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# Customer Enquiry Management in global supply chains: A comparative multi-case study analysis

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## KEYWORDS

Customer Enquiry Management (CEM); Customization; Pricing decisions; Multi-case study research; Global supply chain management

**Summary** The Customer Enquiry Management (CEM) process is of strategic importance to non-Make-To-Stock companies but few empirical studies have explored the CEM practices adopted by firms in practice. A study on the Italian capital goods sector by Zorzini, Hendry, Stevenson, and Pozzetti (2008) provides the most comprehensive contingency-based framework to date. This paper builds on Zorzini et al. (2008) by conducting multi-case study research with seven global capital goods companies managing CEM in the UK. The evidence suggests that both high levels of coordination and formalization of the CEM process are linked to improved performance. In particular, cross-functional coordination and formalization impact jointly on the performance of companies characterized by a large-sized control problem. Two moderating factors are also identified: the proportion of slightly/highly customized orders and the availability of integrated information systems. Analysis of the impact of supply chain coordination and other globalization factors on CEM shows that CEM practices are: directly influenced by the complexity of the supply chain configuration; and, indirectly influenced by the types of relationships with supply chain partners. Two sources of complexity that result from operating in a global context are also identified: coordinating the activities of sales structures distributed around the world; and, managing global customers with different languages and cultures. In terms of managerial implications, the results indicate that coordination with partners along the supply chain is needed at the customer enquiry stage and constraints linked to global customers should be considered when structuring CEM.

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## Introduction

A responsive supply chain relies on the effective and efficient processing of orders and information across its various

channel members, especially in the initial stages of the customer order process. This can be particularly challenging when products are customized, decision-makers are dispersed and customers demand short lead times. As a result, Customer Enquiry Management (CEM) is fundamental for non-Make-To-Stock (non-MTS) firms and impacts the ability to provide quotations that are competitive, reliable and realistic (Hicks, Mc Govern, & Earl, 2000; Watanapa & Technitisawad, 2005). The term “non-MTS” refers to a

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variety of production strategies, ranging from limited product customization to a completely new design for each new order (see, for example, [Stevenson, Hendry, & Kingsman, 2005](#) and [Hendry, 2010](#)). In such contexts, CEM can be defined as the multi-stage decision process which takes place between the receipt of a customer enquiry and the processing of a confirmed order, including: determining whether the company wishes to make a bid for the enquiry; preparing cost and lead time estimates; and, determining the price and lead time to bid ([Kingsman, Hendry, Mercer, & De Souza, 1996](#)).

Coordination among all the parties involved is often fundamental to CEM. With globalization and a generally decreasing degree of vertical integration in many manufacturing environments, coordination becomes more complex and critical to both organizational effectiveness and efficiency ([Gunasekaran & Ngai, 2005](#); [Meijboom, 1999](#); [Prasad, Tata, & Madan, 2005](#)). Globalization also results in negotiations between members of different nations; differences in language and culture play an important role in CEM (e.g., in pricing decisions) and should be considered at a strategic and tactical decision level ([Flint, 2004](#); [Meijboom, 1999](#); [Reynolds, Simintiras, & Vlachou, 2003](#); [Sambharya, Kumaraswamy, & Banerjee, 2005](#)).

Despite the importance and increasing complexity of CEM, few studies have explored the CEM practices adopted by firms in practice ([Ebben, Hans, & Olde Weghuis, 2005](#)). The few studies which have emerged have approached CEM from an internal cross-department perspective ([Jin & Thomson, 2003](#); [Kingsman & Mercer, 1997](#); [Konijnendijk, 1994](#); [Kromker, Thoben, & Wickner, 1997](#); [Zorzini et al., 2008](#)); however, research is now required which adopts a global supply chain perspective, i.e., which considers all the (potentially geographically dispersed) parties across the supply chain involved in the CEM process and the relationships between them.

This paper builds on the most comprehensive contingency-based study to date, by [Zorzini et al. \(2008\)](#), in which the authors: (i) developed a framework based on contingency theory for understanding how and why the CEM process varies between capital goods manufacturers; and, (ii) presented propositions to be tested in further research. Two of these propositions focus on the positive impact of cross-functional coordination and formalization during the CEM process on firm performance. However, those propositions were developed using evidence from Italian-based companies with primarily Italian-based supply chains; in addition, supply chain-related issues were overlooked. In order to overcome the aforementioned gaps, our study pursues two core objectives. Firstly, interviews with global capital goods firms managing CEM in the UK are used to assess whether the framework proposed by [Zorzini et al. \(2008\)](#), based on data from Italian firms, applies to global capital goods companies. Secondly, we adopt a supply chain perspective of CEM, considering all the parties involved across the supply chain and explore whether findings related to cross-functional coordination and formalization within a firm can be extended to global supply chains.

The remainder of this paper is organized as follows. A literature review is presented in "Literature review" before the research method adopted is described in "Research methodology". "Assessing the validity of previous theory

for global companies (RQ1)" then uses case study evidence to assess the applicability of the framework proposed by [Zorzini et al. \(2008\)](#). "Impact of supply chain and globalization factors on CEM (RQ2)" provides a global perspective of CEM based on issues that emerge from the case study evidence before possible refinements to the framework are considered in "Refining the contingency-based framework". Finally, conclusions are drawn in "Conclusion".

## Literature review

CEM requires inter-disciplinary competences ranging from operational and planning and control to behavioral processes; as a result, most studies have approached it from a cross-department integrated perspective ([Jin & Thomson, 2003](#)). Key contributions from this perspective are presented in "The CEM process: A cross-department perspective", with particular focus on empirical studies. But given increasing competition, global markets, outsourcing and extended supply chains, CEM is of even greater importance but needs to be approached from a broader supply chain perspective, i.e., considering all parties involved in the process rather than only focusing on internal units within an organization ([Hicks et al., 2000](#)). Therefore, the impact of supply chain characteristics (e.g., configuration, defined by [Demeter, Gelei, and Jenei \(2006\)](#) as the "relationship structure of customers and suppliers") and globalization-related issues (e.g., global customers and suppliers) on coordinating modes and, specifically, on the CEM process are described in "The CEM process: A global perspective". The state-of-the-art is assessed in "Assessment of the literature".

### The CEM process: A cross-department perspective

The CEM process often involves complex trade-offs (e.g., between price and delivery lead time), requiring inter-disciplinary expertise ([Jin & Thomson, 2003](#); [Kromker et al., 1997](#)). Setting Delivery Dates (DDs, i.e., the planned points in time at which specific orders will be delivered to customers) that are both competitive and reliable therefore requires ongoing coordination between the Sales and Production departments ([Kingsman & Mercer A., 1997](#)) and is a critical activity for Make-To-Order (MTO) companies ([Easton & Moodie, 1999](#); [Ebben et al., 2005](#); [Ivanescu, Fransoo, & Bertrand, 2002](#); [Moses, Grant, Gruenwald, & Pulat, 2004](#); [Wullink, Gademann, Hans, & Harten, 2004](#)). The challenge of managing trade-offs and conflicting objectives has been studied by several authors, e.g., [Crittenden, Gardiner, and Stam \(1993\)](#) and [Kate \(1994\)](#) and formalization in supporting cross-functional coordination has been discussed by [Javorsky and Kohli \(1993\)](#) and [Welker \(2004\)](#). Of the few empirical studies that have addressed cross-functional coordination in non-MTS firms, those by [Konijnendijk \(1994\)](#), [Hicks et al. \(2000\)](#), [Bramham, MacCarthy, & Guinery, 2005](#), [Parente, Pegels, and Nallan \(2002\)](#) and [Zorzini et al. \(2008\)](#) focus on industrial markets such as capital goods and are of particular relevance to this research. [Konijnendijk \(1994\)](#) explored the interdependence between sales and manufacturing in Engineer-To-Order (ETO) companies through a survey and case studies, proposing several

coordination mechanisms. However, further research is required to analyze the impact of contingency factors on coordination requirements and mechanisms.

