

Developing a Supplier Evaluation Conceptual Framework For Humanitarian Supply Chains

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Abstract— Performance measurement in the humanitarian sector is a somewhat under-researched area. To our knowledge, there seems to be a lack of a supplier evaluation framework for humanitarian organisations to categorise their critical suppliers - strategic and bottleneck suppliers related to high supply risk purchases. As such, this study seeks to answer three research questions regarding the current state of supplier evaluation in the sector; challenges faced when evaluating suppliers and the key criteria for assessing strategic and bottleneck suppliers following the Kraljic Matrix. The research aimed to develop a conceptual framework for evaluating high-supply risk suppliers.

Keywords—Humanitarian Logistics, Supply Chain Management, Supplier Evaluation, Kraljic Matrix

I. INTRODUCTION

Procurement is essential in the context of humanitarian operations. A humanitarian organisation (HO) typically spends around 65% of its budget on procuring goods and services [1]. As such, HOs must optimise their procurement operations to maximise the value of these purchases in supporting the needs of their beneficiaries.

There are many scholarly articles regarding procurement operations, strategies and methodologies for the four established quadrants of Kraljic's procurement portfolio matrix [2]. However, there is room for further research on and development of complete supplier/purchasing evaluation frameworks.

Specifically, there is currently no reliable framework for humanitarian organisations to perform supplier evaluation for their Strategic and Bottleneck suppliers (suppliers with the highest supply risk). This paper reviews extant literature and practices in supplier selection and evaluation in the humanitarian context to conceptualise a supplier evaluation framework to aid humanitarian organisations in making decisions in their sourcing process. This framework will focus on the Strategic and Bottleneck categories of the Kraljic model, as these suppliers are recognised as carrying high supply risk, which is closely linked to the balance of power between a buyer and their suppliers [3]. Additionally, any disruptions to the supply of goods/services of these two categories will severely affect operational effectiveness or result in a high financial impact on HOs. Hence, this paper focused on suppliers of these two categories (hereafter referred to as "high supply risk suppliers") to provide practical insights to ground practices in humanitarian procurement. The findings from this study were also validated by an independent humanitarian field expert, who supported the focus on studying the two critical categories – strategic and bottleneck suppliers for humanitarian procurement expenses at the HOs.

II. LITERATURE REVIEW

A. Purchasing Strategies for Relief Items

Reference [4] sought to create a purchasing matrix to fill the gap of a suitable solution in evaluating suppliers in the procurement of humanitarian relief items and suggested an overlapping commonality with purchasing models in the commercial world. Using the established Kraljic (1983) model as the basis for their matrix, as well as the Analytic Hierarchy Process (AHP) [5], common or similar parameters between those in the model and humanitarian operations specifically were identified. These mainly centred around the "Importance of Purchasing" and "Complexity of Supply Market" parameters of the Kraljic model and the use of the AHP to prioritise evaluation criteria.

		Importance of Purchasing			
		Criticality			
		High		Low	
		Financial Impact		Financial Impact	
		High	Low	High	Low
Complexity of Supply Market (Risk)	High		Hygiene Kit Cleaning Kit	Raincoat	
	Low	Mattress/ Food Basket	Glove	Blanket	Coat Sheet T-shirt

Fig. 1. Humanitarian Purchasing Matrix [4]

The authors also discussed the current state of supplier evaluation in the humanitarian aid sector, with many organisations only recently realising the benefits of strategic procurement, such as improving capacity and efficiency in managing resources. The authors also noted the lack of academic studies and models for procurement strategies. The article is relevant to the first two research questions regarding the current state and challenges of supplier evaluation in the sector. Based on the article, we learn that HOs generally tend to be more reactive in the procurement of goods rather than establishing long-term strategies, which include a system or framework to evaluate supplier performance.

