration. In addition, the paper also makes a conscious attempt to refine and build theory surrounding purchasing organizations and offshoring organizations (Gioa, et al., 2012).

In order to achieve this goal, we describe and analyze the case using the VSM of Beer (1985), in line with the approach used in Hyer et al., (2009:2006) as the basis for "constructing and deconstructing the tale of an organization". Furthermore, we draw on a preliminary study of the literature and scoping of the problem as done in section 2.1 to enhance the reliability of the study.

Similar to exploratory types of research, we organized the first interview in order to establish the pertinent theoretical issues in the case and set appropriate researchable questions, which is the basis we used to develop a robust line of inquiry. We also used the initial interview to identify and select more research participants based on a non-probability sampling method – chain referral sampling (Heckathorn & Cameron, 2017).

3.1. Research context and data collection

The environment in which data are collected determines the extent to which the researcher can correctly decipher the right cues about organizational behavior and choices (Gioa et al., 2012). In this case, the study took place in two business units of a large multinational engineering corporation. Both business units were previously independent operations responsible for niche markets in their respective industries. One business unit was responsible for one product group in the portfolio of plant automation products located in Europe for market based reasons. The other business unit was responsible for the second category of products in the automation portfolio and was located in Asia for cost reasons.
In 2009, the company relocated its manufacturing facilities from Europe to Asia, for reasons we discuss later in the case description. Along with manufacturing, the purchasing unit was relocated as well, while its the product development unit was retained at the European facility. The problem we investigate concerns purchasing as a support function and a boundary spanning unit to both production at the Asian facility and product development in the European facility. More specifically, the problem is conceptualized as that of interaction where previous purchasing routines and capabilities are dismantled and rapidly rebuilt with new and somewhat different roles, yet these must rapidly support cross-functional and cross-business unit operations. The context therefore called for a review of the purchasing coordination problem beyond just organizational and functional boundaries to that of

integration of information and communication processes within geographically disjointed manufacturing processes (Moses & Åhlström, 2008).

The primary source data were twelve (12) semi-structured interviews equivalent to 602 minutes of tape recorded data were conducted and transcribed by the first author. Most of these data were gathered during two site visits to the factories in Europe and in Asia. These data were supplemented with field notes, photos, archival documents, reports and presentations, external reports and research papers, videos, press releases and industry publications. The data collection exercise that was part of a large doctoral project lasted approximately 18 months. The details of the informants are presented in Table 3.

Table 3**:** Details of informants

Informant	**EURR**	**ASIR**	**# Interviews**	**Participation in offshoring process**
Head of Purchasing and Supply Unit (HPSU)	√	√	1	Change agent
Head of Supply Chain Management (SCM)		√	1	Post-offshoring
Tactical Purchasing Manager (TPM)		√	1	Pre & post-offshoring
Sourcing Manager (SM)		√	1	Pre & post-offshoring
Supply Quality Manager (SQM)		√	1	Pre & post-offshoring
Technical Center Manager (TCM)		√	1	Change agent
Project Managers (#1, 2, 3, 4 & 5)	√		5	Varied roles
Global Commodity Manager (GCM)	√		1	Pre & post-offshoring

Based on chain referral and purposive sampling techniques, 15 informants were targeted. Only 12 were willing to participate in the study. The informants were a mix of mid to top managers in the company. Specifically, we targeted informants that were involved in the pre and post offshoring process, which provided for variation within the case. More importantly, variability enhances rigor in case study research (Gioa et al., 2012). The use of multiple sources of data as recommended by Yin (2018) was used in order to enhance the descriptive validity of the study.

The study conceptualization began in the early 2011. Before and during this period the company was re-organizing its global operations following relocation of manufacturing from Europe to Asia. This provided an opportunity to explore the problems caused by sourcing under changing organizational contexts. Two organizational contexts were explored. The informants from the old business unit were interviewed along with informants at the new business unit, some of whom belonged to both units or had been transferred to the new business unit during the knowledge transfer process.

3.2. The data analysis exercise

The process of analyzing the data began with transcribing the interviews by the first author. Some professional transcription help was sought for the subsequent interviews that were carried out later. The interview transcriptions alone resulted in up to 200 pages of transcribed verbatim dialogue. Added together with other documentary evidence mainly company presentations, field notes write up, photos, reports, press releases, and so on, we had up to 500 pages of data to analyze. First, we began by reducing the data through a detailed case write-up. Here we identify the roles of all participants in the offshoring process, which would help us take a birds-eye view of the forms of interactions that existed within the firm, and perhaps point to where to look in the data. A more refined description and tabulation from this exercise is presented in section 4. Second, we entered all the data into *Nvivo* software and coded the data around the general theme, "problems in coordination". The result was an

extensive list of codes, that we gave titles based on informant terms, as recommended by Gioa et al. (2012). In total, we had 56 titles. The next stage involved further reducing these to a manageable number. Using a mind map program – *Cmap*, we grouped the data into categories based on differences and similarities among the first codes. The categories were drawn from the literature as well new ones that emerged. We generated a data structure based on eight (8) categories to interrogate our analytical framework from the literature. For example, we asked, where in the VSM do inter-functional cooperation challenges exist and why? By referring back to each category (and further to the codes) by asking similar questions of the data, we obtained several findings that we present in section 5 of this paper.

4. CASE DESCRIPTION

The case concerns a large division of a global manufacturing corporation. The division alone, a 30,200-employee business, represented $9.9 billion in revenues at the time of collecting data. We focused primarily on two production units of one of the division's strategic business units (*hereafter* company) as seen in Figure 3. The focal units (*hereafter* business units or factories) were responsible for the manufacture of high-end precision equipment mainly for the global automotive and aerospace markets. Until 2009, the company's setup involved three factories, one in Asia (ASIR) and two in Europe. For reasons explained in the next paragraph, we shall focus on the interactions between ASIR and one of the (former) factories in Europe, which we call EURR.

The company is an original equipment manufacturer (OEM) of two flagship products: X, Y, and several peripherals and peripheral services. Initially ASIR was a manufacturing unit responsible for product X alone, while product Y was the responsibility of EURR. All the purchasing of materials, production, sales, marketing and distribution was done independently within business units. In 2009 however, the company decided to relocate the production of product Y, a historical "world first" invention by EURR to ASIR. Production was relocated along with other support functions including, procurement, sales and marketing. For historical reasons, only R&D capabilities remained in EURR.

The offshoring of production was motivated by two related reasons: (i) the market slump in the automotive industry at the start of the European financial crisis in 2005 hence a widespread reduction in capacity investments, and (ii), the rapid shift of the automation market to Asia. Trends in the automotive industry, the primary consumer of product Y, showed that Asia was growing twice as fast compared Europe, according to a senior executive at the company. By 2010, China alone had over 100 automotive manufacturers, which represented the largest B2B segment of the market for the company. Therefore, relocation close to the market was considered inevitable.

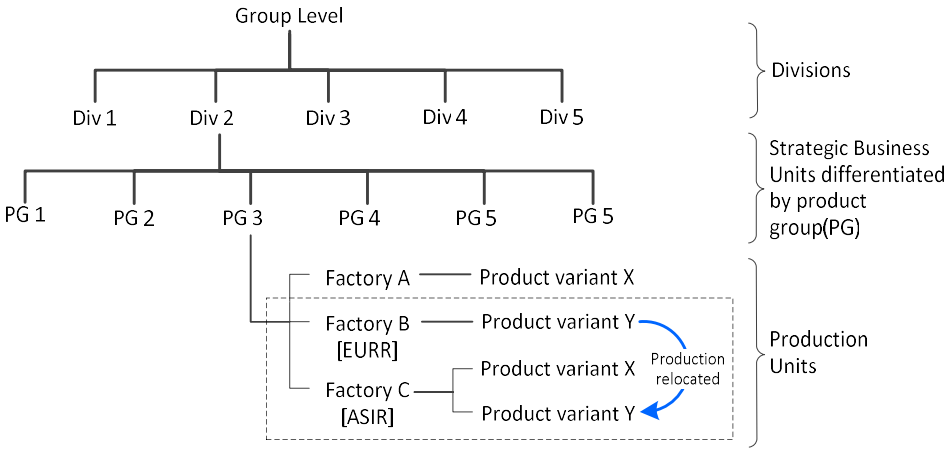

Figure 3: *Foci of the study*

The physical relocation of the manufacturing operation occurred in the spring of 2009. In 2010, the firm began the process of restructuring its operations to ensure efficiency in cross-BU activities. The case shows that a number of problems emerged shortly after the offshoring of manufacturing. One senior executive was quoted as saying: "I will not say that this transfer is successful in terms of moving closer to the market. It's extremely dangerous if we don't take responsibility for the customer, but now we are in a situation where [the product Y] is about to be totally killed because we are not meeting customer demand and we have a deteriorating quality on the products we are delivering" (Interview: Informant #06).