The impact of contingency factors on the CEM process was considered by Hicks et al. (2000) and Bramham et al. (2005). Three main categories of factors (i.e., company characteristics, product features, and market features) were identified by Hicks et al. (2000), which can help to understand differences in terms of business processes (including CEM) and their relationships in non-MTS companies. Bramham et al. (2005) suggested that quotation processes differ in configuration depending on environmental characteristics, such as the degree of product complexity. Parente et al. (2002) also adopted a contingency perspective, examining the causal effect of the interface between sales and manufacturing on customer satisfaction, but the authors only considered the mediating effect of the type of product (i.e., ETO and non-ETO). Although relevant, none of the aforementioned contributions analyzed the links that exist between contingency factors and specific CEM features. A more complete contingency-based framework for understanding which factors influence the CEM process was proposed by Zorzini et al. (2008). To the authors' knowledge, this is the most comprehensive contingency-based framework for studying CEM to date. The model considers four decision variables: DD monitoring support (including: lead time setting, workload analysis, monitoring of subcontractors and suppliers), responsibility for DD setting, cross-functional coordination and formalization. Based on multi-case study research involving 18 Italian-based capital goods manufacturers, three contingency factors were found to be particularly relevant to company choices: product complexity, system flexibility, and uncertainty of the context. The impact of CEM approaches on company performance (e.g., delivery reliability, i.e., the ability to guarantee on-time deliveries to customers and the strike rate, i.e., the proportion of quotations following customer enquiries that become firm orders) was also investigated. High cross-functional coordination and formalization were found to constitute best practice whatever the contingency factors, while a need to match the approach to CEM with specific sets of contingency factors was highlighted for the other aspects of the CEM process, including supplier and subcontractor monitoring. A notable practical implication was that, although the size of the control problem may have an impact, a high level of formalization of CEM practices was found to be beneficial not only for large companies but also for small and medium-sized firms. Three propositions to be tested by future research were presented. Two of the three propositions by Zorzini et al. (2008) are relevant to this study and are adapted below.

- RP1: *Ceteris paribus*, the greater the cross-department coordination that characterizes CEM, the better the company performance from a productive (i.e., delivery reliability) point of view.
- RP2: *Ceteris paribus*, the higher the formalization level that characterizes CEM, the better the company performance from a productive point of view.

Specifically, cross-functional coordination refers to the degree of integration among different actors at the customer enquiry stage (Bramham et al., 2005; Hicks et al.,

2000; Konijnendijk, 1994), while formalization describes the way in which coordination is achieved and the extent to which the procedures and rules adopted at the customer enquiry stage are defined (Choi & Hong, 2002; Mintzberg, 1979; Walsh & Dewar, 1987; Welker, 2004).

While the above contributions are valuable, no attempts have been made so far to add a cross-national dimension to the research, understanding whether empirical results relating to the Italian capital goods sector are also valid for the same sector in other countries.

## The CEM process: A global perspective

The globalization of operations and supply chains is prominent in almost every industry sector (Chung, Yam, & Chan, 2004; Prasad & Sounderpandian, 2003; Tate, Ellram, Bals, & Hartmann, 2009). Global supply chains can be analyzed according to several dimensions (e.g., Awaysheh & Klassen, 2010; Demeter et al., 2006). For example, the three main dimensions identified by Awaysheh and Klassen (2010) for characterizing a supply chain structure were: distance, transparency, and dependency. Distance, in turn, consists of three sub-dimensions: geographical, cultural, and organizational distance. Specifically, organizational distance is defined by the authors as "the number of tiers that exist between the focal firm and suppliers or customers, and the length of the supply chain". The second dimension, transparency, refers to the extent to which information is readily available to end-users and other firms in the supply chain. Finally, dependency can be defined as the degree to which a firm relies on other members of the supply chain for critical resources.

Given an increasing level of globalization in operations and supply chains, coordination across global supply chains is a critical issue (Camuffo, Furlan, Romano, & Vinelli, 2006, 2007; Fleury & Fleury, 2009). This is particularly important for non-MTS supply chains (Gunasekaran & Ngai, 2005; Hicks, Culley, & McMahon, 2006); because customer orders trigger production, coordination needs to be extended throughout the supply chain for products to be manufactured and delivered on time. Despite this, non-MTS supply chains have received less attention than MTS chains in the coordination and information sharing literature, especially in the global supply chain management area. Most of the existing literature in this area is either generic or focused on MTS contexts (Prasad et al., 2005; Sahin & Robinson, 2005). However, according to Prasad et al. (2005), differences between MTS and non-MTS systems mean that research findings are not transferable across supply chain structures. Some of the most relevant contributions on global supply chain coordination are discussed in what follows before focusing on non-MTS contexts.

In the global supply chain coordination literature, several studies have focused on techniques for coordinating the activities of Multi-National Corporations (MNCs). For example, St. John and Young (1995) presented a framework describing modes of coordination among marketing, operations and product development within MNCs for each of five strategic alternatives; more complex systems of coordination are required for more complex strategies and organization forms. Jarrillo and Martinez (1990) earlier highlighted the connection between strategies characterizing the

subsidiaries of MNCs and their use of different coordination mechanisms: subsidiaries pursuing strategies with a high degree of integration with their corporate parent make more extensive use of both formal integrating tools and informal coordination mechanisms than other firms. Kim, Park, and Prescott (2003) found that the way MNCs in integrated global industries coordinate and control R&D, manufacturing and marketing functions across borders has significant implications for performance. The authors classified coordinating modes into: people-based, information-based, formalization-based and centralization-based integrating modes and showed that certain integrating modes are more effective than others in integrating a function globally, thus resulting in superior performance. Campbell and Goold (2000) focused on coordination between subsidiaries, identifying different types of collaboration. They included: shared know-how, shared tangible resources, collaboration in purchasing decisions and bundled demand, coordinated strategies, and vertical integration; in practice, companies may be characterized by a combination of these types. The authors emphasized that global coordination is not positive *per se*, neither for a single unit or the corporation as a whole.

A relatively limited number of contributions in the global supply chain coordination literature have focused on non-MTS contexts. Some authors have described the international dispersion of entities as an important feature of non-MTS supply chains in the current competitive climate, where planning and execution activities usually involve managing geographically dispersed partners and suppliers (Gunasekaran & Ngai, 2005; Meijboom, 1999). Given the importance of supply chain characteristics and globalization, CEM should be studied from a global supply chain perspective. Few studies have analyzed coordination at the customer enquiry stage from this perspective (Hicks et al., 2000; St. John & Young, 1995; St. John, Young, & Miller, 1999). A key contribution to supply chain management in ETO contexts was made by Hicks et al. (2000) where the characteristics of a group of capital goods manufacturers were examined and their business processes and company structure analyzed in terms of vertical integration, internal manufacturing processes and outsourced supply. The proactive involvement of suppliers in tendering and in product design decisions was found to be strategically important for improving efficiency. However, the benefits of involving all relevant suppliers at the customer enquiry stage should be evaluated, e.g., in terms of impact on the effectiveness of the tendering process (which can be expressed by the strike rate, as defined in "The CEM process: A cross-department perspective" above).

With globalization, MNCs and Small and Medium sized Enterprises (SMEs) participate in more negotiations with members of different cultures (George, Jones, & Gonzales, 1998; Reynolds et al., 2003) that may not share the same ways of thinking and behaving (Simintiras & Thomas, 1998). Therefore, negotiations become more difficult when accompanied by the complexity of culture (Tse & Francis, 1994). For example, Honeycutt and Ford (1995) studied the impact of globalization on the sales force, finding that adopting international strategies increases the complexity of the sales management process. Hence, companies operating in a global context have to understand diverse customer needs and sales managers must consider the role of culture in every decision they make. Despite this increasing impor-

ance of international negotiations, the literature is criticized by Reynolds et al. (2003) for being largely normative and disjointed. Further research is required to assess the impact of globalization on CEM, particularly in small companies, which have been only marginally investigated in previous studies. Implications for efficiency resulting from operating in a global market should also be investigated.

In conclusion, a supply chain-oriented perspective is rarely adopted in studies of non-MTS industrial contexts and the literature fails to adequately describe the impact of globalization on the CEM methods adopted in practice. This is particularly significant given that the negotiation process is becoming increasingly influenced by cross-cultural differences.

## Assessment of the literature

Existing literature fails to adequately describe the CEM methods employed by firms in practice. Few empirical studies adopt a contingency perspective and most studies have approached CEM from an internal cross-department perspective, while it is argued that research should adopt a global supply chain perspective in the study of CEM.

In response, this paper contributes by: (i) adopting a comparative research perspective; and, (ii) extending previous results into a global supply chain context. Based on the existing research literature, a need to analyze the impact of contingency factors on the practices adopted during the CEM process has been acknowledged. Given the intention to adopt a contingency-based perspective to the analysis, this paper builds on the empirical study by Zorzini et al. (2008), which is considered the most comprehensive contingency-based framework for studying CEM processes in practice and focuses on the Italian capital goods sector. The framework by Zorzini et al. (2008) is reproduced in Figure 1 and provides the conceptual basis for this study.

