A project-based purchasing portfolio matrix applied to the Australian construction industry

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Abstract

For a project to be delivered on-time and to an agreed cost in accordance with the specification, it is important to have an appropriate purchasing strategy. A project succeeds due to many factors, one of which is cost alongside timely delivery and quality. Formal purchasing strategies for different purchasing categories are common in the manufacturing industry, but less so in a project-based industry such as construction. The paper argues that purchasing strategies suited to the project-based nature of construction would improve project delivery and other success factors. The purpose of this study is to determine if a matrix could assist companies in the project-based industry to formulating their purchasing strategies. Case studies of five Australian construction companies' purchasing practises were undertaken to support this work. There is evidence that, to remain competitive, it is necessary for companies to develop a network of well-established relationships with suppliers and subcontractors. Purchasing strategies need to be adapted to each purchasing situation as projects are rarely, if ever, the same. It is necessary, therefore, to adopt an approach that combines the best commercial deal and most effective collaboration.

Keywords Portfolio model · Purchasing · Project-based industry · Construction

Introduction

Depending on the nature of a project, there can be different kinds of suppliers and subcontractors involved. Some might necessitate more involvement than others from the buyer's side, with the extent of it depending on the complexity of the product or service. Determining which purchasing strategy best suits a particular purchasing situation can be considered as a common task for a construction company, often on a project-by-project basis, and must take account of many factors. Thus, purchasing strategies are crucial for a construction company as purchased products and services

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not only comprise a significant proportion of the total cost of a project (Axelsson 2005), but the suppliers of those products and services are also responsible for assuring a large part of the quality of the end products (Proverbs and Holt 2000; Karim et al. 2006).

The Kraljic (1983) matrix (or portfolio purchasing model) is regarded as the most widely used model for mapping purchasing strategies for different products and services, and combinations of them. Despite variants and extended versions of the matrix, it remains a cornerstone of purchasing theory. The Kraljic matrix and its derivatives are focused mostly on sectors of manufacturing industry. The Kraljic matrix has been applied to the construction context before, however, mostly through quantitative studies and with its original axes: strategic impact and supply risk. For example, Ghanbarizadeh et al. (2019) investigated commercial construction DEMATEL-ANP-VIKOR hybrid technique to weigh factors that quantifies the axes. Ferreira et al. (2015) and Arantes et al. (2014) applied the Kraljic matrix to the construction industry using AHP and multidimensional scaling. Abbasianjahromiet al. (2016) used mathematical modelling for subcontractors' categorization into the Kraljic matrix. Bildsten et al. (2010) extended the Kraljic matrix with one extra square to emphasize the mix between leverage and strategic products and quantified it in terms of purchasing value. Bildsten (2014) made an empirical study of qualitative nature of industrial building where she redefined the axes depending on the nature of the relationship.

Due to the peculiarities of the construction industry, it makes it substantially different from manufacturing. Therefore, there is a need to further develop a matrix for the project-based business of construction. To successfully organize a company's purchasing strategy, it is important to know the industrial context (Faes and Matthyssen 2009). Construction projects are unique in nature and the supply chains are complex. The construction supply chains are usually complex due to the fact that the project organisations consist of various subcontractors and suppliers which are generally not the same across different projects. Some subcontractors or suppliers may not have worked together ever before. The customized nature of construction may also mean new-to-firm suppliers. There are many products and materials that need to fit together which further increases the complexity. In totality, it can be complex to coordinate all the work with different suppliers and subcontractors. A way to decrease complexity is to outsource parts of the project as work packages and in this way create sourcing structures for the project. Cousins et al. (2007), proposed a mapping of sourcing structures that could be integrated into the Kraljic matrix. The sourcing structures describe the relationship between the purchasing organization and its suppliers and subcontractors to form a practical basis for implementing a purchasing strategy. Mapping sourcing structures can reveal strategies that are appropriate for a particular type of product or service. This helps to create a better understanding of how to manage purchasing strategies for different products and services. There is, therefore, an argument for investigating the utility of the Kraljic matrix, incorporating the work of Cousins et al. (2007), to determine if it offers construction companies a basis upon which to develop, implement and evolve their own purchasing strategies. With this purpose in mind, this paper presents an analysis of the literature to support adaptation of the Kraljic matrix to take account of sourcing

structures (Cousins et al. 2007) and a specific industrial context (Faes and Matthysen 2009). An empirical study was designed to determine if the resultant matrix could assist construction companies to formulate their purchasing strategies. An analysis of the findings is discussed, along with suggestions for adopting the matrix.