The article also helped determine the evaluation criteria for the Strategic and Bottleneck categories, as the authors had provided academically-validated criteria, in which there was a higher interest in the parameter of "Complexity of Supply Market". This aided immensely in answering our third research question regarding the key evaluation criteria for Strategic and Bottleneck items and the development of the conceptual framework

B. Key Evaluation Criteria for High Supply Risk Suppliers

Pazirandeh (2011) developed a conceptual paper centred around procurement and supplier evaluation criteria for the international health supply chain. It aimed to create a model

to optimise the procurement of medication and vaccines for developing countries, where slow-onset national health disasters can be prevalent. The paper primarily utilised a criteria literature review to establish supplier evaluation criteria and existing methods for sourcing decision-making. The author reviewed criteria for supplier evaluation proposed by other scholars and eventually developed a list to distinguish criteria for both local and global sourcing (Fig 2). These criteria are relevant to answering our research question on the critical supplier evaluation criteria for Strategic and Bottleneck items. Despite the limited scope of the paper on vaccine sourcing, these criteria were adapted to further define objective criteria and sub-criteria for our stakeholders regardless of the disaster.

Orientation	Criteria	Sub criteria
Common in global and local sourcing	Quality Service	Rejection rates
		Reputation
	Delivery	Flexibility
		Reliability
In global sourcing	Cost	Communication Reputation On-time Lead time
	Risk	Product price
		Logistics
	Compatibility	Environment
Density		
Political stability		
		Culture Infrastructure Language

Fig. 2. Proposed List of Criteria for Sourcing Decisions [6]

C. Key Barriers to Performance Measurement in Humanitarian Supply Chains

In [7], the authors sought to determine and model the key obstacles to performance measurement in the humanitarian supply chain. The authors determined 17 barriers under 5 categories, as shown in Fig 3, by performing an extensive review of the literature before ranking them based on established quantitative and qualitative methods.

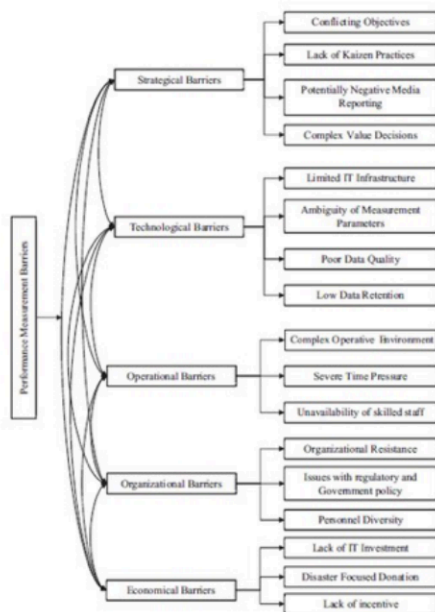


Fig. 3. Proposed List of Criteria for Sourcing Decisions [7]

Within the 17 barriers, the authors determined that the lack of skilled staff has the most significant impact. They have also determined that the disorganisation of the operative

environment, organisations' conflicting objectives and a lack of resources for investment into information technology were other vital barriers.

These findings helped answer our research question on the challenges of supplier evaluation, as the authors had provided specific barriers or challenges within defined categories. Thus, we were able to use these barriers, especially the four key ones mentioned above, to validate findings from our study regarding challenges faced in supplier evaluation.

One notable limitation of this article is that it was meant to establish common key barriers for performance measurement in the whole supply chain and not just for procurement/supplier evaluation. Nonetheless, the barriers determined by the authors are general enough in the area of supply chain management to be explicitly adopted in supplier evaluation.

D. Carter's 10 Cs

The final literature review is centred around Dr. Ray Carter's 1995 article, which sought to develop a framework to facilitate effective decision-making in supplier evaluation. The final model, known as Carter's 10 Cs, eventually comprised ten key criteria that would contribute to an optimum decision: Competency, Capacity, Commitment, Consistency, Cost, Cash, Communication, Control, Clean and Culture.