In this case study, we primarily focus on how and at what stage, purchasing coordination problems emerge. We do this by examining the interface (material and information flows) between the two BUs before and after production offshoring as seen in Figure 3. Two embedded episodes, i.e. before offshoring and after offshoring, are therefore considered.

From the literature review, we demonstrate that the purchasing process is central to understanding purchasing coordination in general. It defines the nature and quality of decisions and the interfaces purchasers have with suppliers and other functions that participate in the purchasing process. At the company, the purchasing process consisted of the following general tasks:

a) *Research and Development (R&D) tasks*. For most new projects, i.e. new product developments (NPD), R&D tasks were the first component in the development of specifications. From new parts such as hinges, casings, and cabling to redesign of screws, rotary joints or a total rebuild of a new system, product development (PD) engineers had to translate customer requirements to specifications through the Material Requirement Specification (MRS) process. R&D tasks were therefore always the beginning of the purchasing process.

b) Sourcing and purchase order (PO) confirmation tasks. Once the specifications were minimally defined, most often loosely, suppliers were invited to work on proposals for the components or parts. Some supplier pre-selection was made and one or two suppliers worked with PD engineers to make the required components or parts preceeding sample testing and approval. Negotiation and final supplier selection took place and POs issued.

c) Quality approval and delivery tasks. Incoming parts were checked for quality, first externally at the supplier facility by the firm's quality engineers then internally again, by a team of incoming quality control (IQC) engineers. Deliveries were often made directly to the production line while standard purchases consisted of deliveries made to a warehouse.

The tasks listed above represented the purchasing process in general, which represented only the purchasers' viewpoint than other actors in the same process. Since we are interested in purchasing coordination, it was important to find out the underlying sub-processes in which both purchasers and non-purchasing staff were "equal" participants. These underlying sub-processes were among the emergent themes during the analysis of semi-structured interviews. The theme in task 1 was the development of specifications through an MRS sub-process, the theme around task 2 was supplier involvement and subsequent tactical purchasing, while task 3 involved all supply quality management tasks. We will stick to these terms as we map purchasing process actors and their interactions in Table 4.

Table 4: Mapping the team interactions in the purchasing process – before and after Production Offshoring

Stages in Purchase Process / Key Actors	Market Requirements Specification (MRS)		Supplier Involvement and Tactical Purchasing		Supply Quality Management	
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
1. Product Manager	Communicates market requirements to [2]	Communicates market requirements to [2]				
2. Project Manager	Engages [1,3,4,5]	Engages [1,3,4,5,11]: occasionally [6] [11]	Make or buy decisions involving [1,3,5]			
3. Project Committee	Consists of [1,2,3,4,5]	Consists [1,2,3,4,5,8]; occasionally [10,11]				
4. Project Participants	Involve [2,5,7] & production resources	Involve [2,3,5,8,11] & recently [12]	Agree on technical requirements [2,3,5,7]			
5. Product Development Engineer(s) - EURR	Support [4]		In-sourcing: interpret drawings for [7]		Check quality of parts, occasionally involving [7]	
6. Product Development Engineer (s) - ASIR						
7. Tactical purchasing Team - EURR			Joint price & delivery decisions with [2,6]: occasionally consult [6,8]		Communicate progress and changes at supplier to [2,3,5]	
8. Sourcing Team - ASIR				Coordinate exchanges between suppliers & [9,11,10,12]		Problem solving with suppliers [7]
9. Tactical purchasing Team - ASIR				Contract suppliers, coordinate deliveries with [8,10]		Supply expediting Reports to [8,10,12]
10. Supply Quality Team				Check quality of parts for prototyping [7]		Coordinate deliveries with [9]: inspect quality
11. Technical Team		Plan resourcing for prototyping stage with [5,6,8]		Interpret drawings & check conformity of parts with [5,6,8]		Technical support to [10]: communicate progress to [2,5,6,12]
12. All projects Coordinator		Coordinate the projects-purchasing interface [8,9]		Report material status to [2,3]		Report material status to [2,3]

4.1. The status of purchasing coordination, *before* the offshoring of production (2009)

Before 2009, purchasing processes were organized locally and independently within the two facilities. Even when the ASIR facility began to assemble specific modules for the EURR facility, all purchasing decisions for product Y were still made at EURR. ASIR's purchasing team only played an advisory and communication role with suppliers that were based in Asia mainly with regards to language translation with local suppliers. This service was extremely important given that all suppliers for the gearbox unit, the most core part for product Y were based in Asia. In addition, toward the offshoring decision of 2009, some level of centralized decision-making and category management practices had been adopted in order to minimize spend and control transactional risks associated with purchase of components for the gearbox unit. That is as far as ASIR's and EURR's purchasing teams collaborated. Most purchasing interfaces were internal and local to the EURR factory and therefore the coordination of activities in the purchasing process was entirely local to the factory in Europe including with suppliers.

4.1.1. The market requirements specification (MRS) process – before 2009

This process was essentially the first stage of the purchasing process and the first step in NPD. The product manager, often the factory manager as the technical owner of the product identified a market need or a new solution. It could be a simple hinge redesign to more complex aspects of the product such as sensors, gearbox or an entire dosing system.

An appointed project manager then assembled both a committee with participants from say product development, production, marketing and sales, purchasing, logistics etc. who physically implemented the project. The type of information exchange among the project participants at this stage was mainly technical with occasional requests of purchase related information such items as updated supplier lists and updated parts inventory. The routines were tacit, stable and known to almost every MRS participant. This type of informal working and collaboration was also evident to suppliers as well. For example, "…Because we have a relationship with [suppliers] in this area, we knew the tooling, we knew the machinery [they have], and we knew everything. [So we didn't] make detailed drawings. They [only imported] the 3D module drawings from our development system", one project development engineer quipped (Informant #11).

As an output, the MRS process generated somewhat detailed drawings of parts, and identified which components were needed for further sourcing, in what dimensions, their quantities, the purchase level and the projected lead-times.

4.1.2. Supplier involvement and tactical purchasing – before 2009

The exchange between suppliers and PD engineers was considered the first step of supplier involvement. It involved finding suppliers who would work together with PD engineers on in-sourced parts. For these parts, suppliers and the PD team combined competencies, while for the parts and components in the "buy" category, purchasers would go ahead and engage suppliers, receive proposals and negotiate price and delivery terms. On paper, this was how it ought to have been. In reality, PD engineers were also deeply involved in the "buy" category, often performing the key purchasing tasks such as source planning and supplier proposals' assessment, while purchasers were left to manage the clerical and logistical aspects of the process. PD engineers argued that purchasing people lacked the technical skills, since most "buy" parts required further machining and calibration.

It was justified that the deep involvement of PD engineers further into purchasing process helped to check for tolerances of parts before the full specification sheet was approved. This was done by the PD engineers in collaboration with the suppliers directly. This blurred functional boundaries between purchasing and the PD teams' enhanced quality and flexibility, short communication, and favored the product's characteristics (high-end, complex product architecture and small volumes). However, many purchasers believed that the boundaries had become "too blurred" thus creating tensions as PD engineers had no interest in cost reduction goals whatsoever.

4.1.3. Supply quality management (SQM) – before 2009

In standard manufacturing involving repeat purchases, the PD engineers were rarely involved in quality processes as suppliers delivered finished components based on an approved specification sheets to the production line ready for testing and mounting or to storage. Purchasers had full responsibility. However, for project procurements the process was relatively more complex. It involved two sub-processes. First, there was quality inspection of components for the assembly of the first prototype. This involved extensive communication among suppliers and PD engineers, often with little involvement or contribution from purchasing. Once the quality of samples was approved, the second sub-process ensued. Here the purchasing people were more involved in generating bill of material (BOM) quantities and to expedite the parts delivery process. Most parts went to the production line immediately with suppliers a "call away" in case an assembly quality issue was raised. As a result, issues of quality and component failures were infrequent because the communication cycles between suppliers, purchasers, PD engineers and the project manager were short and swift. There was a common and often informal understanding of quality management issues among purchasers, production and PD counterparts in the SQM process. For historical reasons, this extended to suppliers in the form of strong supplier collaboration having closely worked with these same suppliers for over four decades. With production offshoring in 2009, everything changed. For example, one project manager reminisced: "… [in one case] the supplier in China said these tolerances were too small. I looked into [the drawing again] and there were many small question points from the supplier. [I then sent it to our old] supplier in Europe and they said it's not a problem; it's the same tolerances we make all the time" (Informant #10). We describe more such changes in the next section.