Purchasing strategies

Strategic purchasing

Purchasing has not always been regarded as something of strategic importance; instead, it has tended to be seen as an administrative task (Monzka et al. 2008). According to Paulraj et al. (2006), strategic purchasing is: (1) formal long-range planning; (2) part of the overall strategic goals and planning of the company; and (3) visibility for purchasing professionals. This can be interpreted as a combined top-down and bottom-up perspective, where there is awareness and communication between senior management and operations. The views of Paulraj et al. (2006) can be extended by a fourth dimension the interaction between purchasing and production since everything has to ‘fit together in the end’. According to Spekman et al. (1998), purchasing managers have moved from being transaction accountants to information brokers and now managers of externally sourced manufacturing. Purchasing could thus provide a basis for more effective execution of a project. As construction is a project-based business, there can be different views between the project teams and the central purchasing department in a company (Ellegaard and Koch 2014). Usually, some decisions are delegated to the project team and specialist subcontractors. It is vital that the person responsible for the purchasing decision has knowledge about the project to make the right choices (Carr and Smeltzer 1997). This means that everything does not need to be centrally controlled, but just centrally coordinated. Depending on the size of the company, its nature and the environment, there could be different degrees to what is centrally coordinated and what is centrally controlled. Understanding the nature of the relationship between the purchaser and supplier/subcontractor on a strategic business level is therefore important. The first hypothesis to be investigated in creating a new purchasing portfolio is therefore:

H1: Purchases of high project specificity are less suitable for centralized purchasing and needs to be handled by the project team or a subcontractor.

Purchasing models

In the seminal work of Kraljic (1983), a matrix was presented for mapping purchasing portfolios assigned to different products. This portfolio approach to purchasing has been of considerable interest over the years because it acknowledges that there is not just one purchasing strategy that could be applied to all products and services. It has been used primarily in manufacturing sectors; see, for example, Gelderman and Donald (2008) (logistics); Lee and Drake (2010) (lifts/elevators); Pagell et al. (2010)

(sustainable sourcing); Padhi et al. (2012) (commodities). Some authors have introduced variations on the matrix theme (see, for example, Elliott-Shircore and Steele (1985), Olsen and Ellram (1997), Syson (1992); Lilliecreutz and Ydreskog (1999)). Even so, no significant changes have been made to the original Kraljic matrix. The matrix has also been considered from the perspectives of power and dependence (Caniëls and Gelderman 2007) and culture (Kibbeling et al. 2009). Faes and Matthyssen (2009) made a connection between the purchasing strategy and product life cycle through a new interpretation of the Kraljic matrix. They regard the purchase of new products as risk taking coming from the right-hand side and moving through the matrix to the left-hand side when the product has become an established purchase.

The Kraljic matrix has become established as the standard for purchasing portfolio models (Gelderman and Van Weele 2005; Pardo et al. 2011). The Kraljic matrix is based on two dimensions: importance of the purchase, e.g. its cost, and complexity. The cost of purchases represents a significant proportion of a company's turnover typically in the range 70–80% (Axelsson 2005) but as much as 90% (Hinze and Tracey 1994) and hence it is of particular importance. The dimension of complexity is the risk impact of standing without materials in production, which more specifically relates to scarce supply, monopoly or oligopoly conditions and logistics. Purchased products and services are aligned against the two dimensions and positioned within one of four categories: leverage items, strategic items, bottleneck items and non-critical items. Faes and Matthyssen (2009) offer a perspective of how the product life cycle can be connected to The Kraljic matrix. This provides insights into the novelty of the purchase and where these kinds of product or service belong in the Kraljic matrix. The novelty of a purchase was considered much earlier by Robinson et al. (1967). They categorized purchases into new buys, modified rebuys and straight rebuys. A new buy is when a “new to firm” product is purchased that generally presents significant interaction with the supplier. A modified rebuy is when the product has been purchased before, but something in the supplier offering has changed from previous purchases or it might involve a new supplier. These products can be considered project specific. Straight rebuys are repetitive situations involving previously purchased products that do not require any new information, and which are handled on a routine basis.