According to the comparative and global supply chain research perspectives adopted, this study focuses on capital goods companies, all managing CEM in the UK (i.e., pre-sales and sales activities) and being characterized by global supply chains. This paper pursues two research questions (RQ1 and RQ2) as outlined below:

- RQ1: *Are the two research propositions (RP1 and RP2 above) and the contingency-based framework, both previously presented by Zorzini et al. (2008) based on analysis of the Italian capital goods sector, supported by evidence from global capital goods companies managing CEM in the UK?*
- RQ2: *How do supply chain characteristics (e.g., supply chain configuration) and globalization factors (e.g., global markets and supply networks) impact decision variables related to the CEM process, such as coordination and formalization?*

## Research methodology

A comparative research perspective has been adopted (Bryman & Bell, 2003; Usunier, 1998). To allow comparison between the previous study by Zorzini et al. (2008) and the

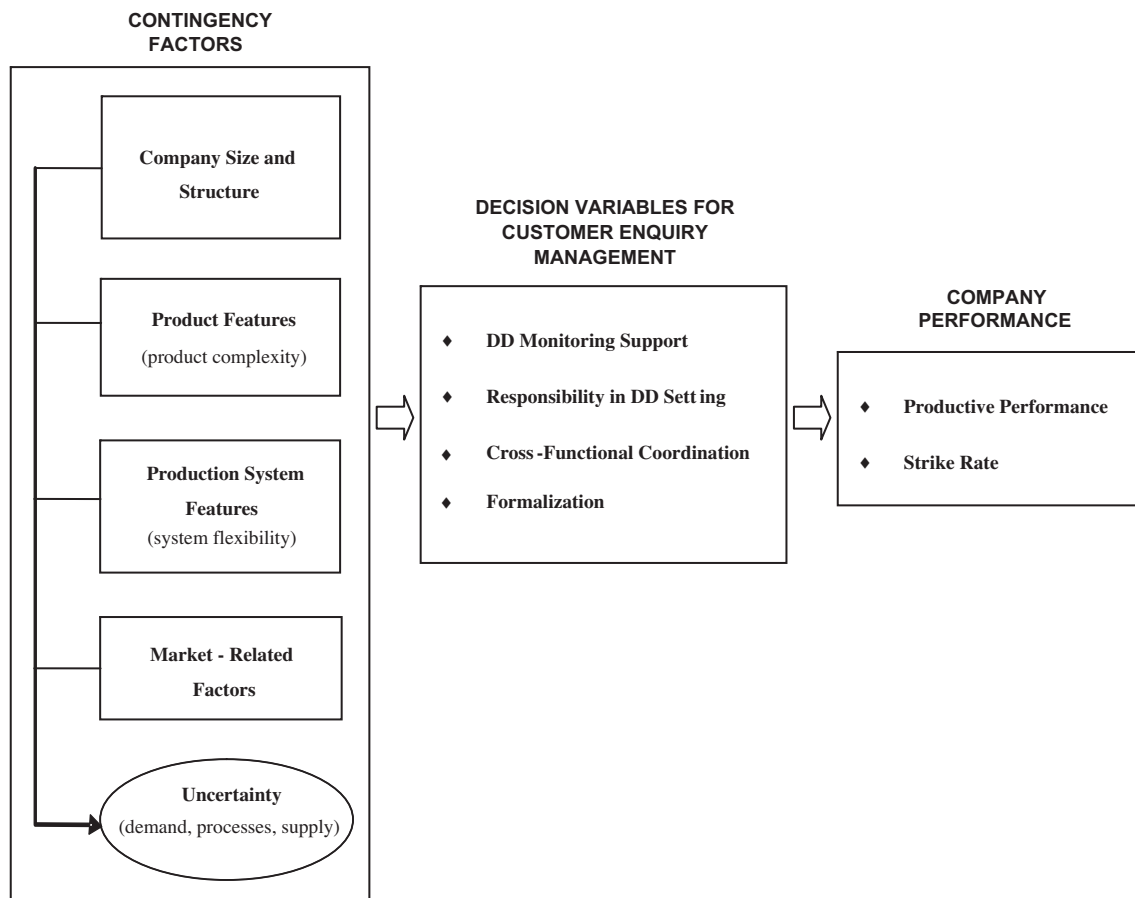


Figure 1 The contingency-based framework proposed by Zorzini et al. (2008).

work presented here, the research was designed to provide consistency and equivalence between the methods implemented in the two studies (Bryman & Bell, 2003). Therefore, as a multi-case study research strategy, allowing for in-depth investigation, was adopted in Zorzini et al. (2008), this has also been adopted in our study. "Case selection procedure" outlines the case selection procedure before data collection and analysis are described in "Data collection" and "Data analysis", respectively.

### Case selection procedure

Given that this research focuses on global capital goods companies that manage CEM in the UK, companies meeting these two requirements were chosen for the research. As a database of companies was available to the researchers, this was used to make a preliminary list of potentially suitable case studies. The final selection was made via a process of contacting the companies via e-mail and/or telephone to verify their suitability and to check their availability. Thus, seven cases were selected. Given that the present study builds on a framework previously developed and, given that case research is judged on its theoretical generalizability rather than its statistical generalizability (Eisenhardt & Graebner, 2007; Hillebrand, Kok, & Biemans, 2001; Stuart, Mccutcheon, Handfield, Mclachlin, & Samson, 2002), a sample of seven case study companies was judged to be sufficient.

The sample includes five small and two medium sized capital goods companies (see Table 1). Four of the companies can be defined as ETO, while the remaining cases are: MTO (two companies), and ranging from MTS to ETO (one company). The analyzed companies are labeled C1–C7 in the remainder of this paper.

### Data collection

To establish equivalent operational measures and procedures for field work (Usunier, 1998; Yin, 2003), data has been collected through face-to-face semi-structured interviews with a senior representative from each company using an English language version of the questionnaire used in Zorzini et al. (2008). Details concerning each interviewee's role in their company are included in Table 1. In all cases, the selected interviewees were involved in CEM and able to provide detailed information about the CEM process; they were identified before the interviews based on some preliminary contacts with different members of the organizations. Interviews were audio-recorded and transcribed for analysis.

The questionnaire consists of three main sections. "Introduction" includes general company features (e.g., strategic objectives, type of customers, critical success factors) and product characteristics (e.g., modularity and type of customization); "Literature review" covers production

**Table 1** Characteristics of the companies interviewed.

Company	Interviewee	Product type	Employees	Turnover [€m]	Production strategy	Location of headquarters	Activity location	Group member
C1	Product manager	Sorting machines	150	35	MTO	UK	Pre-sales, sales, after-sales, engineering and manufacturing in the UK	Yes
C2	Sales director	Vacuum forming and thermoforming machinery	21	5–10	Ranging from MTS to ETO	UK	Pre-sales, sales, after-sales, engineering and manufacturing in the UK	No
C3	Sales manager	Textile finishing machinery	35	8	ETO	UK	Pre-sales, sales, after-sales, engineering and manufacturing in the UK	Yes
C4	Production manager	Textile machinery	30	1.5	ETO	UK	Pre-sales, sales, after-sales, engineering and manufacturing in the UK	No
C5	Sales manager	Laser cutting and water-jet cutting systems	85	24	MTO	Switzerland	Pre-sales, sales and after-sales in the UK, manufacturing and engineering in Switzerland	Yes
C6	Managing Director	Injection moulding machines	31	9.2	ETO	Germany	Pre-sales, sales, after-sales and engineering in the UK, manufacturing in Germany	Yes
C7	Managing Director	Industrial refrigeration and thermoregulation systems	5	2.3	ETO	UK	Pre-sales, sales, after-sales and engineering in the UK, manufacturing in Italy	No

characteristics, including the level of system flexibility, the network of suppliers and subcontractors, and the planning process. "Research methodology" investigates CEM, including general process features, information processing, organizational features, supply chain relationships, and, finally, the impact of the CEM mode on company performance. Secondary data, such as from company websites, was also collected and a case study database was created and detailed reports were drafted to aid analysis.

The framework proposed by Zorzini et al. (2008) was applied to each case. It identifies links between decision variables related to the CEM process, contingency factors that may influence this process, and measures of company performance (see Figure 1). The process through which the analysis contributes towards answering the two research questions is outlined in the following subsection.

## Data analysis

- Answering RQ1: The degree to which Proposition 1 (RP1) and Proposition 2 (RP2) are supported by our sample was assessed in order to identify possible similarities and/or differences compared with the previous findings. Three possible levels of support (full support, partial support, and no support) were defined for the two propositions. Links between CEM practices and the contingency factors identified as most relevant by Zorzini et al. (2008) (product complexity, system flexibility and uncertainty of the context) were also analyzed. This allowed us to investigate the relevance of additional factors that had not been taken into account previously and implied changes to the framework. In light of this analysis, refinements to the two propositions were considered. In accordance with the analytic induction process described by Bryman and Bell (2003), the propositions were refined to exclude and/or explain deviant cases.
- Answering RQ2 (An Emergent Question): Examining cases through the inductive process described above was intended to contribute towards answering RQ1, but it also highlighted the importance of the impact of supply chain characteristics and other globalization-related issues on the CEM practices adopted in practice. Hence, the second research question (RQ2) emerged from the process of addressing the first (RQ1). Having identified RQ2, the initial literature review was widened and a global supply chain perspective of CEM was adopted.

