

Tool for Identifying Critical Control Points in Embedded Purchasing Activities in SMEs¹

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Abstract

This paper discusses risk and uncertainty aspects and proposes an assessment tool leading to identification of critical control points (CCPs) within purchasing-oriented activities of small and medium enterprises (SMEs). Identifying such CCPs is the basis for developing SME purchasing instruments to support purchasing-oriented activities. The identification of such CCPs will be theoretically approached from a systems perspective using four management functions which are needed to operate as a viable system: implementation, control, intelligence and coordination. When applied to the development of purchasing instruments, these instruments can be used for supporting one of these four management control functions.

Key words

Small-Medium Sized Enterprises (SMEs); purchasing-oriented activities; critical control points (CCP).

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1. Introduction

Organizations need to purchase products and services in order to meet their objectives. These purchases involve risks and uncertainties whether or not this is acknowledged or ignored by organizations (Zsisidin *et al.*, 2004). To be able to cope with such purchasing risks and uncertainties instruments can be developed. Using supportive managerial purchasing instruments (in short *purchasing instruments*) for the function of purchasing can be interpreted as a way to reduce risks and uncertainties related to purchasing activities. Academic and practitioner purchasing literature describe numerous purchasing instruments (see e.g. text books of Van Weele (2010) or the purchasing chessboard consultancy handbook of AT Kearney (Schuh, *et al.*, 2014). However valuable these instruments may be, they implicitly relate to purchasing activities within bigger organisations (c.f. Ellegaard, 2006). As SMEs have different organisational settings and are not miniature-versions of large enterprises, purchasing in SMEs also differs (see Hagelaar *et.al.*, 2014). However, the manner in which purchasing is executed within SMEs has not been described in literature. Purchasing processes in small and medium sized enterprises (SME) tend to receive little attention in purchasing literature (Christensen, 2003; Ellegaard, 2006; Quayle, 2002). Hence from an academic perspective the management of purchasing within SMEs is rather a terra incognita. To start filling this gap a research programme into SME purchasing processes has been developed. The aim of this programme is to develop purchasing instruments for SMEs to strengthen their purchasing activities in relation to their intended or emerging business models. These instruments should aim at continuing, strengthening or positively influencing certain purchasing activities and hence the viability of SMEs (see in general Ford and Greer, 2005).

Purchasing instruments need to be supported by and embedded in the organisations' activities in order to perform well and be effective. Specifically for the SME-focussed research programme this means that the design of purchasing instruments must be in line with patterns of purchasing activities within SMEs (see in general Ten Have *et al.*, 2010). In our earlier research we identified purchasing activities in the form of Purchasing Oriented Patterns (POP) in SMEs. We defined a POP as an organized collection of purchasing activities which effectuate the value proposition to the customers of the SME. These purchasing activities and their interconnections all belong to an identifiable pattern (see Hagelaar *et al.*, 2015) which can explain competitive advantage (compare Barney 2001, 2012). Managerial support of purchasing activities entails that these activities are strengthened and guided into viable patterns (Berry *et al.*, 1995). Insight in purchasing patterns and especially in purchasing activities which cause risk and uncertainties related to achieve the organisation's objectives is then necessary to clarify at which points managerial support is needed. These points in need of managerial support, located in purchasing activities, are called critical control points (CCPs). A CCP is a concept from the domain of food quality management which denotes a point in a (production) process that is important for the ultimate quality of the final product. Once identified, these CCPs become focal points of measurements, evaluation and possible corrective actions to reduce risk of getting out of tolerance and hence the risk of not meeting the original objectives (Luning and Marcelis, 2009).

In this paper we propose an assessment tool to identify critical control points (CCP) derived from the assessment of risks and uncertainties when executing POPs within SMEs. The identification of such critical control points will be approached from a systems perspective and four managerial functions which enable a system to operate as a viable system: i.e. implementation, control, intelligence and coordination (Beer, 1995; see also the section 'Control and Management'). To be able to achieve objectives by means of purchasing activities, such activities specifically need to be controlled in the short and long term. This requires an insight in the operation of POPs within their organisational context.

