A Humanitarian Supply Chain Maturity Model

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ABSTRACT

Over the past decades, humanitarian organizations have largely been criticized for their lack of effectiveness regarding their mission of assisting vulnerable population. However, few researches have investigated what ideal should humanitarian organizations tend toward and the path to undertake in such transformation. In this perspective, this paper intends to overcome this situation by proposing a supply chain maturity model specifically addressed to the humanitarian sector. In the form of a two-dimension matrix, the table aims at: 1) Objectify one organization's position regarding its transformation journey 2) Depending on the organization, identify the specific improvement areas and suggest their sequence. An instantiation of the maturity model is also proposed through the case of the Indonesian red cross.

Keywords

Maturity Assessment, Performance, Humanitarian Organization, Supply Chain.

INTRODUCTION

In constantly changing societies, organizations to remain prosper must keep up with the competition and thus, seek for improvements. To do so, one way consists in assessing the organization's key capabilities to determine a level of control (i.e. maturity). This observation allows highlighting gaps and opportunities and helping the organization position among its peers. Consequently, attention and efforts should concentrate on heightening those capabilities that may figure in various domains. However, to smooth the change, a certain logical approach (i.e. a kind of a roadmap) must be followed. For instance, those improvement guidelines can be found in maturity models and the supply chain domain have several of them. By taking a closer look at the humanitarian world, where humanitarian organizations assist vulnerable people with relief services or items through a specific supply chain, we identified a shortage. Indeed, in the literature many papers abound to highlight the lack of effectiveness in the aid provided by humanitarian actors (Haavisto and Goentzel 2015). However, even though humanitarian supply chain (HSC) is a branch of the supply chain, too few papers provide perspectives of improvement. Consequently, we need to objectify the level of maturity of current HSCs to be able to support them in their transformation. Therefore, the research question studied in this paper can be formulated as following : how to assess the maturity level of existing HSCs in order to objectify their forces and lags in the objective of remediation or improvement ? To address this need, the paper starts with a contextual setting developing HSC features and supply chain maturity models and their design. After that, follows a discuss around the humanitarian supply chain maturity model proposed. An application of the model and assessment results are then provided through the case of the Indonesian Red Cross.

BACKGROUND

Humanitarian supply chain features

Most of the time, due to urbanization, a disaster occurrence leads to the disruption of territory where population

are distributed. The hit duration and intensity generate harmful effects in terms of victims and facilities damages. To recover from this situation, that requires funding and assistance, humanitarian aid is generally provided by government entities and specialized organizations. Those experts have for main objective of alleviating human suffering of vulnerable people. To do so, aid is provided respecting four principles, shared by most of the humanitarian organizations; humanity, neutrality, independency and impartiality principle (Kwon and Kim 2018). Where agencies differentiate themselves lie in the combination of their strategic choices, disaster managing approach, structure and other supporting activity processes.

Strategy

The starting point of these differences stems from the fact that humanitarian players do not share the same understanding and importance of the core principles mentioned previously. Consequently, facing the same situation the behaviours and approaches vary and thus, generating many coordination issues between the organizations (Slim 1997). To illustrate these differences of public policies, Dijkzeul and Moke (2005) categorized organizations according to both their relationship to/with victims and stakeholders. Based on this typology, the International Committee of the Red Cross (ICRC) and Médecins Sans Frontières (MSF) strongly value the impartiality principle e.g. providing aid without any discrimination and Independence regarding the funding sources and the decision autonomy. At the opposite, others such as World Food Program (WFP) or CARE give priority to the physical presence on the field (i.e. Solidarity) and support projects developed by governments (i.e. Subcontracting) (Dijkzeul and Moke 2005).

Disaster management

Disaster management (or emergency management) is defined by (Moe and Pathranarakul 2006) as involving *"plans, structures, and arrangements established to engage the normal endeavours of governments, voluntary and private agencies in a comprehensive and coordinated way to respond to the whole spectrum of emergency needs".* Disaster management is generally divided into four phases forming a cycle, namely the mitigation, the preparedness, the response and the recovery phases (Coppola 2015). The mitigation phase concentrates on assessing potential risks and intends to reduce or eliminate its probability and/or impact before it occurs. The preparedness phase includes contingency plans, evacuation or awareness campaigns to prepare for any eventuality that mitigation cannot manage. After disaster detection, the response phase starts. It is a question of providing assistance to affected communities to limit suffering and meet basic needs (Kusumastuti et al. 2010). Finally, the recovery phase, that does not have a clear triggering point, consists of helping affected communities restoring or improving the pre-disaster situation (Moe and Pathranarakul 2006). Concretely, all the phases are not equally considered. Indeed, the emphasis is on the response phase that is the most complex function to manage (Coppola 2015) while preparedness and recovery phases are often neglected due to the absence of support from donors (Kwon and Kim 2018).