Whilst not providing specific importance on Strategic and Bottleneck suppliers, Carter's 10 Cs model was critical to developing our framework. Based on the literature reviewed and insights generated from the field work, we aimed to identify the most relevant Cs specific to Strategic and Bottleneck suppliers for the humanitarian sector and form the basis of a new framework to help HOs evaluate and select these suppliers.

In summary, the literature reviewed highlighted a lack of academic work on procurement strategies to guide HOs' sourcing decisions. The review also established the key obstacles to performance measurement and the critical evaluation criteria for Bottleneck and Strategic suppliers. Our study sought to adapt Carter's 10 Cs [8] to develop a conceptual framework that could help guide future work on developing supplier evaluation strategies for HOs to evaluate their suppliers effectively.

Additionally, the study aimed to address some of the limitations of the literature reviewed, particularly on the current on-the-ground state of and challenges faced in supplier evaluation in the humanitarian sector, as well as the critical evaluation criteria specifically for high supply risk suppliers.

III. METHODOLOGY

A. Research Design

The primary data sources from the study are semi-structured interviews with humanitarian field experts who have had experience working with and consulting for HOs of different sizes and leaders and managers of small-to-medium HOs. The five interviewees provided insights to answer our first two research questions on the current state and difficulties/challenges of supplier evaluation in the humanitarian sector. We also used the insights garnered to determine the critical supplier evaluation criteria in the sector, which encompassed our third and final research question.

The insights provided by these interviewees were analysed according to the research questions to identify commonalities, themes, differences and additional insights between and within each category. This analysis also used insights and findings from the literature review section. A different humanitarian field expert validated the insights from the interview findings to eliminate potential bias.

B. Data Collection

The main data collection type was primary, qualitative data, manually gathered through five online interview sessions (e.g., via Google Meet and Zoom). The interviews were transcribed, mined for qualitative data/insights, and analysed.

1) *Current State of Supplier Evaluation:* For the first research question regarding the current state of supplier evaluation in the humanitarian sector, the interviewees at different HOs were asked questions to determine their current practices and views on supplier evaluation. The questions were aimed at understanding the type of framework that would be helpful to these organisations. In the semi-structured interviews, the interviewees were encouraged to elaborate on their answers, which provided additional insights into the current state of supplier evaluation in the sector.

2) *Challenges and Difficulties in Supplier Evaluation:* We asked questions about the challenges and difficulties faced by the HOs during their supplier evaluation process to generate insights on factors and obstacles in the procurement process. As with the previous set of questions regarding the current state of supplier evaluation, the interviewees were asked to elaborate and share specific examples of challenges and difficulties. The insights gained from these questions helped us understand the biggest and most common obstacles that the supplier evaluation framework should help eliminate or mitigate risk and facilitate effective supplier evaluation.

3) *Key Supplier Evaluation Criteria:* For the third research question, namely the critical supplier evaluation criteria for suppliers of Strategic and Bottleneck items, the analysis includes data from interviews, relevant literature, and annotated records. During the semi-structured interviews, we asked questions specifically on Strategic and Bottleneck suppliers based on the Kraljic model. Our questions relate to if there is a framework specifically for strategic and bottleneck suppliers (high supply risk; the HO's general view on and current relationships with strategic and bottleneck suppliers; as well as the expected performance of their strategic and bottleneck suppliers.

We performed qualitative coding of all the interviews, where themes and exemplars were identified and noted across all five interview transcripts.

The findings from the interviews were validated by an experienced humanitarian field expert who was not involved in the interviews to eliminate any potential bias during analysis. The validated findings – particularly on the third research question, were then adapted to Carter's 10c model for supplier evaluation [8] and form the basis for the development of a conceptual framework.

IV. FINDINGS

The research findings are presented in accordance to the research questions in this section.