In Section 2 we will first describe the study object i.e. Purchasing Oriented Patterns (POPs) and nature of SMEs, supply chains and environment. In Section 3 we will explore literature on management control and on management processes. In Section 4 we will discuss three basic assumptions underlying this research. In Section 5 we will construct an assessment tool for empirical research to determine where and what kind of support (CCPs) is needed in a series of purchasing activities. The paper ends with first conclusions.

2. Purchasing activities: POPs in organisations, supply chains and environment

The assumption here is that to design purchasing instruments which enable control of organisations' purchasing activities, we need to understand the risks and uncertainties related such activities for SMEs. This implies that we need to include in our research the purchasing activities and also the environment in which these activities are executed. This again implies a system-oriented perspective underlying the development of purchasing instruments. By means of a framework (see Hagelaar *et al.*, 2015) Purchasing Oriented Patterns (POPs) are identified within the specific context of SMEs. This framework is developed on the basis of the Transaction Cost Theory (TCT), the Resource Based View (RBV) and nature of SMEs (see Hagelaar *et al.*, 2015). Combining TCT and RBV captures a major characteristic of purchasing i.e. the balance between the costs of necessary transactions and the added-value after completion of the transactions.

Transaction cost

The core of the Transaction Cost Theory (TCT) is the relationship between the degree of alignment or vertical integration between parties involved in transactions and the related transaction costs. Such costs are the supportive information, negotiation, coordination and monitoring costs necessary for conducting transactions between organisations. The degree of alignment varies in a continuum from several independent organisations operating in a spot-market versus one fully vertically integrated organisation. The two central attributes which influence the choice of management control are asset specificity and uncertainty (Williamson, 1981; for an adoption to purchasing see Adams, 2005; Hoffmann *et al.*, 2011; Noordewier *et al.*, 1990,). With management control we mean ensuring consistency and transparency in management and oversight of an organization, to ensure an efficient and effective achievement of corporate objectives. This level of integration is *one dimension* in defining POPs for characterizing the relationships between the organisations' internal and external parties involved in purchasing activities.

Resource based view

The idea of alignment as promoted by the TCT perspective is also found in the Resource Based View (RBV) theory (Barney 2001). This theory discusses (Barney 2012) the added value of purchasing and supply chain management for competitive advantage of organisations. The basic theoretical reasoning is that only knowing how a product-market competition develops is not enough to understand sources for competitive advantage. One should also understand the suppliers' markets and the competition in these markets to anticipate competitive advantages in the downstream-oriented product market. In this reasoning, the purchase of certain resources is done on the basis of the expectation that these resources will realize added-value for customers after the organisation has transformed these resources into specific products or services. In this reasoning sales/marketing and the downstream side of an organisation is directly related to purchasing and the upstream side of an organisation. This chain-oriented view on competitive advantage by highlighting the aligned relation between upstream and downstream activities of an organisation should lead to competitive advantage. This means that the alignment should lead to value creation which is rare amongst competitors and possibly costly to imitate or substitute. The question then is: to what extent do the attributes of the resources and of the processes on how these resources are used (relating downstream to upstream), exhibit the competitive attributes mentioned. Thus, the added-value of resources is the *second dimension* of defining POPs for characterizing the purchasing activities from the perspective of the contribution of these purchased resources to the competitive advantage.

As discussed in Hagelaar *et al.* (2014) purchasing research within SMEs must consider specific nature such as informal organisation, less specialization in business functions and less available resources. SME owners focus more on the overall operation and less on specific business functions. The approach of SME management to inward-bound purchasing practices activities is often holistic; its approach to outward-bound purchasing activities is characterized by a relative dependent position in supply chains (Hagelaar *et al.*, 2014). This conceptual framework in our 2014 paper discusses the relation between patterns of purchasing activities and its purchasing performance. The POPs have been described (Hagelaar *et al.*, 2015) on the basis of the combination of the levels of internal and external integration (following the TCT) and specific added value (following the RBV). To explain the relation between POPs and performance, the TCT-related variables general uncertainty (macro and meso environment) and asset specificity (meso environment) are included. It introduces SME and Owner characteristics and Business Model as moderating variables (for more details see Hagelaar *et al.*, 2014). This leads to the framework of Figure 1.