Although a company's supply chain characteristics had not been considered at the initial research design stage, the supply chains of the companies selected differed in configuration (i.e., in terms of the number of suppliers, subcontractors and sales units; the type of relationship with partners; and, the degree of globalization) thereby aiding the theory-building process. The questionnaire designed by Zorzini et al. (2008) collected data concerning supply chain characteristics (although the authors did not investigate the significance of this). Therefore, the same tool remained appropriate for the entire duration of our data collection process.

## Assessing the validity of previous theory for global companies (RQ1)

This section considers the first research question and discusses whether results obtained from the empirical analysis of the seven global companies that manage CEM in the UK support the framework proposed in Zorzini et al. (2008). By applying this framework, important contingency factors and decision variables relating to the CEM process have been identified while company performance has been assessed using the data collected. Evidence from the cases analyzed is presented in "Case study evidence" before research propositions 1 and 2 are discussed in "Research proposition 1 (RP1)" and "Research proposition 2 (RP2)", respectively.

### Case study evidence

Four of the companies (C1–C4) manufacture in the UK, while C5–C7 manufacture overseas (Table 1). C1 is a medium-sized company that produces sorting machinery for different business segments (e.g., rice and grain, high-value commodities, vegetables). C2–C4 are all small-sized companies operating in different sectors: C2 produces vacuum forming and thermoforming machinery for the global market, while C3 and C4 both operate in the textile sector. C5 and C6 produce cutting systems and injection molding machinery, respectively; they both belong to multinational groups. Finally, C7, a UK reseller of industrial equipments (industrial refrigeration and thermoregulation systems) manufactured in Italy, is a very small independent firm with only five employees. In this case, the Managing Director plays a fundamental role in the management of several business processes. The annual volume of orders differs substantially among the seven cases, ranging from 24 in the case of C3 to 500 in the case of C1. The level of competitiveness was described as high in all cases, with an important threat coming from low-cost foreign producers.

Contingency factors, decision variables and company performance are summarized in Tables 2–6, as detailed in the following.

Table 2 describes the relevant contingency factors (i.e., product complexity, system flexibility and uncertainty of the context) for each case. A three-point scale (low, medium, high) has been adopted to classify the contingency factors. The level of *product complexity* is defined by technical features, such as possible modularity and means of achieving customization (Mikkola & Skitt-Larsen, 2004; Skipworth & Harrison, 2006). Three levels have been adopted to describe this, each corresponding to a possible way in which customization can be achieved:

- Low (L): different configurations of common parts.
- Medium (M): some customized parts (largely based on previous projects).
- High (H): a completely new design.

For *system flexibility*, also known as volume flexibility (D'Souza and Williams, 2000; Koste & Malhotra, 1999; Vokurka & O'Leary-Kelly, 2000), the level of system workload is taken into account and twelve flexibility options (internal and external) that are adopted by companies in the medium

**Table 2** Contingency factors for the analyzed companies.

Company	Contingency factors	Summary (Prod Complex-Flex-Uncert)
C1	Medium product complexity–Medium system flexibility–Medium demand uncertainty	M–M–Md
C2	Low product complexity–Medium system flexibility–Low uncertainty	L–M–L
C3	Medium product complexity–Low system flexibility–Medium demand and supplier uncertainty	M–L–Mds
C4	Medium product complexity–High system flexibility – Medium demand uncertainty	M–H–Md
C5	Low product complexity–Low system flexibility–Medium demand uncertainty	L–L–Md
C6	High product complexity–Low system flexibility–Medium demand uncertainty	H–L–Md
C7	Medium product complexity–High system flexibility–High demand and process uncertainty	M–H–Hdp

and short term are identified (Table 3). These options can be used to provide volume flexibility in the order acceptance policy and in DD setting for specific orders. Internal flexibility options include: (1) overtime; (2) shifts; (3) multi-skilled operators; (4) overlapping operations; (5) reallocating operators between work centers; (6) producing normally outsourced components/sub-assemblies in-house; and, (7) re-planning production. External flexibility options include: (8) temporary workers; (9) subcontracting engineering activities to other firms; (10) subcontracting assembling activities to other firms; (11) subcontracting manufacturing activities to other firms; and, (12) reducing supplier lead times. Three levels (low, medium, high) have been adopted based on the total number of flexibility options (both internal and external) used by each company: low (no more than four available options), medium (number of available options included is between 5 and 7), and high (more than seven available options).

For *uncertainty of the context*, three distinct categories for sources of uncertainty can be identified (Davis, 1993; Muntslag, 1994): demand uncertainty, process uncertainty, and supplier uncertainty (Table 4). Possible sources of uncertainty referring to each single area have been monitored during the analysis. For demand, two elements have been taken into account: product demand, in terms of volume (at an aggregate level or per product type) and specific customer orders, in terms of customer confirmation time and customer requirements after order confirmation. For internal and external processes, the following three elements are monitored: resource availability for engineering activities; resource availability for manufacturing activities; and, resource availability for assembling activities. For supply, supplier lead times have been taken into account. Each of the three categories has been first assessed separately (based on the number of uncertain factors identified during the interviews which relate to each of them). Then, an assessment has been undertaken to classify the degree of uncertainty of the context a company operates in at an aggregate level: low (no more than two uncertainty factors), medium (either 3 or 4 factors), or high (more than four factors). The main type(s) of uncertainty (i.e., the most relevant category or categories among

demand, process and supply) has/have also been specified (Table 3).

Table 4 describes the CEM process in the seven cases (i.e., our decision variables: DD monitoring support (Enns, 1995), responsibility for DD setting (Javorsky & Kohli, 1993), coordination (Crittenden et al., 1993; St. John & Hall, 1991) and formalization (Javorsky & Kohli, 1993; Welker, 2004). Alternative methods can be used for each of these four elements. Table 4 shows that CEM features very different characteristics in the seven cases analyzed. Each of the four elements is discussed in detail in what follows.

DD monitoring support can be divided into the following four issues:

- Lead time setting: either based on an average standard lead time or calculated using detailed analysis for each new enquiry.
- Workload analysis: the level of workload monitoring involved in lead time setting is either systematic or occasional.
- Monitoring of subcontractors: the extent to which the availability of subcontractors is checked at the enquiry stage is either systematic, occasional or there is no monitoring.
- Monitoring of suppliers: the extent to which the availability of suppliers is checked is either systematic, occasional or there is no monitoring at all.

The monitoring activity at the enquiry stage appears to be relatively complex in two cases (C3 and C7), where the lead time setting mode is based on a detailed analysis for each new enquiry and the internal workload, subcontractor and supplier availability are systematically monitored. The DD monitoring support is simplified in the other five cases, where part of the monitoring activity is conducted either occasionally or not conducted at all at the customer enquiry stage. In C1, C2 and C5, the lead time setting mode is based on an average standard lead time.

Responsibility for DD setting can either rest with sales, with production or be shared by more than one department. Responsibility for DD setting is entrusted to the sales department in most cases, while it is shared in C1 and C6.



**Table 3** Levels of System Flexibility and Uncertainty for the Companies Interviewed (L: Low; M: Medium; H: High).

Company	System Flexibility												Uncertainty											
	Internal Flexibility						External Flexibility						Overall Assessment	Demand				Process			Supplier	Overall Assessment (Type of prevailing uncertainty: d=demand; p=process; s=supplier)		
	(1) Overtime	(2) Shifts	(3) Multi-skilled Operators	(4) Overlapping Operations	(5) Reallocating Operators	(6) Producing in-house	(7) Re-planning Production	Subtotal	(8) Temporary Workers	(9) Subcontracting Engineering	(10) Subcontracting Assembling	(11) Subcontracting Manufacturing		(12) Reducing Supplier Lead Times	Subtotal	Volume	Customer Confirmation	Customer Requirements	Subtotal	Engineering	Manufacturing		Assembling	Subtotal
C1	X					X	2/7	X	X	X		X	4/5	M	X	X	X	3/3			X	1/3		Md
C2	X				X	X	3/7	X				X	2/5	M		X	X	2/3				0/3		L
C3	X					X	2/7			X			1/5	L	X	X	X	1/3		X		1/3	X	Mds
C4	X		X	X	X	X	5/7			X	X	X	3/5	H	X	X	X	3/3	X			1/3		Md
C5	X						1/7						0/5	L	X	X	X	3/3				0/3	X	Mds
C6	X						1/7	X					1/5	L	X	X	X	3/3	X			1/3		Md
C7	X		X		X	X	4/7		X	X	X	X	4/5	H	X	X	X	3/3	X	X	X	3/3	X	Hdps

In C6, decision-making involves departments located in the UK (sales and engineering) and in Germany (production). As for C4, the CEM process is managed and controlled from the initial contact with the customer to the beginning of the manufacturing process by two people: the production and the engineering managers.