Network organization

In terms of architecture, many of the humanitarian agencies are organized as federations or pools. Even within the group, organizations policies, structure and capacity may diverge. Indeed, as an illustration, Save the Children Fund, presents a centralized structure with standardized decision rules while Oxfam, rather decentralized, operates with branches located in many countries and central offices (Dijkzeul and Moke 2005). In addition to this, the different operating approaches make coordination between the different actors; whatever aid agencies within and outside the pool as well as others both global and local very delicate (Long and Wood 1995). In terms of collaboration also, where partners are supposed to work jointly for a common objective (Moharana et al. 2012), the experiences have been rare and resulted in inefficiencies (Tomasini and Wassenhove 2009).

Supply chain maturity models & design

In the organization context, the term 'maturity' refers as: "an evolutionary progress in the demonstration of a specific ability or in the accomplishment of a target from an initial to a desired or normally occurring end stage" (Mettler 2011). In other words, to support organization progress, maturity assessment or performance evaluation (Charles et al. 2010) serve decision-makers to appraise their situation compared to a certain capability and highlights logical improvement areas to reach it. The origins of the maturity model root within the quality management domain, however, it is better known within the information technology field (Netland et al. 2007). Measuring the maturity level of the supply chain is for companies crucial to maintain competitiveness and ensure the organization's durability (Lahti et al. 2009).

Commercial supply chain maturity models

Although maturity models cover a large range of disciplines, only a few (5%) are focusing on the management of the supply chain and logistics (Santos-Neto and Costa 2019). Among them (McCormack 2001) proposed the Supply Chain Management Maturity Model (SCMMM) developed in five levels and with a business process orientation considering process view, process structures, process jobs, process values/beliefs, process management/measurement and best practices. The assessment is based on a grid and a series of questions where answers are in the form of a 5-level Likert scale. Later (Netland et al. 2007) developed the Supply Chain Maturity Assessment Test (SCMAT) based on best practices in the supply chain and operations management found in the literature. Seven categories that regroup the 50 best practices have been identified namely, the strategy, control, processes, resources, materials, information and organization. The assessment is similar to the SCMMM via an excel-based audit and the result is provided in a radar chart format. Instead of the most common format; 2D matrix with levels versus categories, (Oliveira et al. 2011) proposes a new sort of maturity model. After a statistical analysis of the 90-process capabilities indicators of supply chains collected from industrial opinions, the Supply Chain Process Management Maturity Model (SCPM3) defines maturity levels as a set of capabilities to reach in a specific order like a roadmap. Finally, unlike most maturity models designed for assessment and eventually improvement, the European Technology Platform (ALICE)'s model proposes an innovative approach for logistics and supply chain management deployment in Europe. The model orientation aims to assist supply chain development in being more efficient, competitive and sustainable in future from 2020 to 2050 (ETP ALICE 2014).

Humanitarian supply chain maturity models

In recent years, HSC received increased attention and particularly regarding performance. Many papers discuss the current performance of humanitarian organization, but only a few propose suggestion or areas of improvement of the supply chain (Abidi et al. 2014) or identify critical success factors (Abidi et al. 2013; Behl et al. 2019; Lu et al. 2006; Pettit and Beresford 2009). From the literature review performed, using the keywords: "humanitarian" or "relief" and "maturity" or "assessment" and "supply chain" in Google Scholar, Web of Science and Emerald Insight, only three papers stood out. In each case, the capability assessed in those articles differs. (Salvadó et al. 2018) focuses on sustainability while (Charles et al. 2010) apprehends the agility of humanitarian organizations. In Salvadó et al.'s paper, the objective is to propose a roadmap for humanitarian organizations to achieve sustainable objectives in the perspective to remain competitive. Such planning can be found in the form of a maturity model in five levels (unaware, beginner, medium, good and expert) and integrating three maturity dimensions to assess (social, economic and environmental). The evaluation method involves a list of criteria related to each dimension previously mentioned to measure. The results are available in a radar chart or table and indicate the degree of maturity reached by the organization regarding each dimension. The corrective actions are given by the dimension with the lowest score. In the second paper, Charles et al. highlight the cross-learning opportunity with capacity assessment maturity models designed first for the commercial sector (e.g. the European Foundation for Quality Management (EFQM), Capability Maturity Model Integration (CMMI) or even the SCOR model). However, they must serve as inspiration models because the humanitarian field is too specific and current models are not suitable. Consequently, Charles et al. start with the agility definition and identified key improvement areas from the literature such as the flexibility, velocity or reliability. The assessment is then, performed via an evaluation grid providing a final score on a 5-level scale is suggested to be turned into an improvement plan. Since no improvement cycle really exists, it becomes relevant investigating HSC success factors. Indeed, those are areas ensuring, if controlled, a sufficient performance to remain competitive (Pettit and Beresford 2009). Based on a literature review, Pettit and Beresford identified seven key success factors namely; the strategic planning, the inventory management, transport & capacity planning, human resource management, collaboration, continuous improvement and supply chain strategy.