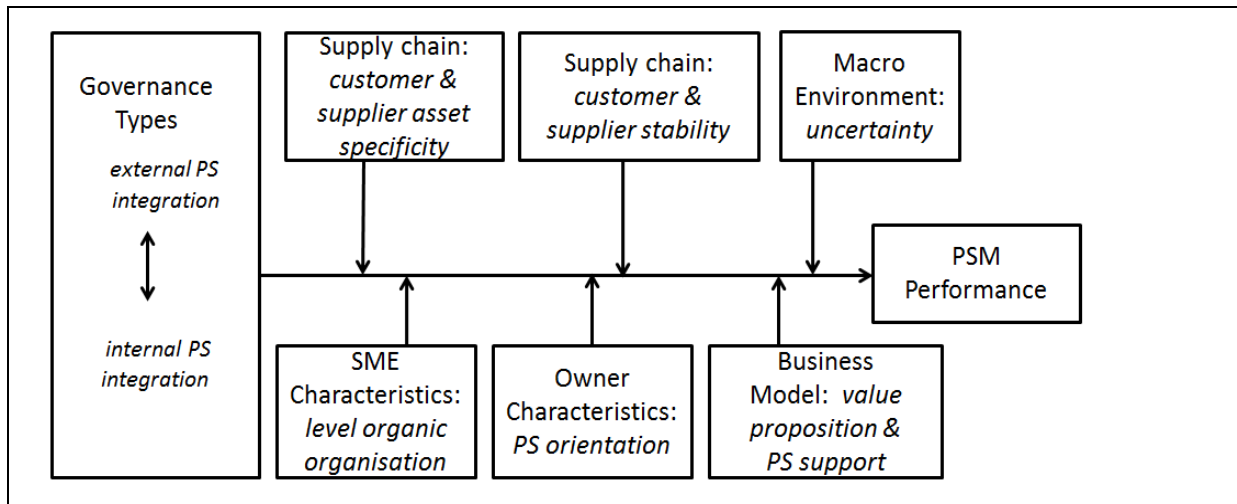


Figure 1: Conceptual framework showing moderating internal and external factors (Hagelaar *et al.*, 2014)

In earlier research we identified managerial practices in the form of four SMEs-typical POPs (see Hagelaar *et al.*, 2015). The combination of *levels of value chain integration* and the specificity of supplier's added-value results in four ideal types of value propositions (Figure 2). The labels of each cell reflect the nature of the purchasing activities and hence the Purchasing Oriented Patterns (POPs) in terms of the relations with suppliers and the specificity of the supplier's added value.

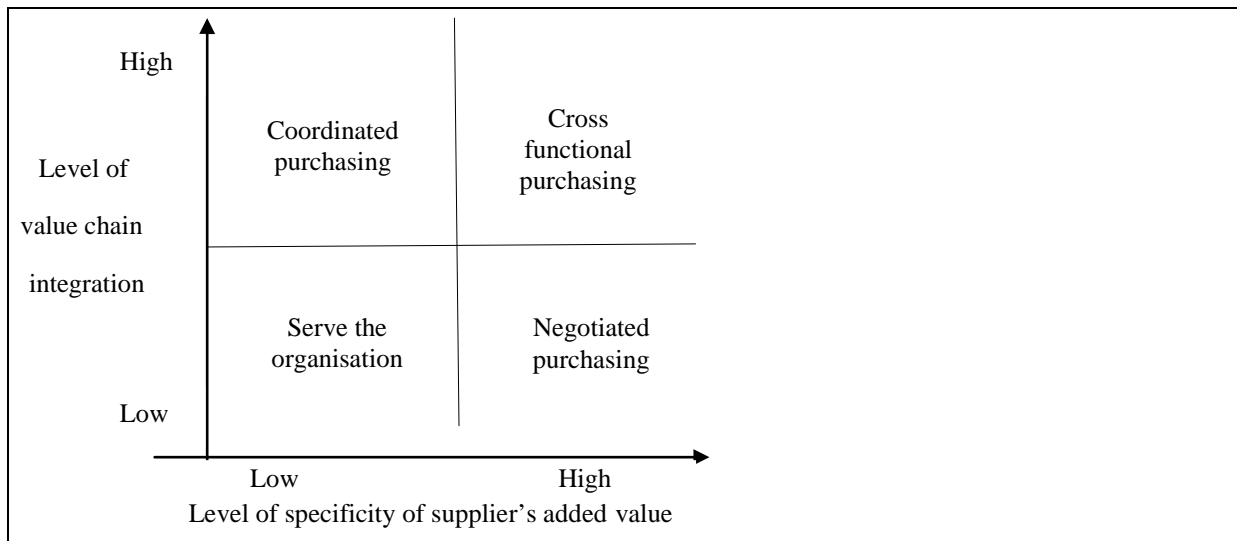


Figure 2: Conceptual framework related to Purchasing Oriented Patterns (Hagelaar *et al.*, 2015)