4.2. The status of purchasing coordination, *after* the offshoring of production

Before 2009, each BU was independent with an autonomous and traditional purchasing department. However, after 2009, this had changed following the offshoring of manufacturing operations which also involved relocation of EURR's purchasing department to ASIR. EURR's purchasing function, including staff were relocated as well; only two purchasing staff remained with the company, and others left the company. Earlier, a similar but small burgeoning purchasing department had been established in ASIR to support the production of variant X (for structure, refer to Figure 4). The merger of the two departments created a fairly large purchasing and supply unit (PSU) of over 50 purchasing personnel distributed into five units/departments: Sourcing, Tactical purchasing, Supply Quality, Supply Excellence and the Technical center to support the purchasing interactions of EURR and ASIRR. It is important to note that the only remnant function at EURR was the PD team, who were also the technical owners of product variant Y. They alone were responsible for design and all technical decisions of that variant, while the new PSU at ASIR was responsible for its procurement decisions.

During and after transition, the technical center, a spinoff from the local PD unit, had emerged as the coordinator of interactions between the PD team at EURR and the new PSU as seen in Figure 4. These interactions failed, however, and have continued to cause disruptions in the purchasing function. One project manager mentioned: "… [in one case we decided to contact the PSU directly ourselves] but even that failed and finally we decided to send one person to stay there for several months" (Informant #09). The coordination between the EURR PD team and the new PSU was extremely important in order to attain enhanced cost savings, reduced project life cycle costs, better quality parts and reduced project risks and lead-time. However, because the interactions within the purchasing function had failed, questions began to arise about the benefits of moving manufacturing to ASIR. Further restructuring in 2012 saw the establishment of a new role of an "All Projects Coordinator" with the responsibility for coordinating the interface between purchasing and the PD team. The new role, with an SCM view, was created to enhance the information exchanges between the PSU members and the PD team of EURR, while the Technical team would coordinate the local interface between PSU and production. In the next sections, we describe the status of purchasing coordination post-production offshoring.

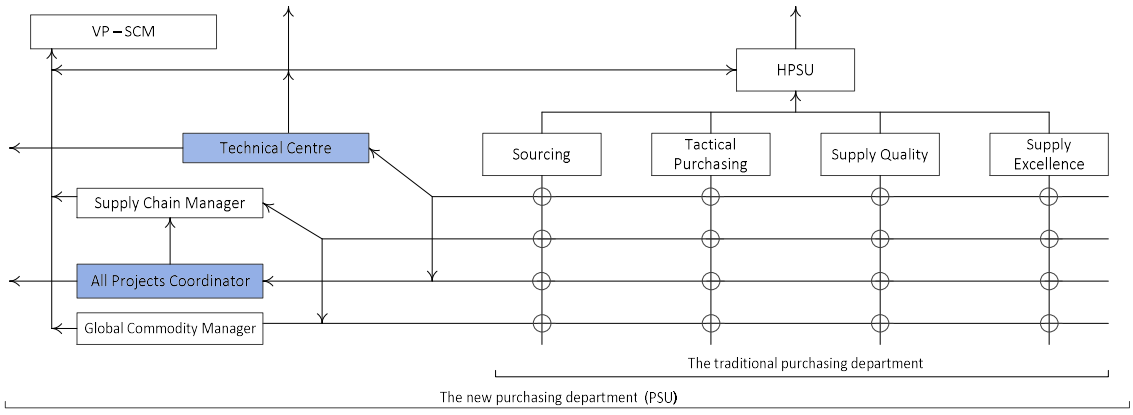

Figure 4: The evolving structure of the purchasing and supply unit (PSU)

4.2.1. The market requirements specification (MRS) process – after 2009

Unlike before, when all MRS activities were independent within business units, the post-2009 changes in set-up meant that the MRS process had become a multi-BU activity with actors spatially distributed across the two business units. The technical owners of the product belonged to one business unit, EURR while the PSU responsible for supporting the EURR were now located at AISR. This change had created a complex functional interface and a number of problems resulted. It was responsible for all project delays partly as a result of geographical distance with time differences allowing only two hours per day for parallel working which according to many interviewees was a "frustrating experience". There was significant misalignment with the work-item list, the platform in which all changes made during the MRS process were registered. Each team maintained their own way of reporting changes into the work-item list because of the different interfaces in SAP. This further led to misunderstandings in the development of a specification sheet and the breakdown in the purchasing process. For example, one manager mentioned: "We [recently had one] huge $10 million project [were] the technical challenges [from suppliers] where not referred back to R&D. So we made the quotation of the project, it should be 800 man-hours work. We spent more than 3000 hours in [EURR] and we were losing money like hell. Then we had to review

[the entire project] since, we didn't know exactly what the customer wanted" (Interview: Informant # 06).

In order to reduce the misunderstandings and enhance the technical center's capacity to manage the already severed PD/PSU interface, an all projects coordinator role was added to the PSU. The new role was specific to project procurement coordination as well direct support to the MRS process locally. See Figure 4 for details.

4.2.2. Supplier involvement and tactical Purchasing – after 2009

Based on the new setup in Figure 4, it seemed clear when and how suppliers had to be involved. Before offshoring of production, suppliers were significantly involved in the PD process as early as the start of the MRS process. After 2009 suppliers were involved later when the MRS process was complete. This time supplier involvement was more formal and structured, and unlike before. The involvement of purchasers in the PD process was early and formalized as well.

In the new arrangement, everything was performed "by the book" with suppliers involved in two phases. The first phase is a purchase-for-prototyping phase. It involved the sourcing team, engaging suppliers to make parts for the prototyping stage. This required PD engineers at EURR to rely on the technical team at ASIR, to interpret and relay their requirements to the sourcing department and suppliers. This failed. According to PD engineers, to get the parts/components required, "we have to push and push and push and push" (Interview: Informant #11). The second phase is the purchase-for-production phase that followed the approval of the drawings as "release for production". Beyond this point, no further changes could be made to the drawings. By default, this phase meant the material master in SAP was also released in order for the PSU to begin sourcing/purchasing for production. The production team also began to prepare (e.g., tooling and fixtures), for (mass) production.

Unlike in the purchase-for-prototyping phase, the purchase-for-production phase did not face any significant challenges (because the PD team in EURR was not involved). As one PSU manager put it: "[locally here we work efficiently], something that needs our support, we solve all the weaknesses once. We work like a supermarket. We have part orders, and once we have approvals, the lead-time is three months then we solve issues". "…but when EURR is involved, it's three years. [Why is that so?]. Those technical aspects you cannot determine by phone. I don't think so, by phone?" (Interview: Informant # 03).

In addition, the current set up ensured that the sourcing team and tactical purchasing team responsible for supplier involvement and PO administration respectively, were co-located in a shared workspace, which enhanced communication among themselves. With this setup, the teams developed an informal way of working with the technical center and All projects coordinator colleagues. Unfortunately, the PD team in ASIR did not participate in the tripartite exchange, except formally through the All projects coordinator. Most PD engineers felt left out of the purchasing process especially when suppliers sought feedback on design tolerances, but no feedback was sought from them. As a result, quality, a key performance indicator (KPI) for PD declined. One frustrated PD engineer mentioned: "[there are cases where] we got several faulty parts in production. No action was taken. We got [product recalls] and after 15 months they got a warning from a very big customer in Germany. [But at] that point we had several 100 [product Y] parts in the field and the cost was most likely more than €1 million" (Interview: Informant # 11).

4.2.3. SQM – after 2009

As an OEM, the link between the purchasing process and quality had implications for its financial performance. Accordingly, even in the PSU setup, an SQM team was co-located to

the sourcing and tactical purchasing teams mainly because the decisions and actions of these teams depended heavily on each other (hence high level of interaction). Therefore coordination among them was extremely important.