Five distinct levels (high, medium–high, medium, low-medium, low) are used to describe the degree of coordination and formalization; they vary substantially among the cases analyzed and are detailed in Table 5. The level of *coordination* at the customer enquiry stage has been analyzed by monitoring two elements: the departments involved in CEM decision making (sales, production, engineering, purchasing), and the integrating mechanisms adopted to support information exchange. For the latter element, the following four categories of integrating mechanisms are considered: (1) telephone, e-mail system, paper; (2) direct face-to-face contact; (3) cross-functional meetings; and, (4) information systems (fully integrated or partially integrated systems supporting CEM). Coordination ranges from low-medium in C7 to high (C1, C3, C4, and C6). For example, in C7, apart from sales and production, no other departments are systematically involved at the enquiry stage, and information exchanges occur by telephone and via e-mail when needed. The coordination level is classified as high in C3, which is characterized by the maximum number of departments being involved and the maximum number of integrating mechanisms in use. C4 is an exception: the level of coordination has been classified as high (see Table 5), although only the manufacturing and engineering departments are involved in the CEM process and telephone, e-mail and direct contacts are mainly used to support information exchange between departments. This is due to the fact that a proper sales department cannot be identified in this case; the entire quotation process is managed by the production and engineering managers and

a continuous interaction is achieved between them mainly via direct contact.

The degree of *formalization* characterizing CEM has been analyzed by monitoring two elements: the way in which coordination is achieved and the degree to which the procedures and rules adopted at the customer enquiry stage are defined. For the former element, coordination may be achieved through: pre-planned exchanges of information; on-demand meetings, and the use of information systems. For the latter element, whether procedures are clearly defined with steps/rules for decision making has been analyzed. Formalization ranges from low (C7) to medium–high (C3 and C6). For example, the formalization level is low in C7, where information exchanges are usually managed on-demand. The level of formalization has been classified as medium–high for Company C6, where all information exchanges are pre-planned (either by telephone, e-mail, paper on fixed dates, or by cross-functional meetings) and information systems are adopted. Furthermore, procedures are clearly defined, e.g., for direct contact with the customer, coordination with other internal departments or supply chain partners, negotiation with the customer, and analyzing possible flexibility options. While some defined steps can be identified in all of the cases, specific rules for supporting decision making at each step have not been found in any of seven cases.

Company performance is described for each case in Table 6. Performance is assessed based on productive efficacy measures, such as the average percentage of delayed orders and the average delay compared to the total delivery lead time (Hicks & Braiden, 2000). The strike rate percentage is also taken into account and considered as additional information to the aforementioned indicators (Kingsman & Mercer A., 1997; Kingsman, Worden, Hendry, Mercer, & Wilson, 1993). Five distinct levels are used (very good, good, medium, poor, very poor), based on an understanding of

Table 4 Decision Variables for the Analyzed Companies.

Company	C1	C2	C3	C4	C5	C6	C7
DD Monitoring Support	Average standard lead times	Average standard lead times	Detailed and systematic analysis for each order	Detailed and systematic analysis for each order	Average standard lead times	Detailed and systematic analysis for each order	Detailed and systematic analysis for each order
Lead time setting	Systematic	Systematic	Systematic	Systematic	Systematic	Systematic	Systematic
Workload analysis	No monitoring	No monitoring	Systematic	No monitoring	No monitoring	No monitoring	Systematic
Monitoring of subcontractors	No monitoring	No monitoring	Systematic	No monitoring	Occasional	Occasional	Systematic
Monitoring of suppliers							
Responsibility for DD	Shared (sales, engineering, production)	Sales	Sales	Production and Engineering	Sales	Shared (sales and engineering in UK and Germany, production in Germany)	Sales
Setting Department(s) responsible for DD setting							
Coordination	High	Medium	High	High	Medium	High	Low-medium
Formalization	Medium	Low-medium	Medium-high	Low-medium	Medium	Medium-high	Low

the capital goods sector derived from previous studies. However, some efficiency measures, such as the system utilization rate (Hendry, 1998), have been monitored during the analysis to exclude possible cases characterized by a close inter-relationship between efficacy and efficiency indicators (e.g., cases with a very low utilization rate and very good efficacy performance). Note that the system utilization rate does not differ significantly across the cases.

To assess the validity of Propositions 1 and 2, the levels of coordination, formalization and performance in each case have been analyzed; a correspondence is expected between the various levels. A proposition is considered to be: “supported” if the levels correspond strictly; “partially supported” if there are one or two degrees of difference between coordination/formalization and the performance level; and, “not supported” if the levels of coordination/formalization and performance differ by more than two levels. Proposition 1 is fully supported in one case and partially supported in six cases. Proposition 2 is fully supported in four cases, partially supported in one case and not supported in two cases. The results are also summarized in Table 6 and suggest the need to: (1) refine the proposed propositions, and/or (2) add further contingency factors or introduce moderating factors into the framework. While contingency factors impact directly on decision variables related to the CEM process, moderating factors influence the link that exists between the process and company performance. An explanation of the results is presented in what now follows.

### Research proposition 1 (RP1)

Six cases of partial support have prompted us to refine RP1 (also affecting RP2) and to add contingency or moderating factors, as described below. Possible further factors impacting CEM are then presented based on the empirical evidence.

#### Proposition refinement

C1, a medium-sized company, features a high level of cross-functional coordination and a medium level of formalization. Based on previous theory from Zorzini et al. (2008) and given a high level of coordination, a very good performance would be expected. However, the performance achieved is medium only; hence, this case does not fit RP1. This led us to refine RP1 (which also impacts RP2). C1 is described in more detail in what follows.

In terms of formalization, procedures adopted by C1 at the customer enquiry stage include clearly defined steps; however, no rigid general rules are in place because the method of interacting with customers is driven by the type of commodity (the company operates in three different business areas). Coordination is largely achieved informally, mainly on-demand and often through face-to-face contact. The interviewee explained that: “contacts within the company are quite informal. All of the directors are easily approachable and communication among the various departments is aided by our closeness to each other in terms of office location”. At present, C1 is trying to increase formalization in the CEM process by making their paper-based sales contract system purely electronic-based.

**Table 5** Levels of Coordination and Formalization for the Companies Interviewed (L: Low; L-M: Low-Medium; M: Medium; M-H: Medium-High; H: High).

Company	Formalization												Overall Assessment		
	Coordinating mechanisms						Coordination							Overall Assessment	
	Integrating mechanisms			Pre-Planned Information Exchange			Information Systems			Steps of CEM Process					Decision-Making Rules
	Telephone, E-mail, Paper	Direct Contacts	Cross-Functional Meetings	Information Systems	Information Systems	Information Systems	Subtotal	Subtotal	Subtotal	Subtotal					
C1	X	X	X	X	X	X	X	X	X	X	X	X	X	1/2	M
C2	X	X	X	X	X	X	X	X	X	X	X	X	X	1/2	L-M
C3	X	X	X	X	X	X	X	X	X	X	X	X	X	1/2	M-H
C4	X	X	X	X	X	X	X	X	X	X	X	X	X	1/2	L-M
C5	X	X	X	X	X	X	X	X	X	X	X	X	X	1/2	M
C6	X	X	X	X	X	X	X	X	X	X	X	X	X	1/2	M-H
C7	X	X	X	X	X	X	X	X	X	X	X	X	X	1/2	L

The company also aims to improve the monitoring of enquiries and orders confirmed by customers. Given the large number of orders managed each year by C1 (about 500 machines per year), and its medium size, a higher level of formalization is needed to adequately support the CEM process and cross-department coordination. The interviewee highlighted the aim of improving responsiveness to customer enquiries and the reliability of DDs. Current company performance can be defined as medium (based on the average number of delayed orders and the average delay). The manager interviewed argued that: *“delays tend not to be too frequent, but we would like to improve company performance from this point of view”*.

This case implies that cross-functional coordination and formalization impact jointly on the performance of companies characterized by a large-sized control problem (i.e., a high number of orders managed each year and/or a high number of employees). In contrast, very good performance is achieved by C4 with a high level of coordination and a low-medium level of formalization. It is argued that either a high level of coordination or a high level of formalization can result in good company performance in small-sized companies. For medium and large-sized firms, a high level of cross-functional coordination alone will not guarantee good performance; a high level of formalization of the process is also needed. This can be considered a refinement to RP1 (and RP2).

#### Further factors impacting CEM

Four cases of partial support (C2, C3, C5 and C6) identify a factor not previously taken into account: the proportion of the production volume that is highly customer-specific orders versus more standard orders (requiring slight or limited customization). This proportion, linked to production strategy, varies across the four cases (C2, C3, C5 and C6).

For C2, standardization is high compared to the average level offered by capital goods manufacturers. Only 10% of the production volume is highly customized. The interviewee explained that *“the only uncertainty is on the highly customized machines”*. This allows C2 to plan part of the production for stock; this stock provides a manageable buffer that increases flexibility. This explains how reliable DDs are achieved despite a medium level of cross-functional coordination. Only the sales and manufacturing departments are involved and communication is mainly on-demand via e-mail and telephone. C5 has the same level of coordination and performance as C2 (medium coordination and very good performance) and, in this case, the low number of highly customized orders compared to the total production volume is also relevant. The commercial manager interviewed explained that: *“normally, products are not re-engineered and changes to the standard machines are reasonably slight; re-design may concern the handling system but not the basic machine”*. For both C2 and C5, the proportion of slightly versus highly customized orders allows the companies to achieve very good performance with medium coordination levels. For C3 and C6, this proportion impacts the link between coordination and company performance in the opposite way: the performance of C3 and C6 is good, but not excellent, despite a high level of coordination. This is explained by the high percentage of highly customized orders.