We distinguish four POPs:

1. *Coordinated purchasing*: purchasing is interwoven with other functions (such as marketing, sales, development, production) in which agreements are established with nearly-integrated suppliers who deliver standard goods or services that fit the organisations' value proposition.
2. *Cross functional purchasing*: purchasing is interwoven with other functions (such as marketing, sales, development, production) in which value-added activities of nearly-integrated suppliers are directly included to enable tailor-made contributions to the organisation's value proposition.

3. *Negotiating purchasing*: purchasing is, under market conditions, directed at negotiations with commodity suppliers on prices and qualities of products or services to enable specific deals from suppliers.
4. *Serve the organisation*: purchasing is, under market conditions, directed at ordering from commodity suppliers who deliver standard goods or services that fit the organisations' value proposition.

In the POPs three steps in the overall business flow of purchasing activities are identified (Hagelaar *et al.*, 2015): (1) outside-in, (2) inside, (3) inside-out. Each step is positioned around a specific transformation:

1. *outside-in* is positioned around the transformation of the added value proposition for the customer into (customer) requirements,
2. *inside* is positioned around the transformation of these (customer) requirements into specifications of resources,
3. *Inside-out* is positioned around the transformation of these resource specifications into the requisition of these resources.

We need insight in such POPs and especially in critical control points within such POPs to be able to locate possible needs for managerial support for dealing with purchasing related uncertainties and risks when pursuing the organisation's objectives.

3. Management control and its basic functions

In developing purchasing instruments the management approach to purchasing activities is central. Purchasing activities are captured in POPs and management instruments need to support their viability. According to Beer (1995) a viable organization is defined as being effectively organized. Beer (*ibid*) as cited in Ten Have *et al.* (2010, 462) poses that an effective organization can be achieved by systematic management control which entails four functions: implementation, coordination, control and intelligence.

1. *Implementation* concerns with the daily operations with which products and services are produced.
2. *Coordination* concerns with the regulating system (task, authority, responsibilities) which secures the course of operations.
3. *Control* concerns with supervision and steering related to implementation and coordination.
4. *Intelligence* concerns with the system of adaptation to (substantive) environmental changes

This has as a consequence that *in control* means that the organization itself is object to managerial control, but its context and contingencies as well. This approach towards control means that purchasing instruments will be positioned within the organisation's activities with the acknowledgement that these activities are also influenced by context and contingencies.

The four functions are related to each other in the overarching concept of management control. Management control combines the strategic, tactical and operational level, pays attention to both the long and short term, and steers and adapts organizational activities. The combination of the *time* dimension and the *steering* dimension results in Figure 3. Applied to the development of purchasing instruments for POPs, these instruments can be directed at supporting one of these four management control functions.

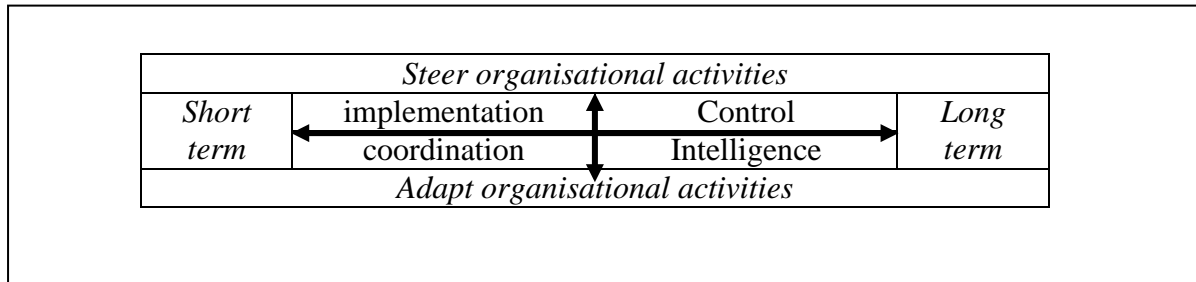


Figure 3: Four functions in conjunction (Ten Have, 2010, 469)

4. Basis assumptions related to identifying CCPs

This study focusses on locating and characterizing CCPs in POPs in order to develop purchasing instruments in a later stage of the research programme (see section Introduction). To locate and characterize the CCPs some basic assumptions underlie this study.