Regardless of its popularity, the Kraljic's matrix has received criticism concerning, for example, implementation difficulties, lack of precision and subjectivity (Ramsay 1994; Cox 2001). There exist some quantitative studies that have attempted to quantify the axis e.g. Ghanbarizadeh et al. (2019). Nonetheless, the primary purpose of the Kraljic matrix is to serve as a tool for discussing the relative positioning and strategy for products and services and not as an exact measure of purchasing. To facilitate implementation, discussions are likely to be most fruitful across departments of production and purchasing to make the company more efficient. Ferreira et al. (2015) made a single case study of a construction company where they emphasized the involvement of project team members, i.e., close to production, in the placement of different kinds of purchases in the Kraljic matrix. Nevertheless, there are no studies up to this date that have changed any of its axes to fit project-based idiosyncrasies of traditional site-based construction. It is appropriate, therefore, to consider its use in project-based industries such as construction, because of the need

to find a model to support purchasing decision making in companies. Therefore, the second hypothesis is:

H2: As projects are unique, it is relevant to modify the supply risk axis of the Kraljic matrix to instead highlight the complexity of a purchase in terms of need of information and project specificity.

Sourcing structures

The different ways in which construction companies can work with suppliers and subcontractors can be represented as sourcing structures. Cousins et al. (2007) defined four primary structures: single, multiple, delegated, and parallel. The different structures are part of a purchasing strategy and depend on the prevailing situation and the needs of the company.

Single sourcing is when a purchaser has only one source for a product or service. This might depend on the high cost or the strategic importance of the end product (Kraljic 1983). The client or the architect might have specified a particular product. Sometimes, there might only be one source of supply because of the market structure. The advantages of single sourcing are that it is easier to exchange ideas for new product development; there is also the opportunity to redesign the products and processes and to move towards cost transparency. The downside is that there is only one source of supply and that could put the purchaser in a position of weakness if the relationship is not maintained (Faes and Matthyssen 2009). Another scenario could be that the supplier goes out of business which would be problematic for the purchaser. Furthermore, single sourcing could limit the purchaser's flexibility to acquire innovation (Yusoon et al. 2015).

Multiple sourcing means securing multiple suppliers for a product or service. The supplier is chosen primarily based on price (Zeng 2000). In this type of structure, the purchaser can choose and compare capacity constraints with supplier performance before placing an order. The relationships between purchaser and suppliers are, in this case, loose with a high degree of competition, low switching costs and low levels of technical competence. With this approach, continuity of supply is maintained on a short-term basis, enabling price-reduction; however, if demand exceeds supply, then the price is likely to increase. In addition, there might be more focus on price than total cost (Ellram and Siferd 1993).

Delegated sourcing was pioneered in the aerospace and automotive industries (see Womack et al. (1990) and Lamming (1993)). This structure applies when there is one supplier for a sub-assembly as opposed to an individual part. For example, the construction company delegates authority for a sub-assembly to a key supplier known as the first-tier supplier. The first-tier supplier in turn works with the suppliers of components for the sub-assembly. The advantage for the construction company, when adopting the delegated sourcing structure, is that it reduces the number of suppliers with which it can have close collaboration and is, therefore, able to reduce transaction costs (Ireland 2004).

Parallel sourcing was developed as a concept through game theory by Richardson (1993) to optimize supplies for the purchaser. This structure is a combination of

single and multiple sourcing that aims to have the advantages of both, whilst excluding the disadvantages. Parallel sourcing occurs when a purchaser has a single sourcing relationship for the components within a product group, whilst having a multiple sourcing relationship across product groups. For example, two building construction projects have two types of subcontractors, A and B. Type A subcontractors, for instance for electrical installations, are different companies in the two projects. Type B subcontractors, for instance for mechanical installations, are similarly two different companies in the same two projects. In this way, the purchaser has alternative sources of supply if necessary. The purchaser can thereby maintain price competition and avoid capacity constraints while still working closely within each product group.