**Table 6** Results from the Analysis of Propositions 1 and 2 (RP1 and RP2).

Company features	Companies						
	C1	C2	C3	C4	C5	C6	C7
Performance	Medium	Very good	Good	Very good	Very good	Good	Very poor
Level of coordination	High	Medium	High	High	Medium	High	Low-Medium
Proposition 1	Partially supported	Partially supported	Partially supported	Fully supported	Partially supported	Partially supported	Partially supported
Level of formalization	Medium	Low-Medium	Medium	Low-Medium	Medium	Medium-High	Low
Proposition 2	Fully supported	Not supported	Fully supported	Not supported	Partially supported	Fully supported	Fully supported

In “Conclusion”, the proportion of slightly/highly customized orders can be considered a moderating factor that affects the link between decision variables related to the CEM process (specifically, coordination during the process) and company performance. This can be considered a possible refinement to the framework.

The distinguishing features of the three companies with overseas manufacturing (C5–C7) led to identifying a second moderating factor: the availability of integrated information systems. An increase in the complexity of coordination was expected in these three cases due to the geographic dispersion of the value chain, as described in the literature (Levy, 1995; Narasimhan & Mahapatra, 2004). Inter-organizational coordination was also expected to have a stronger impact on company performance (compared with inter-departmental coordination). However, these results have been verified for C7 only, where no integrated information systems are available. C7 is a very small independent firm selling industrial equipment. While the main equipment is always supplied by an Italian company, the final product delivered to the customer may be supplemented by components and sub-assemblies provided by UK-based suppliers (managed directly by C7). C7 is characterized by low-medium coordination; most communication at the customer enquiry stage is on-demand via e-mail and telephone. Contact may be frequent, but the information exchanged is limited. Hence, inter-organizational coordination is low-medium and has a strong impact on company performance (very poor – the worst performing company). The company has a low level of knowledge concerning technical features of the product and production resources compared to C5 and C6. This may also have a negative impact on performance and is an important factor to consider when structuring the CEM process from both an inter-departmental and an inter-organizational perspective.

C5 and C6 belong to large multinational groups, meaning resources and competences are more readily available (compared with small independent companies). In both cases, advanced information systems are available and IT plays a significant role in supporting the CEM process at a global level. The integrated systems allow information to be shared more easily within the groups, reducing coordination complexity. This may explain how C5 achieves very good performance with only a medium level of coordination. This supports Sambharya et al. (2005), who highlighted that the democratization of IT reduced geographic distance and compressed response times for MNCs. Results are also similar to St. John and Young (1995) and St. John et al. (1999), whose findings support the notion of a hierarchy of coordinating techniques that parallel the complexity of international strategies adopted by MNCs, reducing the level of complexity in communication. Meanwhile, C6, with a high level of coordination and good performance, implies that if both integrated information systems and a high percentage of highly customized orders are present, the latter tends to cancel out the moderating effect of the former, i.e., making communication less effective.

In conclusion, the availability of integrated information systems impacts the link between the CEM process (more specifically, the level of coordination) and company performance. Therefore, it can be considered a moderating factor

(like the proportion of slightly/highly customized orders, as discussed above) rather than a formalized integrating mechanism characterizing the CEM process (as in Zorzini et al., 2008).

Key results derived from the analysis of RP1 are as follows:

- Refinements are required to RP1 (and RP2) to reflect the joint impact of coordination and formalization on company performance for medium-to-large sized firms.
- Two moderating factors should be introduced into the framework to account for the proportion of slightly/highly customized orders and the availability of integrated information systems.
- A further contingency factor – knowledge within departments/organizations about the product and production system – should be considered.

## Research proposition 2 (RP2)

Analysis of RP2 highlighted four cases of support but also two cases of no support and one case of partial support. The two cases of no support are C4 and C2. C4, with a low-medium level of formalization and very good performance, contradicts RP2 for two reasons. Firstly, due to the high level of centralized decision-making within the company; and, secondly, due to the type of business (mainly national and repeat). Similarly, C2, with a low-medium level of formalization and very good performance, contradicts RP2 for two different reasons. The first reason is a high degree of vertical integration within the value chain; the second is a high proportion of standard orders.

The level of formalization characterizing C4 is low-medium. Management of the quotation process is based mainly on implicit knowledge and past experience. The interviewee argued that: *“most of the work is repeat work”*. The high degree of centralization of information sharing and decision-making makes it unnecessary to formalize rules and procedures, or to introduce information systems to support the process, in order to achieve good performance. The CEM process is managed by the production and the engineering managers. The interviewee explained that: *“a continuous, non-stop interaction between the two managers is achieved by direct contact or by e-mail”*. The two managers usually have all the information they need to interact with customers and plan production. This allows them to prioritize orders quickly and effectively based on customer needs and changes in requirements. Based on this, it is argued that the degree of centralization of decision-making procedures impacts CEM. Also, the type of business managed by C4 explains why RP2 is not supported. As most customers are UK-based, and 99% are repeat customers, the complexity of managing customer enquiries is reduced, allowing the CEM process to be managed in a centralized and informal way. However, these features (i.e., mostly national and repeat rather than global and versatile business) are not considered to be the dominant trend in the capital goods sector. Hence, the proposition is not refined.

C2, which also does not support RP2, has a low-medium level of formalization and very good performance. Here, the high degree of vertical integration within the value chain may have an impact. Conducting most of the manufacturing activities (e.g., fabrication, coating and assembly) internally implies a high degree of control over them and makes high formalization unnecessary for achieving good performance. However, as in C4, this feature is considered to be an exception compared to increased outsourcing by many other capital goods manufacturers (Hicks et al., 2000). As a result, again, the proposition is not refined.

A second reason why C2 does not support RP2 is the high percentage of standard orders. This confirms the relevance of the proportion of slightly/highly customized orders as a moderating factor. Furthermore, C5, which partially supports RP2, confirms the relevance of both moderating factors (the above and the availability of integrated information systems).

Key results derived from the analysis of RP2 are as follows:

- No further refinements to the proposed propositions are needed because the features that explain the cases of no support for RP2 are considered to be exceptions compared to the main trends that characterize the competitive landscape in the capital goods sector.
- The importance of the two moderating factors from the analysis of RP1 is confirmed.
- The degree of centralization of decision-making procedures can be considered as a further contingency factor.

Although the features explaining cases of no support for RP2 did not lead to refining the propositions, as in the analysis of RP1, they highlighted the impact of supply chain characteristics and globalization issues on CEM practices. This will be discussed in the following section.

## Impact of supply chain and globalization factors on CEM (RQ2)

This section explores the importance of supply chain characteristics and globalization to CEM in the analyzed cases (in “Impact of supply chain characteristics on CEM” and “Impact of globalization on CEM”, respectively). The main supply chain and global features characterizing each case are summarized in Table 7; these include: number and geographical distance of suppliers; use of subcontractors; and, addressed markets (Alwaysheh & Klassen, 2010). Most of the companies interviewed feature a low degree of vertical integration. C2 is the only company characterized by a very high degree of vertical integration, as most of its activities, including fabrication, coating and assembly, are carried out internally and most of its components are customized in-house. In five cases, engineering, manufacturing and installation activities are either subcontracted on a regular basis (e.g., C1, C6) or when there is an internal overload (e.g., C7). In terms of the dispersion of supply chain activities, the supply chains of all seven companies are characterized by a certain degree of globalization. Extensive use of global suppliers is evident in C5 and C6, which are part of large multinational groups; C1, C2, and C4 mainly make use of lo-

**Table 7** Supply chain characteristics for the companies interviewed.

Company	Supply chain		
	Suppliers	Subcontractors	Customers
C1	454 suppliers  Mainly local	Several subcontractors are used for both manufacturing and engineering activities	Global, depending on the business area:  Rice and grain: India, Thailand, Far East, Brazil High-value commodities: West Coast of Africa, South America Vegetables: Europe, USA
C2	30 suppliers of standard components  Mainly local	No subcontractors are used	Global: Europe, Far East, USA, Australia, South-Africa
C3	300 suppliers  Both local and global (Italy, Spain and Germany)	The use of subcontractors tends to be minimized	Global: mainly India, China and Turkey
C4	10 main suppliers and 50 secondary suppliers Mainly local but some global	3 subcontractors are used on a regular basis 2 further subcontractors can be used in case of overload Mainly local but some global	Local
C5	800 suppliers  Global	Subcontractors are used for both manufacturing and installation activities	Local
C6	400 suppliers  Global	Subcontractors are used for manufacturing, engineering and installation activities	Local
C7	1 Italian supplier for the main equipments  12 UK-based suppliers for items customized according to customer requirements	2 UK-based subcontractors are used for engineering activities in case of overload	Local

cal suppliers, while a mix of local and global suppliers are managed by C3 and C7. Customers are local in four cases, while a global market is managed by C1, C2, and C3, with the Far East playing an important role in all three cases.