A **first assumption** is in line with the integral framework (see section Purchasing activities) and the integral approach to identifying CCPs. Both Hagigi *et al.* (2009) and Gordon *et al.* (2009) advocate a holistic view on risk management based on the argument that various events and situations can simultaneously influence several exogenous and endogenous elements of risk. Specifically for this study we developed an integral framework to study and explain POPs. This framework implies two statements which are important for identifying CCPs. The *first statement* is that the act of purchasing directly contributes to the value proposition of the organisation. Consequentially there even is a purchasing orientation in the most customer-oriented stage of the POP (the *outside-in* stage in which the value proposition is defined and executed). Supply risk management is thus not demarcated as ‘just’ being the direct interface between organisation and supplier but encompasses the three stages of the POP. The *second statement* is that POPs are influenced by internal and external factors (Hagelaar *et al.*, 2014). Changes in these factors can change the execution of POPs and their performances. These factors should then be taken into account to assess the risk exposure within the POP. This risk exposure contributes to the allocation and nature of purchasing instruments per POP. The consequence of this acknowledgement of the relation between POPs and their environment is that the risk exposure can vary. Hence there is no general overall list of risks linked to purchasing activities, but there will be a list of risks per POP. Consequentially the design of purchasing instruments will in principle be related to individual POPs.

A **second assumption** is that dealing with particular risks when using appropriate purchasing instruments will improve the execution of a particular POP and with that will improve the business performance (see for similar reasoning on risk management; Gordon *et al.*, 2009). By using purchasing instruments an organization can pro-actively reduce uncertainty and risks and hence ensure and/or improve the desired business performance (see Zsidisin *et al.*, 2004, p. 410; Smieliauskas and Robertson 2004, p. 478).

Until this point we have not defined the concepts of uncertainty or risk. Although these often seem to be used as synonyms we will make a distinction between them:

1. With *uncertainty* we refer to the entrepreneur's (in this case the SME owner's or director's) *confidence* in his estimates or expectations. Uncertainty is defined as "the difference between the amount of information required to perform the task and the amount of information already possessed by that organization (Galbraith, 1973, p. 5; see for an adoption in the context of supply management Zsidisin *et al.*, 2004).
2. With *risk* we refer to the possible *outcomes* of an action, specifically to the loss that might be incurred if a given action is not taken (Liesch *et al.*, 2011). Risk combines two attributes i.e. probability and impact. Probability is a measure of how often a detrimental event that results in a loss occurs. Impact refers to the significance of that loss to the organisation. The level of risk is then perceived as the likelihood of occurrence of a detrimental event and the significance (impact) of that event (Zsidisin *et al.*, 2004, p. 397).

We argue that the joint study of *uncertainty* and *risk* in POPs will yield information on the nature (uncertainty) and impact (based on the outcome) of CCPs and thus on the nature and location of the use of purchasing instrument(s). As we aim to develop such purchasing instrument we will classify uncertainty from the management control perspective, being: (1) implementation -, (2) coordination -, (3) control – and (4) intelligence uncertainty. The earlier described four functions of management control (section Management: basic functions) for this research will be adapted as follows:

1. *Implementation uncertainties* relate to the daily operations with which purchasing activities are executed.
2. *Coordination uncertainties* relate to the regulating system (task, authority, responsibilities) which secures the course of the purchasing activities.
3. *Control uncertainties* relate to supervision and steering related to implementation and coordination of purchasing activities.
4. *Intelligence uncertainties* relate to the system of adaptation to (substantive) environmental changes which impact purchasing activities.

In this paper we classify risks according to possible negative outcomes of POPs embedded within SMEs: (1) not achieving the value proposition, (2) too high transaction costs in matching the value proposition to product/service specifications and procurement, (3) supplier failure.