Companies use a mix of the different sourcing structures for different products and services and the most appropriate structure depends on the characteristics of the product and supplier market. The various sourcing structures can be mapped to purchasing strategies to create an improved understanding of how to handle the purchase of different products. The relationship between the sourcing structures and portfolio categorization is interesting from a make-or-buy perspective to analyze which party should be responsible for what. Moreover, it offers insight from a strategic perspective regarding decisions on the form of relationships with different suppliers of products and services. The delegation of purchasing tasks inevitably leads to the question of outsourcing. The construction of a building is a complex undertaking (Gidado 1996) and can indeed be viewed as an opportunity for outsourcing. A reason for this can be derived from transaction cost theory (Williamson 1985), where outsourcing is regarded as a means for decreasing complexity. Through purchasing, companies can outsource and thereby generate higher value from suppliers' capabilities and be more flexible with external parties handling part of the production (Quinn 1999).

Construction involves many tasks that require the services of specialists. According to the core competence concept (Prahalad and Hamel 1990) and delegated supplier structure (Womack et al. 1990), construction companies should concentrate on what they do best. This should define the boundary of the company and determine what it is doing. It can sometimes be hard to know where the boundaries are between companies. Some companies undertake some construction work and outsource other services, which can make the boundaries fuzzy. This is typical in traditional construction where many organizations work together. The boundaries surrounding key components of the internal business processes can be regarded as a business model (Morris et al. 2005). However, business models are affected by the extent of interaction with external stakeholders beyond the boundaries (Zott et al. 2011). How the boundaries arise depends both on transaction costs as well as on internal and external capabilities (Argyres and Zenger 2012). The "glue" between the boundaries and the external capabilities found in the environment can be represented by a supply or sourcing structure. The chosen structure depends on the particular situation, confirming the utility of the sourcing structure (Cousins et al. 2007).

As there is usually a lot of interaction between the buyer and supplier and a need of expertise in construction projects and simultaneously it is important with concurrence to have a reasonable price, the following hypothesis is suggested:

H3: Delegated and parallel sourcing are the most common sourcing structures in project-based purchasing such as construction.

Methodology

Research design

In order to understand the rationale behind companies' purchasing strategies, a case study approach was considered, where the three hypotheses could be tested in order to develop a project-based purchasing portfolio matrix for construction companies. According to Ellram (1996), case study research is suitable for investigating purchasing largely because of the qualitative aspects of the phenomenon. The investigation of such phenomena also includes contextual factors, for example industry idiosyncrasies (Johnston et al. 1999). As Eisenhardt (1989) observes, case studies are often employed as a means for building theory. Identifying theoretical constructs is an important initial consideration; thereafter, it is essential to select relevant cases, crafting instruments and protocols and to carry out the analysis during the data collection as well as afterwards for "within-case" and "cross-case" patterns that can then be compared with the theory.

Data collection

Interviews were chosen as the method of data collection, with at least one interview undertaken per case. In all, nine interviews were conducted with the five construction companies (see Table 1). According to Eisenhardt and Graebner (2007), interviews are "a highly efficient way to gather rich, empirical data, especially when the phenomenon of interest is highly episodic and infrequent"; furthermore, they claim it might be the only way to capture strategic decision making within companies. A semi-structured format was chosen, where the questions served as a guide for capturing data to test the matrix. Each interview lasted for 45–60 min and was later transcribed to enhance reliability in the interpretation of the data. Initially, interviewees were found through personal inquiry and were followed by the offer of introductions to other individuals/companies who might be interested in contributing to the study, i.e., an example of snowball sampling (Biernacki and Waldorf 1981). The latter has

Table 1 Construction companies and personnel interviewed

Company and its business areas	Interviewees
A. Construction, building and infrastructure	Purchasing specialist engineering
B. Construction, building, infrastructure and mining	Project manager for operations and maintenance
C. Construction, building, infrastructure and mining	Head office purchaser
D. Construction, building and infrastructure	Head office purchaser, project manager, project engineer
E. Construction, building and infrastructure	Owner, project manager, head office purchaser

been acknowledged as capable of creating dynamic moments where unique social knowledge of an interactional quality can be generated (Denzin and Lincoln 2005).