### Impact of supply chain characteristics on CEM

The relevance of supply chain characteristics, particularly configuration (i.e., the number of tiers in the supply chain and the number of actors at each tier) and relationships with supply chain partners, is explained in what follows. Configuration is discussed based on evidence from C7 and C2 before C4 is used to show that the type of relationship with supply chain partners is also influential. Finally, the distinguishing features of the two companies belonging to multinational groups (C5 and C6) are then discussed.

- **Configuration:** In C7, the main equipment supplied by the Italian manufacturing company may be complemented by components, sub-assemblies and assemblies provided by twelve UK-based suppliers. Design activities are also sometimes outsourced to two UK subcontractors. This complex supply chain configuration led the company to decide to systematically monitor suppliers and carry out detailed analysis when setting lead times. The interviewee explained that: *“most of our delays are caused by problems concerning supply”*. Meanwhile, C2 features high vertical integration – most physical processes are carried out internally. Standard components are supplied by external suppliers (thirty mainly local suppliers) but no subcontractors are used. This low supply chain configuration complexity has a direct impact on CEM practices and makes monitoring unnecessary.

- Relationships with supply chain partners: C4 uses ten main suppliers, fifty secondary suppliers, three main subcontractors (on a regular basis) and two further subcontractors; the majority of these are local firms. Despite the high number of suppliers and subcontractors, C4 does not monitor their capacity availability at the customer enquiry stage. Relationships are well-established, which affects the level of system flexibility (high) and the level of process and supply uncertainty (low). The production manager interviewed argued that: *“our suppliers are very flexible and we rely on them. In case of rush orders, the required components can be delivered even in one day”*. This impacts the CEM process, as illustrated by the framework presented by Zorzini et al. (2008). Therefore, the type of relationship with individual supply chain partners affects CEM indirectly by influencing the levels of system flexibility and uncertainty. While the type of relationship with individual supply chain partners was taken into account in the previous study, supply chain characteristics (e.g., configuration) should be added to the framework as a new contingency factor.

The two companies belonging to multinational groups (C5 and C6) are distinctive. In both cases, the supply chain is very complex: C5 has approximately 800 global suppliers while C6 has about 400 global suppliers; in both cases, multiple sourcing policies are typically adopted. Despite this complexity, the approach to managing the CEM process is not significantly different in the two cases. In both cases, the monitoring activity is carried out by departments at the headquarters (in Switzerland and Germany) and integrated information systems are available; subcontractors are not monitored (rarely used) and suppliers are only occasionally monitored (for highly customized orders). For C5, a complex and thorough monitoring activity is carried out by the Swiss unit for non-standard orders. As customer enquiries at a local-level usually require high responsiveness, approximate estimations are usually preferred by the sales subsidiary at a very early stage of the quotation process. For C6, partial monitoring (for critical components only) is conducted at the quotation stage, reducing time requirements. Thus, in the case of companies belonging to multinational groups, the influence of supply chain configuration on CEM needs to be carefully analyzed. In these cases, monitoring activities are carried out by both the sales subsidiary and departments at the headquarters and mechanisms are used for inter-organizational coordination. Belonging to a multinational group can be considered a further contingency factor to be added to the framework.

### Impact of globalization on CEM

Two main sources of complexity related to globalization have emerged from the analysis:

- A need to coordinate the activities of globally dispersed sales agents and structures.
- Difficulties in managing global customers with different languages and cultures.

Each source is discussed in detail in what follows based on evidence from C1, C2 and C3.

The first source of complexity that emerges is the need to coordinate the activities of sales agents and structures distributed around the world. As highlighted in the literature (Meijboom, 1999; Sambharya et al., 2005), a small-to-medium sized company entering the global marketplace will encounter many good opportunities and some increased complexities. C1 has customers in the Far East, Europe, America and the West coast of Africa; C2 has customers in the UK, Europe, the Far East, US, Australia and South-Africa; and, C3 gets 90% of its business from the Far East. The strategic relevance of this is underlined by Honeycutt and Ford (1995) and Wotruba (1996). None of the three companies use the sales structures adopted by larger companies (e.g., resellers or subsidiary agencies). C1, a medium-sized company belonging to a group, chooses to manage its global customers through sales teams located in each main European capital city and on each continent in the world. Most agents are dedicated to a single company within the group while some are shared by the group C1 belongs to. C2 and C3 are smaller companies and use freelance agents to save on costs.

The three companies differ in the degree of centralization adopted for CEM and the mechanisms used to coordinate sales agent activities, largely dependent on the volume of orders managed. C1 assigns managers to sales territories that are then responsible for coordinating activities. The high number of orders managed each year (approximately 500) means the CEM process cannot be managed centrally. Centralization is possible for C2 and C3, where the number of orders is lower (70 and 24 orders, respectively). The sales director in C2 stated: *“I check and track directly all enquiries, even the ones managed through agents”*. The sales manager in C3 explained that *“enquiries are transmitted by the agents to the headquarters in the UK, quotations are generated at a central level and then communicated to the agents”*. In both cases, a central database is available but cannot be accessed by the sales agents all over the world. In C2, this is aided by a high degree of production standardization. In C3, these steps are usually followed by an initial discussion with customers through agents aimed at assessing customer interest in the offer and the need for face-to-face negotiation. Some differences are dependent on the country. For example, enquiries coming from China tend to be managed in a less centralized way because the agents located there are well-established and have better knowledge of the product compared to those in other countries.

Operating globally can also lead to communication and language difficulties, especially for small independent companies; this has emerged as the second main source of complexity related to globalization. This may complicate and prolong negotiations with customers, making it a resource-intensive process, which makes it increasingly important to manage customer enquiries efficiently. For C2, costs and benefits associated with each enquiry submitted by foreign customers are carefully estimated to decide whether to invest resources in defining an offer (especially when requirements are non-standard). This can lead C2 to reject some enquiries, maintaining a high efficiency over the

process. Dealing with overseas customers can also make setting DDs more difficult by adding further constraints to the problem, such as shipment schedules for C3.

When negotiations with customers are particularly important (e.g., when there is high competition) and the market is global, it may be advisable to differentiate the quotation process according to the customer's country of origin. This allows C3 to account for cultural differences between global customers, a factor highlighted by many authors (Lin & Miller, 2003; Reynolds et al., 2003; Simintiras & Thomas, 1998; Tse & Francis, 1994). The sales manager interviewed suggested that, depending on the customer's dominant culture, the negotiation phase may need to focus more on technical details and engineering aspects (e.g., for Turkey) rather than on price (e.g., for Pakistan). Therefore, different negotiation margins are used for the different markets, starting with different initial prices to quote (e.g., 30–40% negotiation margin for Pakistan; 10–15% for Eastern Europe; 5% for Australia; and, no margin for the UK and US). A formal approach to exchanging information is needed in order to manage the quotation process in such a differentiated way while maintaining efficiency. This is aided by the availability of an integrated information system.

C2 and C3 suggest that managing global customers increases complexity. Their small size, the scarce resources devoted to the quotation process and a tendency to manage the CEM process centrally can also have an impact. To cope

with high uncertainty, C3 splits the process into stages that differ in terms of the level of detailed analysis. An initial and approximate quotation is usually given in 15–20 min, consisting of 2–3 pages of order specification. If the customer is interested in the offer, a more detailed definition (15 pages of documentation) follows. This may take several hours or days to prepare and requires further information to be obtained from the customer.

The two sources of complexity related to globalization discussed above should be considered when structuring the CEM process, particularly in small independent companies operating globally. Specific needs linked to global customers can be considered a further contingency factor for inclusion in the framework. Increased complexity caused by global customers also impacts the efficiency of the CEM process. This can require careful estimation and monitoring of resources during the quotation process and the adoption of methods aimed at increasing efficiency.