A **third assumption**. As we study purchasing activities within SMEs we propose that the perception of the director/owner of uncertainties and risks related to POPs will be viewed as the organisations' uncertainties and risks. Ellegaard (2006, p. 273), based on Dollinger and Kolchin (1986) and Gadde and Hakanson (2001), posed that within SMEs the director/owner has an important role in managing the SME and is involved in purchasing activities. Although we acknowledge that perceptions of individual SME employees could also have an impact, with this assumption we theoretically and methodologically relate the individual level of director/owner to the organisation level.

We will take the perception of uncertainties and risks as our starting point for the identification of CCPs. Ultimately individual perception and assessment give meaning and significance to value adding purchasing activities and their embeddedness within the organisation and its environment (see for a general discussion on this issue; Liesch *et al.*, 2011). Moreover, we expect consistencies in uncertainty and risk perceptions when analysing the data gathered for the individual POPs.

5. An assessment tool to assess CCPs in POPs

As stated on the assumptions on the theoretical framework for assessing CCPs, supply risk and supply uncertainty are linked to purchasing activities and must be interpreted from the perspective of the value proposition of a POP. For example, a purchasing ordering activity which leads to a potential delay of one day for the entire process will be judged differently in an organisation which is focussed on reducing costs or lead times compared to an organisation which is focussed on quality or innovation. The activities for each POP are captured in three main stages: *outside-in*, *inside* and *inside-out*. The outcomes of these activities are related to risks. Moreover, the framework also makes clear that a process is more than a just a flow of activities. There are more factors that influence the flow of activities in all three stages of the POPs. Risks can originate from the mentioned organisations' internal and external factors (for a more general reasoning in this matter see e.g. Zur Muehlen, 2005). Changes in these factors, individually or in combination, can cause alternations in the activities within the POP which again can cause an undesired outcome. As stated, these factors are also related to uncertainty. Hence the combination of a relatively high perceived level of risk and a relatively high perceived level of uncertainty leads to determining the nature and location of a CCP in a POP.

In a later stage of the overall research programme the purchasing instruments will be developed. The identified CCPs will be important for developing these instruments. Hence the instruments will be directly linked to an activity in one of the stages of a POP and to the nature and location of the instrument. The objective is to develop tailor-made instruments for specific situations. In line with this we now need to elaborate on the types of risks and uncertainties.

Risks

Risks are classified here according to possible negative outcomes of POPs embedded in SMEs: (1) not achieving the value proposition, (2) too high transaction costs in matching the

value proposition to product/service specifications and procurement, (3) supplier failure. As stated earlier these risks relate to purchasing activities. To stay in line with these activities, this classification has emerged from the three stages of activities within POPs (subsequently: outside-in, inside, inside-out). The different risks classifications are then operationalized with the following (supply-related) indicators: design, quality, cost, availability, and manufacturability (for a further elaboration see Zsisidin *et al.*, 2004, p. 405). This leads to the following risk assessment grid (Table 1).

Risk classification Indicators	Value proposition (VP)	Transaction costs (TC)	Supplier failure (SF)
Design	Has the supplier the ability to contribute to design to meet VP	Too high complexity of design leading to too high complexity of supplier base	Setting too high demands for supplier (s)
Quality	Do products/services meet the quality standard	Too high monitoring costs	Too high amount of quality failures
Cost	Can suppliers contribute to acceptable costs	Too high costs because of renegotiations	Suppliers fail to produce against the agreed price
Availability	Can the supplier meet delivery specs such as time and amount	Too high monitoring costs for delivery	Suppliers' internal planning system fails
Manufacturability	Does the suppliers lay-out of facilities and equipment meet the VP requirements	Too high monitoring costs during production	Can the suppliers produce according to specifications

Table 1: Risk assessment grid - operationalising several indicators in risk classifications

Uncertainties

Uncertainties are described from a managerial perspective and relate to a lack of information. The basic question concerning the four management functions therefore is: what kind of information do SMEs lack - does it relate to implementation, coordination, control or intelligence? And again linking to purchasing activities; in what stage do SMEs miss managerial information on what indicators (e.g. design, quality, cost, availability, and manufacturability). This combination of stages of purchasing activities and functions of management control leads to the following uncertainty assessment grid (Table 2).