Interviews were undertaken with senior managers, such as project managers, contract managers and general managers. Their different positions, views and knowledge could be captured to develop the matrix in a puzzle-solving analysis (Morgan 1980). By interviewing people from different organizations, locations and functional areas, diverse perspectives were largely assured, reducing the risk of bias such as convergent retrospective sense-making and/or impression management (Eisenhardt and Graebner 2007). The five largest construction companies of Australia were chosen. In order to find replicating patterns, the construction companies were chosen to be large enough (1–12 billion AUD turnover) to be involved in projects of significant size such as commercial building construction projects, infrastructure and mining projects. Smaller firms such as house builders were excluded due to their more repetitive construction technique that does not capture the full range of purchases. Appendix lists the questions used to guide the interviews.

Data analysis

The interviews were analysed during the data collection from field notes. This was especially important given that questions (see Appendix A) can be interpreted differently and so a small discussion around each question helped to avoid misunderstandings and improve accuracy. Different angles to the questions were adopted and, over the course of the case studies, the answers started to converge. The point of data saturation (Eisenhardt 1989) was achieved after five cases, beyond which it was expected that no significant new data would be forthcoming.

Findings from the case studies

General procedures

Purchases for the construction projects at the case companies can be made both centralized e.g. on a company level and decentralized e.g. at a project level. Most purchasing is done at project level by the project managers. Some of the companies have, however, recently implemented framework agreements across projects, typically handled by a purchasing manager at the head office. Normally, framework agreements are with two suppliers/subcontractors for each item or service. Framework agreements cover such items as subcontracted labour, support services, fuel, waste management, tires, vehicles, industrial hardware, protective clothing, heavy equipment, and general equipment hire. Framework agreements are supposed to be used, through call-offs by the project manager, but this requirement is not mandatory. Not everything can be covered by framework agreements because each project is different. One of the studied companies, Company D started with framework agreements by purchasing materials separately, but later reversed its decision. It found that the items it had bought would not

fit directly into the building and they had to be modified to fit. In the end, the company returned them to the subcontractor and gave it responsibility for making everything work properly. According to Company E, centralized purchasing agreements take control away from the people who are actually responsible for the work. Centralized purchasing works well for repeatable standard items, for example concrete or plumbing fittings but not items which are customised for the project. For construction projects, centralized purchasing is not easy because every architect wants something different and there is not a consistent flow of these purchases. In addition, there is an element of after-market modification with the subcontractors retained for maintenance. Company D felt that it was difficult to make centralized purchasing efficient.

The study showed that the construction companies use a supply-and-install strategy, i.e. delegated supplier structure, to a large extent. For example, the tiler supplies both the tiles and the labour and the roofer similarly supplies the components and labour (Company E). The same applies to the purchase of operations and maintenance services, which are subcontracted services bought as packages on a labour and materials basis (Company B). Many subcontractors can deliver an entire package and this helps the company to pass most of the risk to the subcontractor. For smaller projects, materials such as concrete, reinforcement and bricks can be bought separately from labour. The size of the projects/companies matter depending on if labour and materials are separated or not. Smaller construction companies separate labour and materials to a greater extent than the larger construction firms. Suppliers and subcontractors are generally those that are situated close to the project in order to reduce transportation costs and avoid the need for living accommodation.

Typically, the project manager knows most suppliers or subcontractors in the marketplace. In this way, the project manager understands who is working at a given point in time. Keeping relationships open is a part of the companies' purchasing strategy, because it needs to have a pool of available suppliers and subcontractors to maintain a healthy level of competition. The companies usually have several possible choices for each trade or specialization, whether it is a supplier, subcontractor or consultant. The underlying reason is that there is never just one supplier or subcontractor that can deliver everything. Most companies have up to three in a tender competition. This can mean that the company moves between the suppliers or subcontractors as a form of parallel sourcing (Company D).