However, events after 2009 had added SQM tasks, which required a strong engineering and machining competencies to purchasers who were not competent enough in these processes. Therefore purchasing involvement in technical center work significantly improved sample testing and approvals without directly involving the PD team at EURR. Again, the PD team who, as mentioned earlier, were the technical owners of the product felt sidelined from the "most important decision of the product, i.e. quality". According to one PD engineer, most feedback regarding quality came from external customers and not internally within their ASIR based teams. As a result, some level of mistrust between the PSU and the PD team had emerged.

Another SQM area, this time of contrast, was incoming quality control (IQC). The SQE team collaborated with the technical team to ensure quality compliance of all materials destined for the production line. But because IQC was performed locally among the technical team, SQEs and the tactical purchasing team, high levels of coordination were registered. Whenever a quality problem was detected, the SQEs and technical center referred this problem to the local PD engineers in order to solve the problem swiftly without involving the technical owners in EURR. This created a lot of conflict among the technical owners of product and the PSU and as a result, the coordination of purchasing activities suffered considerably.

In summary, our comprehensive analysis of the case data identified the following dominant reasons for the coordination crisis faced in the company. They included issues of geographical distance and time differences, the complex organizational set-up, information sharing complexities, language and culture, and asymmetry in competencies. We build the analysis, discussion, and a normative purchasing coordination model around these issues.

5. ANALYSIS

In this section, we analyze the results from the case about coordinating purchasing activities within a firm that had recently offshored its manufacturing operations as described in the previous section. Our analysis will focus on the problems in the coordination of purchasing activities following the offshoring of production: we shall attempt to explain why these problems occur using the theoretical framework presented earlier. First, we emphasize the inherent differences among teams and business units that were expected to participate in the "new" purchasing setup – as seen in Figure 5. Then, second, we reflect on the findings by considering the possible sources of coordination failure using the VSM.

5.1. Offshoring as a threat to system 1 coherence – the impact on purchasing coordination

System 1 elements represent the operations or precisely the productive activities of the firm. Purchasing activities, which form the focus of this paper, are central for operations by way of facilitating the acquisition of materials, services, and capabilities that enable operations to function effectively. Before production offshoring, purchasing was independently organized within BUs: each BU focused on a unique product variant as illustrated in Figure 3. EURR had been responsible for its own design to production processes, as was the ASIR. Despite the same corporate leaderships, occasional information exchanges, shared global tools and common routines, each BU was independent with own goals, technology, culture, decision making styles and purchasing practices. This is illustrated in Figure 5 where the only linkages

between the BUs are presented as the squiggly lines as described in section 2.3. These squiggly lines are fundamental for our subsequent discussion of the impact offshoring had on the system 1 as a whole.

In that sense, each BU's purchasing practices varied extensively. Before production offshoring, purchasing activities were deeply embedded in product development activities; creating an integrated sourcing model within each BU. This setup facilitated a reduction in quality problems and reduction in new product development lead-times. The decision making was quick and, flexible, because of deeper supplier involvement in product development.

Alongside production, the purchasing function relocated to ASIR in 2009. In order to reduce cost and administrative complexity, a centralized purchasing was formed. Most older suppliers and purchasing routines phased out, amidst a new and more hierarchical structure. One person, the head of the PSU, was now responsible for the entire purchasing organization, with the responsibilities of a technical manager replacing those of project managers in the purchasing process. This change did not go down well with the product development team. In addition, the goals changed radically; quality was important, but not as important as cost reduction. New purchasing practices such as supply base reduction and localization, standardization of parts and contracts were driven mainly by cost reduction.

Considerable tensions and misunderstandings had emerged due to differences in culture, language and decision making patterns: every participant in the purchasing process was trying to accommodate each other's differences. This further weakened the linkages between the two BUs. For example, in the sourcing of components for the first prototype of the new redesigned coating system in 2010, the entire purchasing process was twice repeated costing the company 2200 man-hours over and above the 800 proposed man-hours for that project. The "new" purchasing personnel (and suppliers) admitted to not understanding the MRS outcomes and drawings from their PD counterparts which affected coordination in the entire purchasing process.

Perhaps the more critical problem was that of the emergence of new, dominant power centers within the purchasing process. Project managers (project owners) and the product development team had become an aggrieved power center having lost control of the key purchase decisions (especially the supplier selection decision). The new purchasing team had become the main center of power (with control of budget) following centralization of all purchase decision making. As a result, mistrust, cross-functional conflicts and withholding of information became frequent with each team blaming the other for process failures, increasing quality problems, and project cost overruns.

In sum, following the offshoring of production, two dominant changes had occurred. First, offshoring had exposed stack differences within the operations of the two BUs, which later strained the linkages between them – the operations. The quality of linkages between the operational units were even more weaker. Previously, the differences also shown in detail in figure 5, were only minor undercurrents from shared processes within the global sourcing and logistics support model. Second, the structure of the purchasing function had greatly changed because of offshoring – from decentralized and independent units to a fully centralized purchasing organization. In addition, significant changes were made in roles and responsibilities because of downsizing and corporate-level transfers. As a result, the differences in purchasing competencies within the BUs widened even further, including the breeding of functional expediency. The collaboration and cooperation within the purchasing function was therefore mainly a result of physical and formal ("matter-of-fact") interactions and not necessarily because actors looked forward to working together. Not surprisingly thereafter, team misunderstandings were very common in the purchasing process and cooperation was limited.