Stages Mgmt. control	Outside-in	Inside	Inside-out
Implementation	Clarity on: <ul style="list-style-type: none"> • who needs to be consulted about the supplier base, • the issues which are of importance concerning the supplier base • the possible role of suppliers 	Clarity on: <ul style="list-style-type: none"> • who, possibly suppliers as well, does what during the transition of VP into specifications • what issues are addressed by whom. 	Clarity on: <ul style="list-style-type: none"> • who contacts the supplier and sources the goods, services • what issues are of importance during the sourcing.

Coordination	Clarity on: <ul style="list-style-type: none"> • who leads the outside-in operation including the role of purchasing and possibly supplier • the issues that need to addressed. 	Clarity on: <ul style="list-style-type: none"> • who leads the internal transition from VP to specifications • the possible role of a supplier • what issues need to be addressed in that transition. 	Clarity on: <ul style="list-style-type: none"> • who leads the actual sourcing process and possible feedback to involved people in the organization • and the issues that need to addressed.
Control	Clarity on: <ul style="list-style-type: none"> • a plan/way to act to match customers' VP to the organisations' offer to the customer including the role of purchasing and supplier • which evaluation criteria are of importance. 	Clarity on <ul style="list-style-type: none"> • a plan/way to act to monitor the transition from VP to specifications including the role of purchasing and supplier • which issues need to be addresses during the monitoring 	Clarity on: <ul style="list-style-type: none"> • a plan/way to act to monitor the sourcing process and the information exchange between supplier and organisation and internal stakeholders • and the issues that need to be addressed in monitoring
Intelligence	Knowledge on the relevant capabilities of suppliers	Knowledge on the relevant capabilities of involved employees	Knowledge on the operational capabilities of suppliers

Table 2: Uncertainty assessment grid - need for clarity on purchasing activities versus management control

Earlier in this paper we have posited that POPs are not merely a flow of activities in a POP but that internal and external factors can influence this flow of activities. These factors can influence the flow of activities in such a manner that they can cause a risk as described above. This has as a consequence that uncertainties can derive from those factors as well. Thus the assessment of uncertainties should incorporate the internal and external factors. It is assumed that these factors have a more general influence on the execution of purchasing activities. In this paper (Figure 4) we distinguish six internal and external factors which are directly related to a specific type of uncertainty or need for clarity.

1. *Supply chain - asset specificity*: Clarity in the longer term on the type and detail of specifications requested by customers
the type and detail of specifications delivered by suppliers
2. *Supply chain - stability*: Clarity in the longer term on stability of the customer market
stability of the supplier market
3. *Macro environment*: Clarity in the longer term on the stability of the political and economic environment
4. *SME characteristics - organic organisation*: Clarity in the longer term on the support of the organization as a whole for executing the POP
5. *Characteristic of the owner - purchasing orientation*: Clarity in the longer term on the positive attention of the owner for purchasing
6. *Business model*: Clarity in the longer term on the viability of the business model

Figure 4: Uncertainties (with related needs for clarity) due to six external and internal factors

Combining the insights from Table 1 and 2, and Figure 4 leads to the assessment tool in the following Figure 5 which summarizes the factors used for assessing the purchasing CCPs within POPs.