A. Research Question 1 - the current state of supplier evaluation in the humanitarian aid sector

1) *Existing Systems and SOPs:* A key insight from the analysis of the interview results is that most HOs tend not to have a formal SOP/framework in place to deal with supplier evaluation. However, some larger organisations with some degree of in-house supply chain management expertise tend to have at least a basic system for evaluating suppliers, including the weighted point methodology or a rudimentary/partial version of the cost-ratio method. Lamenza, Fontainha, & Leiras (2019) provided a key insight that HOs are only recently starting to realise the importance of a strategic approach to supply management. These HOs operate on a reactive approach to evaluating suppliers instead of utilising a pre-defined framework supporting an overarching procurement strategy.

2) *Item and Supplier Categorisation:* The categorisation of purchases and suppliers is an essential first step in evaluating Strategic and Bottleneck items, as HOs have first to be able to identify the suppliers and items that fall into these categories, as well as the unique parameters for evaluating the suppliers' performance. Based on the analysis, most organisations split the supplier evaluation process into low-value and high-value purchases. More focus tends to be on the latter, with the former being somewhat ignored. A possible reason for this is that smaller purchases tend to be for ad-hoc purposes where it is a spot buy/one-off purchase, and evaluation is not perceived as necessary. However, since larger purchases inherently carry a higher risk level due to high-value or high-volume assets, HOs would want to evaluate these suppliers before and after contracting them to minimise any potential adverse impacts to the organisation and its operations.

3) *Recognising and Dealing with High Supply Risk Suppliers:* An additional consequence of HOs' inability to categorise suppliers and the lack of academic studies and models for humanitarian procurement strategies is the failure to recognise and deal with high supply risk suppliers. Most smaller HOs often do not recognise that they work with high supply risk suppliers and state that they try to avoid suppliers with "high supply risk". Interestingly, after explaining Strategic and Bottleneck suppliers in greater detail, these interviewees tend to acknowledge that they work with such suppliers. There appears to be a common notion that dealing with such suppliers requires extraordinary effort and levels of expectation. This is an encouraging insight that was highly useful in developing our framework. It highlights the need to fully and adequately explain to Strategic and Bottleneck suppliers so that HOs can correctly identify and effectively utilise them. Beyond that, there appears to be at least a general understanding of dealing with the high-supply risk suppliers.

B. Research Question 2 - challenges and difficulties of evaluating suppliers in the humanitarian sector

1) Internal Systems, Resource and Manpower Availability: Our interviews with HO representatives established that all organisations have some challenges regarding internal resource availability to continuously and consistently perform supplier evaluation. This is because much of the supplier evaluation process is manual and can include compiling documents and data to perform the evaluation. It also necessitates a high level of involvement, such as following up on assurances on delivery time, delivery to the right place and consignee, etc. Most HOs do not have the resources or time to commit to developing automation capabilities and IT systems, even if it would carry the extended benefit of easing the burdens of manually performing these tasks in the long run. This can be especially difficult for smaller organisations with a limited workforce but affects even the large HOs. Additionally, with the amount of time and involvement that the process requires, both small and large HOs tend to defer this responsibility during times of emergency (e.g., responding to a sudden-onset disaster such as earthquakes or flooding) until the damage has been done – such as being served by poor supplier performance. Our review of literature corroborates the above findings from the interviews conducted. [7] developed a list of 17 performance measurement barriers: limited technological infrastructures, lack of skilled internal manpower, lack of investment in IT, and the bulk of donations often redirected towards disaster relief operations. With the understanding that the availability of internal systems, resources, and manpower are cumbersome obstacles faced by the majority of HOs, any framework developed for supplier evaluation in the humanitarian sector should seek to minimise, where possible, the time, resources, and manpower required.