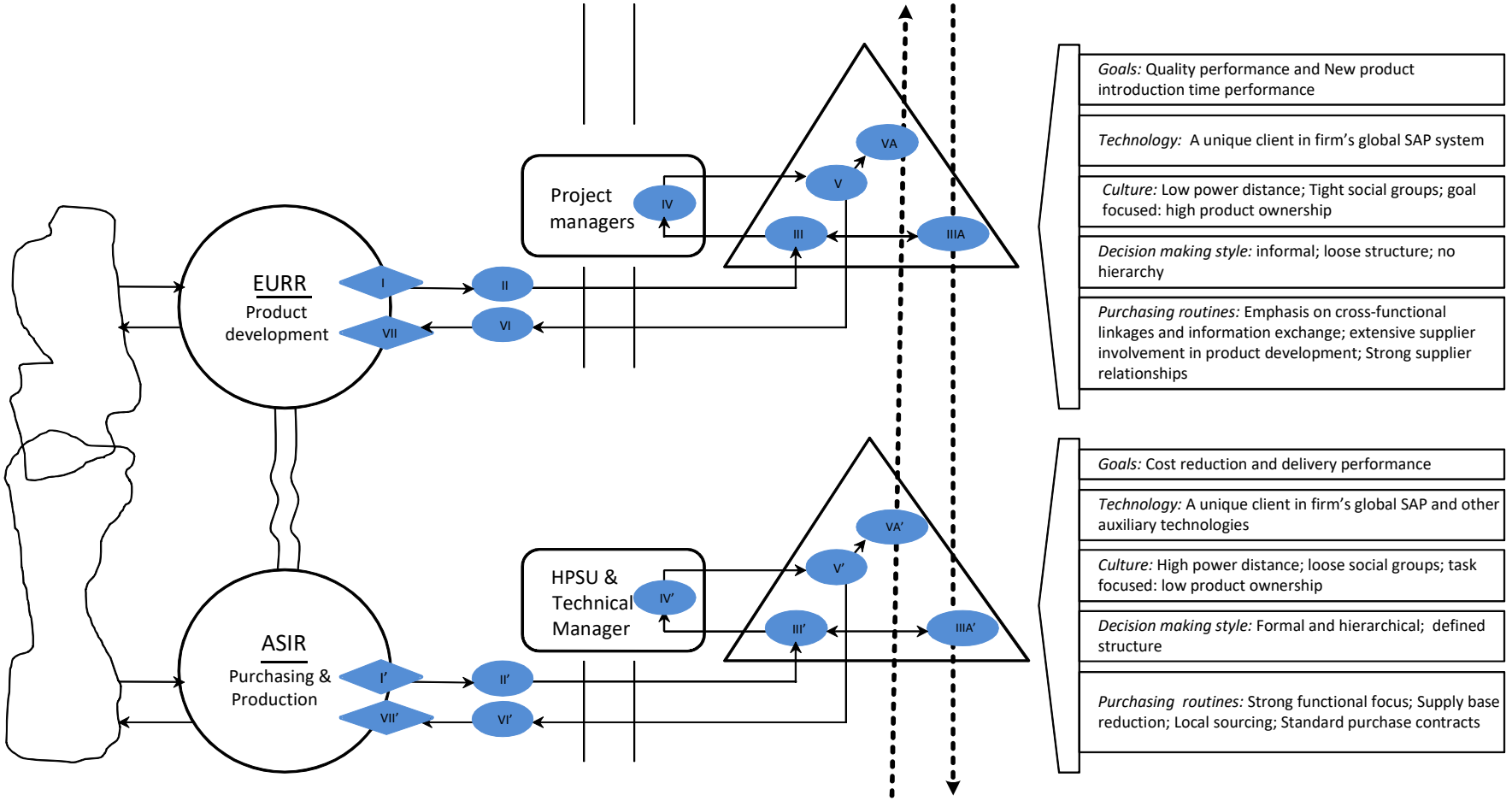

Figure 5: Differences in System 1

5.2. Problems in the functioning of System 2 – the impact on purchasing coordination

Aside from revealing the operational differences, which are the primary threats to coordination in general, offshoring presented even more specific threats to purchasing coordination and hence oscillation in system 1 elements. From the case data, we were able to inductively extract 14 purchasing attributes that threatened the functioning of system 2. These are mapped along with the impact areas of the purchasing process (presented in the table 5). In next sections, we present these findings as threats to the interface between system 1 and system 2 and these are further explained in the sections 5.2.1, 5.2.2 and 5.2.3.

Table 5: Purchasing attributes responsible for instability of system 1 elements (the failure of system 2)

Possible sources of coordination failure		**Purchasing process attributes**		
		MRS	Supplier involvement & tactical purchasing	SQM
Threats to transducers, channels and relays	I &VII	(-) Different technology platforms and no history of collaboration		
	I &VII	(-) Culture and language problems		
	IIIA & VA	(-) Formal versus informal mechanisms of working		
	IIIA & VA	(-) Culture and language problems		
Threats to the input and output synapses	II & VI	(-) Blurred roles and responsibilities		
	II & VI	(-) Low purchasing expertise		
	II	(-) Mistrust & reluctance to share information		
	VI	(-) Misunderstandings in information reciprocity		
Threats to management & the local regulatory center	III	(-) Limited experience with new purchase situations and performance reporting		
	IV	(-) No clear sourcing strategy		
	V		(+) Locally optimized sourcing practices	
	IV	(-) Misaligned goals		
	V	(-) Culture and language problems		

Key: (+) Enhancements to systems functioning and (-) Threats to systems functioning

5.2.1. Threats to transducers, information channels and relays (I,VII, IIIA, and VA)

To begin with, transducers are represented by I and VII in Figure 2 earlier. These facilitate transduction, which basically is a process of coding and decoding a message across a boundary. Effective transduction means that the integrity of communication or a message is maintained as was intended.

In the case, transduction occurred mainly as an interface between the product development function and the purchasing function (the MRS process). Through the MRS exchange between these two functions, it was expected that suppliers would be engaged to work with product development teams to develop parts for the first prototype of the product, before the final drawings were approved for mass production. The first attempt failed because there was no previous history of the two teams working together on the MRS process as highlighted by Figure 5. The involvement of purchasers in the MRS meetings and development of technical drawings was occasional and infrequent, which affected the rapport between the teams. The PD engineers believed that purchasers were not competent enough to interpret drawings independently. The purchasers believed PD engineers were not commercially oriented enough and therefore preferred to be involved in PD much earlier. In order to solve this deadlock, a local technical team, co-located to the commercially oriented purchasing team was introduced to support the interpretation of drawings and support the information exchange between the PSU and suppliers on one hand and the PD team on the other hand. This failed as well. More so, the purchasing and PD function were different clients within the company's SAP system as they previously operated under different BUs.

At the time of the interviews, only two people were responsible for the support function in the technical team compared to the fifty or so purchasers in the PSU. They clearly lacked sufficient requisite variety to efficiently coordinate the information exchange in the MRS process.

The other recurring transduction problem was that of culture and language, also emphasized in Figure 5 and Table 5. Even though some informants were dismissive of this problem, it hugely affected information transmission. In fact, the case evidence suggests a total breakdown in the communication and information exchange immediately after 2009. Previously co-located purchasers and PD engineers had shared MRS information among themselves, often informally, without many problems. After all, they were "colleagues" who spoke one common language (not English the company's corporate language). Given that the PD function was now divided between BUs, the different teams were forced to work together. To the PD engineers, the product was their child – "it meant so much to us" – but to the purchasers, the product was part of the job – "I am hired and paid to do this job and I do it. End of the story". The type of cultures among teams defined the type and quality of information shared by each team. One informant admitted that altogether the respective teams lacked a common understanding of customer requirements because away from the videoconferences meetings, telephones and emails, the corporate language (English) was rarely used. The reliance on the technical team to mediate supplier exchanges from Chinese to English (and vice versa) was a problem for transduction since not all information came through.

The other problematic area was that of information channels and relays, i.e., IIIA and VA. As a standard mechanism of information processing, channels and relays are expected to have the same or greater capacity as the information they are transmitting (i.e., requisite variety). Locally within own units, information exchange was not problematic; it was based on existing internal relationships and informal historical experiences with the same team members. However, it became problematic when it involved other units with each team accusing the other of not communicating effectively.

These differences as emphasized in Figure 5, demonstrate the lack of capacity of the channels to transmit sufficient information within the MRS process. Furthermore, the cross-functional disagreements reiterate the culture problem in the information exchange process. Two local, rather than global/integrated methods of working had emerged, leading to selective, often antagonistic information transmission modes between the two main participants in the purchasing process. Within functions, each team communicated locally and informally, creating a common local understanding but across functions, a formal mechanism and language was used. This created a natural, local filter in the information transmission exercise, which we shall argue acted as an obstacle. Besides, the purchasing informants felt that although they attempted to act formally as a corporate policy to improve cross-functional integration, their PD colleagues maintained their own informal and unstructured culture of exchange with the "new" purchasers. The feeling of "we want corporate management to intervene, on this issue" was quite evident among the purchasing team. They felt forced to integrate with PD engineers who were not willing to make any effort whatsoever. With regard to this impasse, one informant quipped: "Of course, I wouldn't blame the PD engineers; they are closing their own work [and taking it to Asia]".

5.2.2. Threats to the input and output synapses (II &VI)

Input and output synapses play a central role in reducing variety. While the input synapses (II) receive, filter and organize ascending data into information for decision-making, the output synapses (VI) play the opposite role. They break down the descending information into

meaningful operational choices. Without the synaptic function, decision-making would be ineffective since managers would be overloaded with information.

The performance of the purchasing function activities depended a lot on mutual information exchange among actors. The project managers as custodians of the MRS process expected information from purchasers about vendor performance, material availability, and production usage patterns, while the purchasers on their part expected feedback on projects progress in order to begin negotiations suppliers. The evidence suggests that initially this exchange was never well mediated and was therefore a no man's land. Project managers assumed that purchasers were responsible for furnishing the MRS meetings with updates about current supply market expectations under the new purchasing arrangement. The purchasers did not think this was their role but that of their local technical team counterparts to whom they reported all matters concerning communication between the purchasing and PD. However, the local technical team also argued that their role was limited to providing only quality and production support, not front-end, non-technical communication. Despite each team having the appropriate information that the other team desired, they did or could not filter it beyond their own team environments. The reason for this cross-functional impasse was largely a structural problem were after offshoring, the firm maintained specialists within their own departments: all purchasing specialists were retained in one unit, the PSU; the PD engineers were retained in PD units. There was no mix of competencies across the two different units.

The other problem, also somewhat related to structure, was that of low purchase skills. The new purchasing function consisted of five departments each staffed with 10 or so purchasers who before 2009 had been in other functions such as R&D and marketing. Most had an engineering education background. They had been transferred from other functions to take up roles in the new PSU. The general atmosphere about the PSU was one that was very efficient with clerical procurement tasks but in terms of strategy development, collaboration, management influence and so on.

By now it is clear that the effectiveness of the synapse function relied on the quality of skills and experience of those that execute that function. Low skills and inexperience infer a capacity obstacle to the synapse function i.e. translating information into actions.