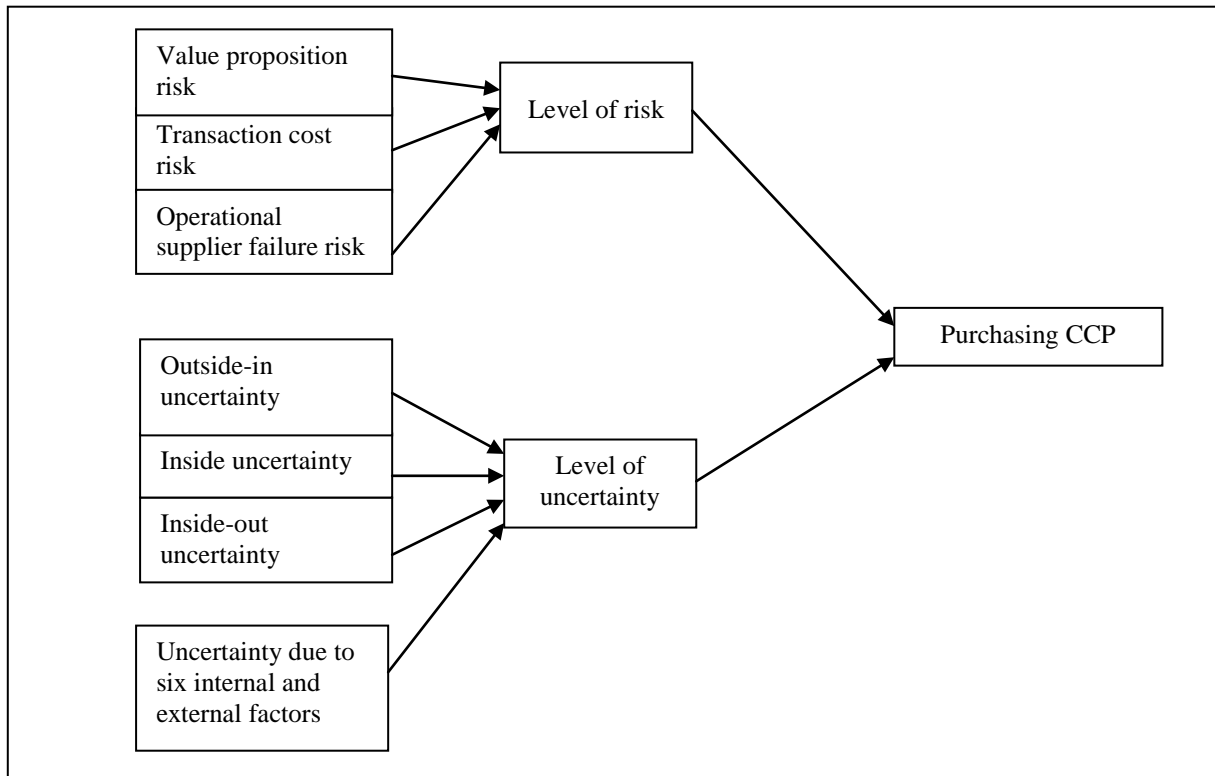


Figure 5: Assessment tool for Purchasing CCPs - assessing levels of risk and uncertainties

6. Mixed research methodology

This research is currently being conducted via 11 case studies, a survey and a Delphi study. We use case studies to understand the mechanisms of how the processes and influencing factors can culminate to a certain level of risks and uncertainties. We conduct a survey to obtain a general picture with more data on the frequency and relative impact of risks and uncertainties. By using this mix of methodologies the nature and frequency of risks and uncertainties will be detected. We use the Delphi study for verification of our findings. This research hence uses a stepwise approach for the identification of purchasing CCPs and subsequent purchasing instruments.

7. Conclusions

1. The concept of Critical Control Points (CCPs) which focuses on risk and uncertainties can be used for management control of purchasing activities within SMEs. Management control can be divided in implementation, control, coordination, and intelligence.
2. These purchasing activities within SMEs can be classified into four Purchasing Oriented Patterns (POPs) depending on the level of organisational integration with the supplier and the added-value of the supplier's resource. These POPs are: coordinated purchasing, cross-functional purchasing, serve the organisation purchasing, and negotiated purchasing.

3. Following supply chain thinking and customer-orientation these purchasing activities in the four POPs can also be related to three stages: outside-in, inside, inside-out.
4. The above conclusions are based on three assumptions: the holistic systems approach of purchasing within SMEs, the performance of a POP will improve with a risk-based approach, and the risk perceptions of the SME owner are essential.
5. Levels of risks are related to supply-related indicators of design, quality, cost, availability, and manufacturability when combined with possible negative outcomes of POPs: not achieving the value proposition, too high transaction costs in matching the value proposition to product/service specifications and procurement, or supplier failure
6. Levels of uncertainties are related to the functions of management control of implementation, coordination, control and intelligence when combined with three stages outside-in, inside or inside-out. Levels of uncertainties are also related to six internal and external factors.
7. Assessing the underlying factors of levels of risk and uncertainties leads to the identification of Critical control points (CCPs) in purchasing activities of individual POPs.
8. These purchasing CCPs can be used to establish purchasing instruments.
9. Further research uses a mixed-mode method and stepwise approach to determine purchasing CCPs within POPs, and consequently to establish purchasing instruments.

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