A building can be described by three primary components or systems: (1) architectural; (2) structural; and (3) services installations, each of which influences the purchasing process. The latter are often more complex than the other two components, so they need more attention to make sure that there are no problems and that nothing goes amiss. The architectural component involves much detail and so demands a lot of attention; it can be a problematic if it is handled incorrectly. A variable factor here is how well the design has been undertaken. It is not necessarily difficult, just time-consuming, to get everything right. If it is a highly complex design, it will take more input and time to make sure that the most suitable supplier or subcontractor is chosen with the ability to undertake the detailed architectural work. A subcontractor that can construct a steel portal frame for a warehouse is not necessarily the sort of subcontractor that can undertake a complex, architectural steel frame

for an atrium. Company D felt that it was important to be careful when selecting the subcontractor in terms of understanding the latter's capabilities and limitations.

A priority when choosing a supplier for operation and maintenance (O&M) contracts is to be clear about the quality of parts and consumables as these will be expected to have a well-defined life expectancy (Company B). The priorities when choosing a supplier were quality, on-time delivery and the ability of the supplier to work properly with the company (Company D). Price is not to the exclusion of all other criteria for awarding a contract. For example, a low price for concrete does not help if the supplier is slow or inconsistent in deliveries. Company E based its decision on whether or not the supplier would get the job on the latter's physical proximity to the jobsite. Other example criteria are lead time and warranty. This company was clear that its relationships with subcontractors were long-term and that there existed a kind of camaraderie that helped in securing a competitive price. Relationships count to a large extent, but if another subcontractor is much cheaper it is likely to be considered.

Categorization of purchases

In this section it will be discussed how the purchasing matrix can be applied to the Australian construction industry with examples of purchases in the different categories. The theoretical contributions presented in the theory section concerning sourcing structures and new product development offer opportunities to view the Kraljic matrix through a different lens. By integrating these concepts with the collected data, a modified matrix will be developed based on the three hypotheses mentioned earlier. As mentioned in the second hypothesis we can see the purchasing complexity in terms of need of information and project specificity on the one axis while the other axis remains the same e.g. purchasing's impact on project in terms of costs (high-value or low-value items). The complexity in terms of need of information and project specificity can be seen in three levels (standard, adapted or unique). The new portfolio matrix for the project-based industry, results in a total of six categories (3×2 matrix). The six categories are explained below, starting with the high value items (1–3), followed by the low value items (4–6):

- (1) *High value standard* purchases are those purchases that are of high value and low purchasing complexity and are generally readily available items. These can be referred to as straight-rebuys. There are not many straight rebuys in the project-based industry such as construction since every building has a different architect with different ideas and preferences about which products and services they like to put into the building. Straight rebuys must be simple items like *steel reinforcement, concrete and fuel*. Company E reported that straight rebuys are something that the client would not care about as these are not project-specific items. There can be an agreed purchasing process where quantities are called off and delivered to the construction site. According to the companies, straight rebuy agreements would only occur as a centralized head office arrangement, not on the project level. Different situations can lend themselves to one supplier in one area and a

different one in another. The company will always have to have the flexibility to allow the project to buy better if it can. With unique projects, it is not possible to follow a fixed purchasing process. The main barriers to straight rebuys are the different requirements for each project which end up with a corresponding unique set of pricing that does not support the same rebuy another time. As the companies purchase mainly subcontracted labour and materials, there are few situations where the company is purchasing material separately. Instead, it is passed to the subcontractor as delegated sourcing.