At a more specific level, the input synapse, a vital filter of information toward management was affected by mistrust between the two teams responsible for this function. The goal was to ensure that mutual exchange of purchasing related information would help each team attain cross-functional goals. However, each was hesitant to do so. The PD engineers felt they would do a much better job if they had the responsibility for this information by themselves; while to the purchasers all sourcing information was embedded in their tasks. Because of this mistrust, both teams were reluctant to participate in the information exchange by withholding information within their team structures.

Regarding the output synapse, it represented the instructions from MRS meetings for example, to implement the project (for the PD team) and for purchasers to engage suppliers. However, this process was marred by discord. Previously, these two tasks were linked which created an embedded information flow between purchasing and PD. Under the new purchasing arrangement, instructions flowed sequentially i.e. the drawings had to be approved first before sourcing of suppliers began rather than in parallel. Yet PD engineers continued to work in parallel, which meant that suppliers had to change their tooling frequently and this increased cost significantly. The result of this cross-functional antagonism meant that purchasers would ignore any new technical changes after approval, which compromised the feedback loop hence, synapse failure.

5.2.3. Threats to the local regulatory centers and in local management (III, V and IV)

The local regulatory functions support their respective local managers by filtering all operational data against the aggregate performance expectations; if there are significant variations, reports are made to management for decision making. In that sense, the regulatory function shields managers from uncoordinated information, which facilitates quick decision making. And more importantly, the regulatory function supports the linkage between the focal operation and the other operations through which mutual exchanges are notified. This linkage is fundamental to cross-functional and cross-BU coordination especially if operations share a common goal or activity for which synchronized communication is necessary.

The evidence in this case highlights several weaknesses within the regulatory function especially after offshoring. Within purchasing, performance was measured mainly through cost savings. The role of sourcing, SQM, tactical purchasing and Supply Excellence department managers within the PSU was to report on cost performance monthly to the head of PSU and the head of SCM. However, the managers had no specific benchmarks since all the internal purchasing processes were new as were some of the purchasers themselves. Accordingly, the notion of control based on thresholds and capacity of information channels within functions was almost absent. Moreover, the expertise and processes were not robust enough to provide reliable performance metrics. Moreover, what to measure was for the most part vague. Most informants appeared to suggest that any initiative, as long as it reduced cost was a viable option to pursue. When asked about issues such as purchasing integration and cross-functional collaboration, there were comments of "we just cooperate! On issues of supplier relationship development, there were comments of "we need to do more there". Therefore, as authors we reasoned that the best check of performance reporting was the existence of well defined goals as well as a clearly defined strategy that were understood or aligned locally and globally.

Furthermore, the cost orientation of the purchasing function appeared to collide with the quality orientation of the PD function. PD engineers accused their purchasing counterparts of focusing too much on "cheap but stupid quality" while the purchasers suggested that some PD actions, such as a preference for previously used European suppliers, was proving costly for the firm. The misalignment of goals had created a great deal of tension between the two teams thus affecting communication exchange and performance in general.

In addition, local decision making was impaired by culture and language challenges. Case evidence suggests that although directorates were locally effective, the effectiveness could not be translated across business units and across teams or in this case at the firm level because the managers had little in common with the other team and therefore were less motivated to work together. Local teams found it naturally easier to communicate with culturally close teams and in a medium understood by that team, than with other teams outside that bracket.

In sum, the above factors pointed to flaws in performance control, communication and reporting functions of the purchasing function, which systemically explain why the firm faced problems of purchasing coordination. In the next section, we attempt to develop these findings further and discuss them in the context of the research questions we posed earlier.

6. DISCUSSION

In the earlier part of this paper, we were concerned that the coordination problem was not well articulated in the literature. On that basis, we postulated that relocating the purchasing department away out of its functional interfaces creates a different dynamic for the purchasing coordination construct i.e., communication, interactions and interface management become

more complex. We identify four areas where purchasing coordination often becomes problematic. We then proceed to argue based on the literature and findings from the case that the coordination of information exchanges and communication of purchase decisions is as essential as the aggregation of volumes and common purchase requirements across the worldwide sourcing organization. In particular, we suggest that although it is a well known fact that the objective of purchasing coordination is to ensure better firm performance, this discussion highlights an even much more understated purpose, i.e. that of organizational stability.

But first, going back to RQ1: *how has the issue of purchasing coordination been conceptualized theoretically*? If we recollect from the literature on purchasing synergy, group sourcing and global sourcing, this body of literature suggests that actors in the purchasing process operate in a concerted effort and that decision making is guided by a common goal (Quintens et al. 2006; Jia et al. 2017)). The lack of coordination however has been portrayed as a result of misaligned goals and strategy (Moses & Åhlström, 2008), politics and power struggles (Smirnova et al. 2011), and limited communication (Handley & Benton Jr, 2013). This study confirms these issues too. However, our findings *also* suggest a new and somewhat different reality in which the aggregate organizational or functional context plays a more fundamental role in purchasing coordination than previously assumed. In terms of management cybernetics, Beer (1972, 1985) referred to this as the "inside and now" of the system. Aspects of organizational or functional context such as a previous history of collaboration, working style (e.g. decision making), and routines as well as culture and language were notably dominant in the case study. So, it is possible that functional goals will not align (they often never align fully) as we saw in the case of purchasing and product development, but the organizational or functional contexts must be in harmony if strategic consensus is to be achieved. Here we are referring to a combination of the way of thinking, practices and routines that mediate information exchange (Lampel & Bhalla, 2011) which causes tranducers and synapses to function differently. Faes (2000) has referred to these as the 'psychology and physiology' aspects of coordination. Therefore, not only goals and structure should be at least partially aligned, but also the cognitive and latent processes that define how actors in the purchasing process interact. That explains why the focus on ICT tools as a basis of coordination has proved inadequate unless supplemented by physical interactions (Morgan et al., 2014). The study of Paulraj et al. (2006) has hinted at something similar, where they suggest that integration can occur without well-aligned functional goals, as long as the informational aspects (e.g. quality of information, quality of procedures and alignment) of a process are synchronized.

Even though the problem of varying organizational or functional contexts has been hinted at by proponents of cross-functional integration (e.g., Foerstl et al., 2013), it is the challenge that different contexts bring, especially functional feuds, that should be cause for concern. Ellegaard and Koch (2014) recently discovered that, because of high differentiation among functions, each actor tended to act in isolation without checking on what others did. We found similar evidence in the case study of autonomous decision making across the purchasing process; each actor arrived at decisions without communicating to the other. As a result, they unknowingly acted in competition and in isolation from each other and that led to misunderstandings, mistrust and conflict. Similar to others (e.g. Moses & Åhlström, 2008), we argue that this is the central dilemma for purchasing coordination in many organizations because the role of a defined information exchange routine or mechanism is not well emphasized as an enabler for coordination and integration for that matter. Therefore, in order to ensure that actors and functions coordinate across each other without competing or being controlled by the other thereby minimizing power asymmetry and conflict, the VSM proposes

the notion of damping such oscillation as a fundamental mechanism for coordination (Beer, 1985). Essentially, any viable organization must have such a function responsible solely for damping oscillation. Without it, the organization or any system for that matter will shake into pieces. Beer (1979, p.178) uses examples of a timetable in a school and the production control function in a factory as some of the coordination mechanisms used to damp oscillations within a school and factory respectively. Before the establishment of an "All-projects coordinator" responsible for the purchasing-PD interface, many conflicts had emerged which threatened functional stability. The role of the new position was to minimize the emerging cross-functional misunderstandings. The standardization of information exchanges, shared forecasts, globally optimized decision-making and so on are some of the several examples of such anti-oscillatory mechanisms in purchasing (Quintens et al., 2006). All these are mechanisms of reducing instability by damping oscillations in the purchasing process and enhancing cross-functional effectiveness.

Even more, we need to answer RQ2 which may now be framed as, *how do oscillations occur in the purchasing process and why?* The case study opened three areas in the VSM from which we can answer this question.

a) *Within and among the operations*: Our attention focused on the purchasing function which is a fundamental support activity of the operations. The operations represent company's value creation activities, and purchasing among other functions exists to aid the value creation process (van Weele & van Raaij, 2014). Typically, the purchasing function is a melting pot of multiple organizational actors responsible for different decisions in the purchasing process. As expected, the outcomes of cross-functional decision making were not effective at all, especially after the offshoring process destabilized the existing teams and routines. Disagreements about quality and cost objectives had led to conflicts. From the literature, this was an expected problem (Bals et al., 2013; Mugurusi & Bals, 2017).