2) Lack of Knowledge and Data: According to several interviewees, HOs face the challenge of not having sufficient market data to help in the pre-contracting supplier selection process. In addition, smaller organisations also lack general knowledge and competencies in supply chain/sourcing management, manifesting as a lack of frameworks or SOPs that hamper the supplier evaluation process. Indeed, [7] provides validation for this, as the authors identified the lack of skilled manpower and Kaizen practices, and low data quality and retention rates, as part of their 17 critical obstacles to performance measurement. It can be argued that HOs' lack of knowledge results from a lack of a proper supplier evaluation framework that could guide a more systematic supplier evaluation and selection and continual data collection for performance measurement.

3) Organisational Culture and Perception of Supply Chain and Sourcing Management: One of the more common challenges cited by the interviewees of this study is the conflicting objectives and perceptions on the importance of Supply Chain/Sourcing management by the various stakeholders of a HO. One interviewee explained that every HO has a different priority in its value chain setup. Not everyone sees supply chain management/procurement as a primary function but as more of a support function. As a result, fewer resources and investments tend to be allocated

to the various areas of the HO's supply chain. Indeed, this notion is supported by [7], who explains that organisational resistance and culture are critical barriers to effective performance management. Any framework developed for supplier evaluation in the humanitarian sector must consider this obstacle, e.g., including detailed explanations on why each aspect of the framework is vital to the overall strategic supply chain function.

4) Cost of Switching Suppliers: Another challenge that mainly affects smaller HOs is the cost of switching suppliers. This challenge was explicitly highlighted by two interviewees representing small-scale, local HOs. Smaller HOs tend to consider switching costs due to their relative lack of leverage and lower purchase volumes. Thus, they do not see the value of evaluating suppliers as even poor supplier performance could cost less than switching suppliers. On the other hand, larger HOs tend not to be as susceptible to this since they would have higher leverage and purchase volumes than smaller ones. While there is no mention of this in any literature reviewed in this study, it should be regarded as a minor point of consideration for the framework to cater to the unique circumstances of smaller HOs during supplier evaluation. For example, the framework could have a note to smaller HOs to evaluate their supplier switching costs versus the cost of poor supplier performance at their discretion.

C. Research Question 3 - key evaluation criteria for Strategic and Bottleneck suppliers in slow-onset disaster relief operations

In our literature review and analysis of interview results, we determined that four key areas are significant in evaluating high-supply risk suppliers. They are service, reliability, cost and corporate social responsibility (CSR). These four areas were adapted to four of Carter's 10 Cs:

1) Communication and Commitment: With the criteria area on service (communication and willingness to collaborate), two of Carter's 10 Cs can be adapted: Communication and Commitment. In the HSC, poor communication often results in disparities between demand and supply and in some cases, can directly impact people and HO volunteers [9]. Measuring communication determines how timely, reliable and effective a supplier's communication is. Based on Carter's 10 Cs, the sub-criteria for communication are responsiveness to requests (for information, quotations, etc.), pre-emptive communication of issues, and availability of communication lines. In measuring the commitment of their suppliers, HOs will be able to assess a supplier's willingness to discuss key issues such as product improvement/iteration and delivery service variability. This allows the organisations to decide if the prospective or current supplier would be suitable for long-term strategic partnerships to manage the supply of high-supply risk items effectively. Sub-criteria to evaluate commitment include quality standards certifications, willingness to collaborate on joint improvement, continuous improvement processes and organisational culture.

2) Capacity: The criteria on reliability can be translated into one of Carter's 10 Cs: Capacity. By measuring a supplier's capacity to provide the necessary supply – including the flexibility to ramp up production and delivery

capacity when required – HOs will be able to identify suitable potential suppliers and determine if current suppliers are able to keep up with the fluctuating demand of the humanitarian sector. Sub-criteria for capacity include total capacity, key buyers and flexibility.