- (2) *High value adapted to project* purchases are those of high value combined with a medium purchasing complexity. Company E gave formwork as something of high value adapted to the project, where the whole flow of the project relies on how good the subcontractor is. Other suppliers/subcontractors that adapt their products to the project are those that must produce shop drawings, for example structural steel, glazing and joinery (Company E). Company D noted that these purchases were often manufactured locally because they had either specific or architectural requirements. Usually, there is a need to take accurate physical measurements on site. It can be a challenge to get measurement and the timing of the delivery right. Company A describes its adapted products as manufactured before arriving at the construction site. These purchases must be watched closely because they have to be the correct material in accordance with the specification. The companies claimed that among purchases adapted to the project of the highest value were *electrical and mechanical work*. In a large project, carried out by Company D, the *building fitouts* comprised *partitions, doors and hardware* and would have been the third biggest package, but this was later split into three separate packages with *security and data* added as a fourth package (Company D). When it comes to the size of subcontractors, large projects are regarded as requiring large subcontractors. Despite this, Company E says it tries to use smaller subcontractors if possible because they tend to be more flexible. Packages are offered in a competitive market and are not, therefore, the subject of single sourcing; nonetheless, the companies undertake much repeat business with these subcontractors and for most effective collaboration, these packages must be considered in terms of *parallel sourcing*. Company E noted that using a longstanding subcontractor meant that issues would be resolved because of the interest in working with the company in the future. A one-time subcontractor might simply quit at the first sign of difficulty if it cared little about future business. The longer the relationship the less is the risk, according to this company's project manager. It can, therefore, be difficult for a new subcontractor to establish itself (Company E). Many common practices can be followed from one project to the next and a common language is shared by the trades. Whatever one construction company asks for; the other construction companies will ask for the same. These services are, however, project specific and the companies prefer subcontractors that they have used before. As project-specific purchases, this adapted to project purchases implies more research into what to purchase and they can therefore be regarded as modified rebuys (Company E). Service contracts with subcontractors and suppliers are usually for the term of the O&M contract with the client, which can be anything from four to 30 years.

- (3) *High values and unique-to-project* purchases have a high purchasing complexity and high value in the project. In general, new suppliers can be introduced if they have something different to offer, a product innovation or a new way of doing business or simply much cheaper. When clients have specified a particular product or service that has not been used before, for example, a new façade system, it represents a risk for the company. Consequently, the companies will often go and look at other construction companies' projects to see the new product in use before adopting it themselves. Long lead-times also occur when input is needed into the design process. New products or services are often proposed by sales staff to architects or to the construction company for design and construct projects (Company E). A common scenario is that the architect has specified a product that can only be provided by a sole supplier (Company D); therefore, this can be regarded as *single sourcing*. A barrier to the purchase of new products, mentioned by Company E, is the prospect of defects. If the same product has been used for the last 10 years, there is experience of what happens to it over time. To have a warranty is therefore important, especially for new products. Sometimes clients would like products from producers in China or low-cost producers from other countries; however, the products in many cases do not meet the Australian standards so the construction company cannot use them. The companies believe that the Australian standards are helpful because they ensure that products are safe.
- (4) *Low value standard* purchases are products and services of low cost and low purchasing complexity. These are general consumables, off the shelf products that are available with many suppliers but just few are selected to make it more efficient and to ensure superior quality. The attraction for a centralized purchasing organization would be less risk and less cost with improved efficiency because an agreement is already set up (Company C). For example, a large facility management company provides services such as living accommodation, security, catering, and cleaning on site. Another was the purchase of general consumables bought from a general consumables company as it does not make sense to purchase, for example gloves directly from the manufacturer. The company also tended to use large, national suppliers instead of having contracts with suppliers in a specific region; however, some projects "shop across the road" anyway (Company C).
- (5) *Low value adapted to project* purchases are of low value and medium purchasing complexity. These purchases categorised in the mid-lower part of the matrix are usually included in the subcontractor packages. These items are project-specific, of low volume and needs expertise provided by subcontractors. Typically, these items can be *electrical products* or *mechanical components*.
- (6) *Low value and unique-to-project* purchases have a high purchasing complexity. Company B says that, in terms of services, complex products require more interaction, and it can be difficult to substitute one specialist subcontractor for another when access to manufacturer's equipment is involved. When asked about new products that have not been used before, the Company E gave examples such as Bluetooth devices that control installations, new kinds of paint, waterproofing

or adhesive (for tiling). *Special tiles* can be complex to buy in terms of lead time if they are sourced from overseas (Company E).

Figure 1 summarizes the discussion above on the placement of different products and services in the purchasing portfolio matrix.