   However, Beer (1985) had mentioned that although some level of physical collaboration (through the squiggly lines) should exist among operational elements, it does not necessarily mean that they are integrated. Each element, in this case each function will tend to operate independently or at least act in partial ignorance of the other function because they naturally serve idiosyncratic environments (Lorentz et al., 2018). The role of purchasing coordination or system 2 is therefore to ensure that the functions 'speak' to each other based on mutual information exchange. Evidence from the case study showed limited information sharing as teams resorted to informal communication exchanges, which albeit important, created situations of information speculation. The quality problems and withholding of information was a sign of variety that could not cross-functionally be absorbed. Beer (1985.p.222) has likened such conditions to "playing poker with the situation" hence oscillation. Several examples of oscillation including: conflicts over non-participation, PD's mistrust of information supplied by purchasers, disagreements on supplier selection decisions and so on are described in the case.

   In addition, limited information sharing suggests a more subtle problem in channel structure and transduction capabilities of the system. Among the many principles of cybernetic organization, two apply to the current situation (Beer, 1985): (i) information channels must always have higher capacity to transmit information than the point from which that information is generated, and (ii), transducers must have the same or at least equal variety as the channel through which transduction occurs. The preference of informal rather than formal communication exchanges suggest that these two principles did not hold. This infers that these channels carried more than the planned variety, which made effective transduction difficult. More so, the capacity of information channels was limited and often clogged with distance, technological, and cultural differences. The low

channel capacity and the limited transducer capability suggest that system 2 is incapable of effectively discharging its duties, which, from our discussion is a purely anti-oscillatory function (Beer, 1979).

Therefore; limited information sharing among actors in the purchasing process, negatively affects the level of both collaboration and integration in system 1 elements and impairs the functioning of system 2.

b) *Within the regulatory centers*: Effective purchasing management considers information processing and performance reporting crucial for better performance outcomes (Trautmann et al., 2009). The function responsible for the information processing and performance reporting is a regulator or regulatory center. In fulfillment of this role, the regulation function works across operations or cross-functionally as well as locally that is functionally.

Firstly, the cross-functional aspect considers local regulatory centers to operate under conditions of cooperation and mutual information exchange. In the portrayal of system 1 earlier, we referred to these linkages as information relays. Since our interest was the cross-functional purchasing process, we expected that performance measurement was facilitated by reciprocated communication (Morgan et al., 2014). There are numerous examples in the literature which suggest that involvement of purchasing specialists in product design facilitated measurement of supplier input and innovation into product design efforts (Schiele, 2010). The same applies to other functions such as product design, marketing, and operations where their contribution to the purchasing process reduces supply risk and cost (Foerstl et al., 2013). Yet, despite the clear evidence that reciprocal information exchange ensures effectiveness of regulatory function (hence better decision-making), we found little evidence of cooperation among the local regulatory centers. Each actor had their own performance goals: purchasing focused on cost while product development focused on quality. This variability coupled with low purchasing skills, unclear structure and inexperience with the current purchasing models meant that the local regulatory functions were incapable of participating in cross-functional exchanges which paved way for oscillation.

Secondly, it is also important to consider the role of local regulatory centers in variety control (i.e. variety attenuation and variety amplification). Typically, the regulatory center controls variety through attenuating operational variety to the directorate on the one hand and amplifying managerial variety to the operations on the other hand (Beer, 1979). In order to carry out this function effectively, the local regulatory center must have the requisite variety to handle both operational as well as management variety in tandem. From the case, the combination of low purchasing expertise and blurred functional structure directly affected the ability of the regulators to transmit information between the directorates and operations. Because of the different performance goals for both the purchasers and the PD engineers, each team filtered out the others information when making decisions. For example, within the purchasing process, variety attenuation would translate into supply base reduction, category management, volume consolidation, and so on, while variety amplification infer actions such as, supplier development, differentiated purchasing approaches and so on. These activities required cross-functional technical and behavioral skills as they are strategic purchasing activities (Ellegaard & Koch, 2012). The lack of these skills meant the regulatory centers were unable to deal with local variety effectively.

Similarly, structure enables better communication across all facets of the purchasing organization (Mugurusi & Bals, 2017). Therefore, when roles and responsibilities are not

well defined, it becomes difficult to exercise variety control within operations (Mugurusi & de Boer, 2014).

In sum, oscillations are also the result of two factors in the mechanics of the regulatory function: (i) the different performance measurement systems which limit the amount of interaction between system 1 elements, and (ii), the low purchasing expertise and unclear purchasing structures which affect the regulatory function's capacity to transmit and receive information for better decision making.

c) *Within in the local directorates*: The directorates represent local management and are concerned with the routine management of local operations (Beer, 1985). Managers here depend on the quality and accuracy of information filtered through the regulatory function. Therefore, the information channels and transduction facilities between managers and the regulatory function must be effective. Although, the case brings to the fore decision making advantages of the localizing the supply base, i.e. closer to production and reduced logistics costs, it created distance among actors in the purchasing process. Purchasers could not satisfy all PD information requirements because their channel capacity was limited to "purchasing information", and was often muddled in cultural and language misunderstandings. The directorates had collided and oscillation set in.

The tensions between departments exploded into a problem referred to as conflicting preferences (Mugurusi & Bals, 2017), with each directorate rationalizing communication locally at the expense of the other. Beer (1979) would argue that localized management is good for the system: it facilitates rapid decision-making. However, because most purchasing activities are cross-functional in nature, localized decision-making needs to also be translated into cross-functional decisions without being interpreted as over-interference. Bals et al., (2009) suggested that over-interference is a result of a lack of awareness of the other function's skills and capabilities, and in other cases, a result of functional biases which affects trust, interactions and intra-organizational relationships.

6.1 A model of purchasing coordination in the offshoring firm

The question "how to effectively coordinate purchasing?" is answered from the lessons we draw from the case study. Toward that end, we present a model in Figure 6 to outline how the purchasing coordination problem should be tackled in the VSM sense. Although this study focused particularly on the offshoring firm, where we postulated that weak operational linkages generated functional tensions which directly affected the level of purchasing coordination, the resultant model (in Figure 6) applies to multi-business organizations and global sourcing organizations as well. They all face the challenge we address in the paper i.e. that of less cohesive "inside and now" configurations, also referred to as varying functional and organizational contexts by Handley & Benton Jr. (2013). Nonetheless we also learned four things from our study that provide the basis for Figure 6.

First, the existence of operational material linkages, such as sharing demand and supply information in cross-functional sourcing process, is not sufficient evidence to enable effective purchasing coordination. Beer (1985) referred to these linkages as "matter-of-fact" interactions among the operational units. These vary depending on the embedded business unit linkages such as financial, structural and human resource dependences. In highly integrated organizations, these linkages are more pronounced and they forge a first level of immediate coordination. However, in less integrated operations, as in our case company, these linkages are blurred by geographical dispersion, which reduces the amount and quality of such interactions (Handley and Benton Jr. 2013). The question from a cybernetic viewpoint is, how can such "matter-of-fact coordination" be enhanced? Percy (2009) proposed the use of internal partnering where problem solving is placed at functional boundaries as a way of

compelling teams to loosely collaborate with each other outside the existing formal interfaces. Also, the use of cross-functional teams has been suggested as mechanism to enhance the purchasing integration (Ellegaard & Koch, 2012), yet as we saw earlier, team operations are often difficult to implement in spatially dispersed organizations (Lorentz, Kumar & Srai, 2018).). It is therefore important that integrated technology be used to supplement cross-functional purchasing teams in order to enhance the existing "matter-of-fact coordination" (Morgan, et al., 2014). This can be further enhanced through clear definition of the information flow structure collaborative product development processes such as modularization and so on (Ellegaard & Koch, 2012). Yet again functional teams must maintain their identity in order to remain viable in their environments, or else they fail to control their own variety.

Second, the local regulatory functions must be aligned and communicate with each other effectively. In this case study, we see that local actuation processes are somewhat effective, for a number of reasons such as shared contexts, common incentives, common culture (Mugurusi & de Boer, 2013; Johansson & Olhager, 2018) and so on, except when decisions have to be transmitted across functional boundaries, do conflicts emerge. We attribute these conflicts to the capacity of channels and that of transducers responsible for information exchange across teams and functions. In principle, channels should be able to transmit information from one function to other and backwards in order to maintain a timely balance of variety in the system; for the same purpose, the transducers must be able to encode and decode the information respectively and as effectively as possible (Beer, 1972). In reality and after offshoring, these functionalities are denatured, clogged and therefore less effective (Mugurusi & Bals, 2017). The purchasing channels would only transmit what they understood best. The product development transducers did the same and as a result, tensions ensued.