3) *Cost*: While the analysis findings suggest that cost tends to decrease in priority in place of other criteria (especially during crises/emergency situations), it is still an essential consideration for all HOs, particularly smaller ones with fewer resources to expend. As such, one of Carter's 10 Cs, Cost, can be measured to provide organisations with insight into the pricing of products and services set by suppliers, how they compare to other potential suppliers in the market and the organisation's budget and requirements. Sub-criteria for costs include product and logistics costs, which, while essential to evaluate before contracting to understand the baseline costs associated with the supplier, is bound to change for several reasons. HOs should thus also consider these sub-criteria after contracting to understand the degree to which costs increase and the supplier's effort in ensuring that prices stay as reasonable as possible throughout the contract period.

4) *Clean*: One of Carter's 10 Cs, Clean, is explicitly used to measure the CSR performance of suppliers. While this criterion may be of lower importance in the commercial sector, we have established in the analysis that this is arguably the most critical factor that HOs have to consider – possibly even before considering the other criteria we have explored. Clean measures how a supplier treats the environment and people and can be tangibly measured through carbon emission reports, green accolades/certification, CSR activities, and even employee review aggregate scores. Measuring and thus ensuring good performance of their suppliers in this criterion allows HOs to ensure that the operations they conduct for the good of their beneficiaries do not do the opposite and contribute to environmental or ethical issues. Sub-criteria for clean include CSR activities, sustainability reports, ethical and green accolades/accreditation, positive publicity and carbon emissions.

D. A Conceptual Framework for Supplier Evaluation

The five Cs corresponding to the five key criteria areas for HOs to evaluate Strategic and Bottleneck suppliers can be represented in a conceptual framework, as shown in Fig 4, to guide HOs on the most critical metrics for evaluating Strategic and Bottleneck suppliers. Each C has at least two sub-criteria to guide specific evaluation efforts and a corresponding key reason for selecting a Strategic/Bottleneck supplier to help HOs understand the importance of each C concerning evaluating suppliers with high supply risk in particular. Each sub-criterion is colour coded, where the purple boxes denote sub-criteria to be assessed before and after contracting a supplier; the orange boxes denote sub-criteria to be assessed solely after contracting; and the green boxes denote sub-criteria to be evaluated solely before sub-contracting.

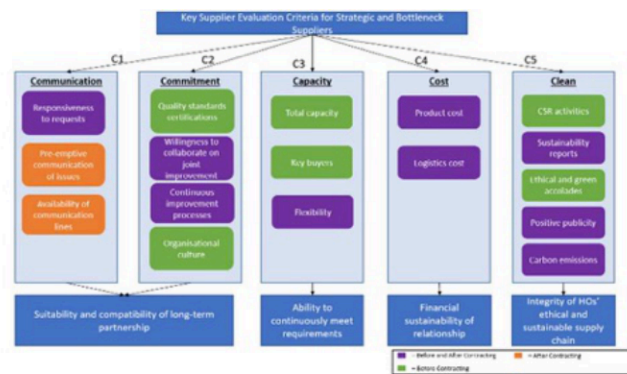


Fig. 4. Conceptual Framework for Supplier Evaluation [Authors]

A limitation of this framework is that it does not help HOs identify Strategic and Bottleneck suppliers and assumes that the HO is already aware of which suppliers carry high supply risks. Additionally, this framework and its included metrics are intended as a guide and are by no means exhaustive. We recommend that HOs determine specific criteria relevant to their organisation within the five Cs.

V. CONCLUSION

This project sought to develop a conceptual framework for HOs to evaluate Strategic and Bottleneck suppliers. An extensive literature review was paired with fieldwork in the form of interviews to answer three research questions using the insights gained.

The literature review and interviews determined that the current state of supplier evaluation in the humanitarian sector leaves plenty to be desired, with a marked lack of established systems, frameworks and academic work. This area of supplier evaluation also encounters various challenges, including the availability of resources, skilled manpower, and relevant data for supplier evaluation, amongst others. Finally, the literature reviews and interviews provided insights on the most critical and impactful criteria areas for Strategic and Bottleneck suppliers. These were then adapted onto Carter's 10 Cs to provide a high-level framework to guide HOs in high supply risk supplier evaluation.

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