### Refining the contingency-based framework

“Assessing the validity of previous theory for global companies (RQ1)” and “Impact of supply chain and globalization factors on CEM (RQ2)” imply refinements to the contingency-based framework presented by Zorzini et al. (2008): new contingency factors are added and moderating factors introduced. While the contingency factors impact directly

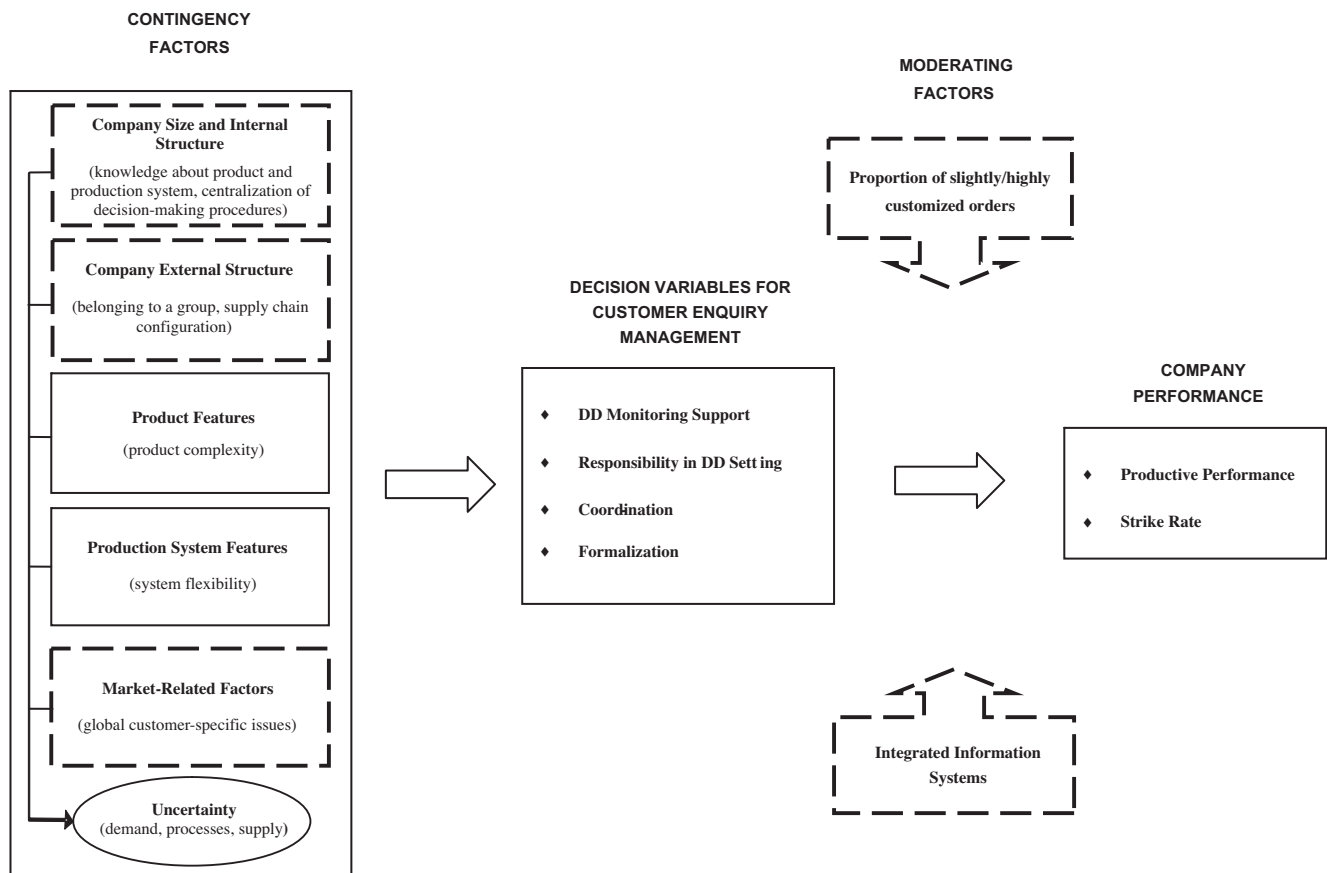


Figure 2 The refined framework.



on the CEM process, the moderating factors affect the link between CEM practices and company performance. This means that, even when the decision variables related to the CEM process (specifically the levels of coordination and formalization) are consistent with the contingency factors, the expected correspondence between the coordination/formalization levels and company performance may not be aligned. The refined framework is shown in Figure 2; changes are highlighted by a dotted line. The following describes how the contingency factors have been revised before exploring moderating factors added to the framework.

Five main categories of *contingency factors* were included in the previous model: company size and structure, product features, production system features, market-related factors, and uncertainty. The factors have been changed by:

- (1) Splitting the category of company size and structure into two: firstly, company size and internal structure (including the number of employees and orders managed each year) and secondly, a company's external structure (e.g., supply chain characteristics and possible group-level issues). Regarding the internal structure, the centralization of decision-making procedures characterizing a company is important (as shown by C4) and has been included in this category of factors. Regarding the external structure, two main contingency factors have been identified that relate to: (i) whether a company belongs to a group/larger enterprise; and, (ii) the supply chain configuration. Belonging to a group can influence CEM, often making resources and competences more widely available compared to small independent companies (as in C5 and C6). Furthermore, group-level decision-making procedures and integrating mechanisms can be implemented. These issues are particularly relevant in large multi-national enterprises. The impact of supply chain configuration has been identified as important in C2 and C7.
- (2) Adding further contingency factors to the category of market-related factors. The impact of globalization on CEM prompted us to take into account specific constraints linked to global customers. These are related, for example, to differences in culture and language and have been discussed in three cases (C1–3).

The previous framework did not include *moderating factors*, but the global cases have highlighted the moderating impact of the following on the link between CEM and company performance:

- (1) The proportion of slightly/highly customized orders. This has been separated from the contingency factors related to product features because it refers to product mix rather than the characteristics of individual orders. This is an important aspect in cases where production volume can be split into highly customized orders and more standard orders. In these cases, a dominant order type cannot always be identified and both types impact CEM and company performance. This sort of hybrid environment is arguably becoming

more commonplace as customer requirements become increasingly differentiated. Evidence from C2, C3, C5 and C6 shows that, given a certain level of coordination, the proportion of slightly/highly customized orders may impact the performance achieved by a company.

- (2) The availability of integrated information systems. This was considered by Zorzini et al. (2008) as a formalized integrating mechanism characterizing the CEM process; however, analysis of the companies with overseas manufacturing demonstrates its impact on the link between the decision variables related to CEM and company performance. Specifically, an increase in the complexity of coordination due to the geographic dispersion of the value chain has been observed in C7, where no integrated information systems are available. In C5 and C6 integrated systems reduce complexity and impact the performance achieved by the companies. This prompted us to separate it from the other factors/variables included in the framework.

## Conclusion

This study contributes to the available literature by investigating the CEM practices adopted by non-MTS global capital goods companies which manage CEM in the UK. It complements the previously presented cross-departmental study of the CEM process by Zorzini et al. (2008) and extends it into a global supply chain context. RQ1 asked whether two of the propositions, and the contingency-based framework, presented by Zorzini et al. (2008) applied to capital goods firms operating outside Italy. The two propositions focus on the positive impact on company performance of high levels of coordination at the customer enquiry stage and the formalization of the CEM process. Results for the global cases generally support these links, although insights from some cases led to refining the propositions to account for the collective impact of coordination and formalization on performance for medium-to-large sized companies. Analysis confirmed the relevance of the three contingency factors identified by the previous study (product complexity, system flexibility and context uncertainty). However, the results also suggested taking into account: (i) further contingency factors affecting decision variables related to the CEM process (e.g., knowledge within departments/organizations about products and the production system, and the centralization of decision-making procedures); and, (ii) two moderating factors impacting the link between the CEM process and company performance (the proportion of slightly/highly customized orders and the availability of integrated information systems).

RQ2 asked how globalization affects CEM. The impact of supply chain coordination and other globalization factors has been discussed together with some efficiency-related issues. The configuration of the supply chain, in terms of the number of tiers in the supply chain, the number of actors at each tier, and the type of relationship with supply chain partners is important. The analysis showed that the number of suppliers and subcontractors has a direct impact on CEM

practices: low supply chain configuration complexity makes the monitoring activity unnecessary while a complex and thorough monitoring activity is required when there are a large number of suppliers/subcontractors, particularly when they are globally dispersed. Furthermore, the type of relationship with individual supply chain partners affects the CEM process indirectly by influencing the levels of system flexibility and context uncertainty. Two sources of complexity that result from operating in a global context have been highlighted: coordinating the activities of sales structures distributed around the world; and, managing global customers with different languages and cultures. Based on the results of the analysis, refinements to the framework presented by Zorzini et al. (2008) have been proposed to make it suitable for a global context.

This research has managerial implications for improving CEM in non-MTS capital goods companies from both an intra and an inter-organizational perspective. In particular, the conclusions suggest:

- A need to coordinate with partners along the supply chain (suppliers and subcontractors) at the customer enquiry stage to improve the flow of timely and reliable information to support CEM, especially in globally dispersed supply chains.
- A need – particularly in SMEs – to be aware of the complexities that result from managing global customers (e.g., differences in culture and language) when structuring the CEM process together with the opportunities that emerge from entering the global marketplace.
- This paper is a starting point for studying CEM in global contexts. More research is needed to further investigate the impact of operating in a global context on the CEM process, especially for SMEs, and to identify promising practices.

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