To correct this, Pohl and Foerstl (2011) the proponents of the purchasing performance measurement system (PPMS), suggested that teams must be able to measure the same thing, at least strategically, which implicitly infers that they must communicate effectively on what they are measuring and the methods they are using. In essence, they argue for effective mutual communication and alignment of goals across heterogeneous actors in the purchasing process. We shall explore this point further on as a basic enabler of system 2 functioning.

Third, joint decision making should not be interpreted as neglect of local decision-making. In cross-functional sourcing processes, the element commonly emphasized is joint decision making (Foerstl et al., 2013). It includes shared information exchange upon which dependent decisions are made, as is the case in the purchasing process where a supplier selection decision involves technical input from PD or production (Schiele, 2010). However, the tendency to focus more on such joint decisions results in ignoring internal functional decision making as seen in this case. This predisposition is risky because the implementation of functional strategies occurs within functions themselves and not across functions (Foerstl et al., 2013). Beer (1972) argued that the role of local management or local directorates is "sufficient and necessary" in the information loop because the psychological limits of the operations must be kept under check or else unnecessary variety proliferates elsewhere in the system. Therefore, local decision making is important to reduce ad hoc decision making problems such as cost and quality misunderstandings (Moses & Åhlström, 2008): it cannot be ignored.

Fourth and finally, to coordinate is to monitor and keep in alignment all elements and actors with diverse roles and interests in the system in order to maintain the overall viability of the system. The objective of coordination is to ensure that a desired level of "efficiency and effectiveness" is achieved (Handley & Benton Jr, 2013). In purchasing, that goal has been, until recently, construed to infer better decision-making and enhanced purchasing power

(Balakrishnan & Natarajan, 2013: Jia et al., 2017). Trautmann et al. (2009:p.57) proposed that this was perhaps a narrower way of looking at purchasing coordination; they suggested that units involved the sourcing function must be "mutually supportive…. to accomplish the firms overall goal". This, we contend, is the way purchasing coordination should be seen, i.e. in a broader sense of organizational viability. By acknowledging that individual operations, or systems are inherently different and difficult to fully integrate, the purpose of coordination is to ensure at minimum that they are aligned or that oscillations, i.e. cases of misalignment are kept within critical ranges. This is the role of system 2 (Beer, 1972), and as we have seen from the case, it is important that system 2 is always present in the firm, because not only is it fundamental for coherence in the sourcing organization, it also provides for viability of the purchasing function (i.e. through attainment of cost, quality, delivery and flexibility goals) and the firm in general in terms of better business performance.

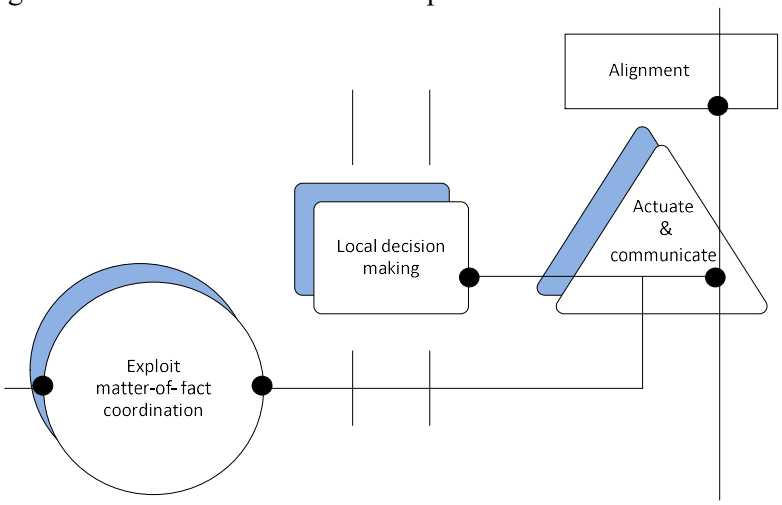

Figure 6: The viable system model of purchasing coordination

7. CONCLUSION AND IMPLICATIONS

The aim of this case study was not to argue for a solution to the coordination of the purchasing problem most organizations face, but rather to develop an explanation, and perhaps a different way of looking at the phenomenon, which has somehow been under the radar in the literature. We were first challenged by the theoretical lenses through which coordination in purchasing was viewed and discussed. It was clear that most of the literature addressed only pockets of the problem such as purchasing synergy, global sourcing, and cross-functional integration. As such some studies began to argue for more holistic frameworks to address the purchasing coordination problem (Mugurusi & Bals, 2017). By adopting the management cybernetics perspective, in particular the VSM, we were able to identify the deficiencies in purchasing function as a system and suggest mechanisms of dealing with them. Besides, the case company offered an opportunity to catch the problem in action. The idea of disjointed firm boundaries, akin to today's multinational enterprises, was more appealing as it emphasized how offshoring created conditions that limited cross-functional collaboration. In particular, we were able to capture how the differences in among actors in the purchasing process increase when companies engage in offshoring.

In the end, we suggest that companies must recognize that actors who participate in the cross-functional and cross-BU purchasing activities, are bound by their organizational and

functional contexts which make them essentially different because of their long-established orientations. The empirical evidence here suggests that the focus on purchasing coordination should therefore be about getting the actors involved to "speak" with each other synergistically and efficiently. This has not been well articulated in the literature. So, as the main contribution of this paper, a normative model and holistic view of coordination in the purchasing function is presented in attempt to explain how problems and conflicts in cross-functional and cross-BU purchasing processes can be minimized (Moses & Åhlström, 2008: Ellegaard & Koch, 2012).

7.1. Managerial implications

The study offers some implications for practitioners. Managers should recognize the importance of managing organizational and functional contexts, which we discussed as the "inside and now" of the VSM. The focus on organizational structure and technological artifacts to link different functional competences is not sufficient to ensure purchasing coordination. Understanding why and what makes functions (system 1 elements) different is important to designing a better coordination system (system 2). As we have seen from this case, the environment affects the nature and types of transducers, synapses and channels hence the idiosyncrasy in system 1 elements. Here are some rules that should be considered when designing a coordination system:

i. Understand the (new) operations and exploit any form or modes of interactions that exist among the operations. The development and enhancement of the "matter-of-fact coordination" should provide the first point of interest for managers.
ii. Build a system 2 that matches the capacity of the operations combined. Each operation in itself is a viable entity. A good system 2 must therefore recognize and reflect these differences and yet be capable of harmonizing the operational exchanges without being considered as interference.
iii. Do not overestimate the virtue of goal alignment. The focus of alignment is to ensure that operations identify themselves with the objectives of the corporate organization.

Furthermore, managers in particular those responsible for purchasing need to pay close attention to variety in the "inside and now" and the channels between systems and across systems. These have strategic implications for purchasing coordination. Some purchasing practices such as standardization, early buyer involvement, supplier involvement, use of sourcing teams and so on are meant to reduce variety within operations. However, the implementation of these practices, particularly in centralized purchasing arrangements, may instead increase variety in other operations. For example, early buyer involvement would mean more actors are involved in the decision making processes hence more decision making time is needed. This is why it is important that the coordination system design ensures that the channels between systems 1 are similar or aligned and have sufficient capacity to transmit the required variety across operations (refer to Figure 6). This is a fundamental prerequisite for successful cross-functional purchasing processes.

7.2. Research implications

This case study challenges researchers on the issue of purchasing coordination by expanding the realm of the concept itself. By using the VSM, we see the opportunities for future research in decoupling the different elements in the VSM (e.g. the operations, regulatory centers and so on) and ascertaining what forms and types of coordination occur with those recursion levels. Like Morales-Arroyo (2012), our focus in this paper has been on only system 2 as a

service to system 1 elements, but several interactions occur also beyond this point that require some forms of coordination.

The study also challenges researchers and is challenged on the issues of integration and alignment, which are common lexicons in the purchasing coordination literature. These appear not to be well defined as to when and where they apply. For example, how much is too much integration or alignment? How much can you integrate without antagonizing existing levels of purchasing coordination? The model developed in the paper suggests that these concepts apply at different levels in the purchasing function. These should be empirically tested.

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