Discussion

The findings in the previous section can be generalized into a generic matrix to guide purchasing policy in companies (see Fig. 2). The results from the study suggest that centralized purchasing can be a suitable strategy for standard items (see dotted squares). The construction companies may then be able to take advantages of economies of scale when buying standard high-value items such as concrete and fuel. There is a low need for information for such items and they have a low project specificity. To make sure that the best price is obtained, multiple sourcing could be implemented with framework agreements with 2–3 suppliers. For the low value standard items, the company can make framework agreements with wholesalers and service providers that provide a bundle of standard products and services. In this way delegated sourcing is obtained and a large supplier base can be avoided. When moving towards the right in Fig. 2, as the project specificity increases among the items, so is the complexity of purchase as new information needs to be acquired (compare with new-buys

Fig. 1 A project-based purchasing portfolio applied to the Australian construction industry

Fig. 2 A generic project-based purchasing portfolio

as in Robinson et al. (1967) framework). This information needs the involvement of the technical staff e.g. project managers and project engineers that has the knowledge about the capabilities among subcontractors and products on-site. For high value items with a medium project specificity, parallel sourcing is suggested to secure the supply of subcontractor services. The project managers can thereby use the same set of subcontractors for several projects. To decrease complexity, the low-value items with medium project specificity can be sourced by subcontractors in the form of delegated sourcing. Moving further to the right in Fig. 2, the items become even more project specific. High-value items with high project specificity are often single sourced because of the uniqueness of the item and the need for close collaboration which can be facilitated in a single sourcing relationship. In the case of low value items of a unique character they can be also single sourced in the case of for example special tiles or Bluetooth devices, but it can also be in the form of delegated sourcing as for example special paint and adhesive typically are sold by wholesalers.

Conclusions

The purpose of this study was to determine if a matrix could assist companies in the project-based industry in formulating their purchasing strategies. The matrix is depicted in Fig. 2. For the matrix to be created, three hypotheses were formed.

The first hypothesis was: *Purchases of high project specificity is less suitable for centralized purchasing and needs to be handled by the project team or a subcontractor.* It is a dilemma for many companies on what to centralize and what not to centralize. The project-based nature of the construction industry implies that there is a change from project to project and, therefore, from purchase to purchase. It is necessary for construction companies to understand how to manage and analyse purchasing strategies for different products and services, because of their impact on project outcomes. This study highlights the difficulty to centralize project specific items that needs technical expertise and cannot be bought in economies of scale. Figure 2 shows the dotted sections of standard items that are suitable for centralized purchasing. The second hypothesis was: *As projects are unique, it is relevant to modify the supply risk axis of the Kraljic matrix to instead highlight the complexity of a purchase in terms of need of information and project specificity.* By changing the horizontal axis to emphasise the need of information and project specificity, the matrix becomes adapted to the project-based business context that differs from the manufacturing industry. Clear groups of items could be formed for project-based purchasing with a distinct purchasing policy for each of the groups. The third hypothesis was: *Delegated and parallel sourcing are the most common sourcing structures in project-based purchasing such as construction.* This study reveals that there is a lot of repeat business with the same suppliers and subcontractors that provide packages of product and services, so-called supply and install subcontractors. This tiered supply chain is of a delegated sourcing structure. As they use the same suppliers and subcontractor as a “pool” for their projects it can be seen as parallel sourcing. The management of low-value products and services represent a significant proportion of the cost and complexity. To manage this situation. The sourcing structure is delegated by the companies in order to take advantage of the (external) capabilities possessed by these subcontractors. It is beneficial for the companies to have this delegated, supply structure given the variety of (comparatively) small quantities of items involved and the subcontractors’ knowledge of the products. Subcontractors concentrate on the tasks that they understand best of all and are responsible for purchasing components about which they have first-hand working knowledge. Delegated and parallel sourcing can thereby be regarded as the most common supply structures in project-based purchasing such as construction.

Future research should be directed at suppliers to obtain a supplier-side perspective of purchasing decisions and to determine whether or not this aligns with the purchaser’s perspective. A comparison of these two perspectives might provide further insights both for researchers and construction companies.

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Declarations

Conflict of interest The author states that there is no conflict of interest and ensures data transparency.

Ethical approval Not applicable.

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