Table 1. Humanitarian supply chain maturity models identified from the literature review performed

Article	Capability assessed	Assessment method	Results availability
(Charles et al. 2010)	Supply chain agility	Evaluation grid	Table and radar chart
(Salvadó et al. 2018)	Supply chain sustainability	Evaluation grid	Table, figure and radar chart

Maturity assessment model design

This section aims at providing explanations related to the design of maturity assessment models. Indeed, such method is not that simple and only a few articles develop the theory associated (Mettler 2011). Essentially, a

maturity assessment model comprises state descriptions (i.e. the maturity levels) along with key drivers of maturity (i.e. assessment items) to address improvement objectives (Mettler 2011). Models are generally displayed as a two-dimensional array where the x-axis represents the maturity levels and the y-axis the assessment items (Netland et al. 2007). Concretely, two approaches exist: the top-down approach that consists in fixing the number of levels and corroborate them with maturity drivers while the bottom-up approach that starts with the maturity drivers to make clusters and end up with the level's definition (Mettler 2011). For his part, Mettler proposes a different method that is the following; the first step consists in identifying an evolution objective based on a need or an opportunity. The second step is about defining the scope i.e. set the parameters regarding the focus, level of analysis, novelty and audience orientation of the model. After that, the third point focuses on the model design through the maturity definition, goal function, design process, design product, application method and respondent's configuration. The next step evolves around the evaluation design where the subject of evaluation, time frame, evaluation method is defined. Finally, the last step namely 'reflect evolution' concerns the subject of change, the frequency and the structure of change. For each stage, the decision parameters can be assigned a value among the existing options defined by Mettler.

PROPOSAL

Many authors agree on the interest of maturity model to place one organization in relation to its competitors and offer improvement area guidance regarding a capability. Santos-Neto and Costa (2019) demonstrate this interest which results in a large diversity of capability maturity models existing. However, if we focus on the supply chain and logistics only, the number scales down to nineteen and reduces to a very few in the humanitarian context. Despite numerous papers highlighting the performance deficiencies of humanitarian supply chains, no chance is offered to objectify such performance and propose a step-by-step evolution in terms of network design. This is the lack identified this paper intends to overcome.

Scope

The phenomenon to be studied is specific since the focus is on the HSC that is a branch of the supply chain and, as previously mentioned, novel. The model is management oriented and first designed for the benefit of the logistics group level but, since logistics account for 80% of relief efforts (Van Wassenhove 2006), it would also serve the organisation level and be by extend to the inter-organisational level if all organizations decide to improve in such way.

Model

The maturity model proposed here (See Table 2), relies on a philosophy whereby there is a lot to gain by taking advantage of opportunities generated by others. In other words, by taking the example of Airbnb, an individual benefit temporary from a place to live whenever someone is having a house and ready to share it in return for compensation. The operation is win-win on many aspects at the same time; social, economic and sustainable. By extension, this philosophy may apply to organizations as well. Indeed, opportunities for sharing capacity like not full-storage areas or empty trucks, etc. are numerous. Such perspective is the basis of a recent logistics concept named the Physical Internet (Montreuil et al. 2013) and is behind ALICE's maturity model as well (ETP ALICE 2014). It is through this concept, which implies different degrees of connection of the network elements, that the maturity model is scaled. Although most models are divided into five degrees of maturity, literature reviews and expert interviews established that four levels are sufficient to fully describe the supply chain transformation process (Meng et al. 2011). Besides, a even number of degrees avoid respondents remaining in a certain comfort zone by choosing the average. Consequently, the model counts four levels whose names are inspired from the linguistic proficiency (See figure 1). The first level is entitled 'Elementary' and includes siloed entities part of a pool organized in a hierarchical structure. The second level is 'Intermediate' and represents integrated entities part of a pool organized in a flat structure. The third level is named 'Advanced', at that stage, the organization extends its connection outside the pool with close partners. Finally, the fourth level titled 'Proficient' represents a wide hyperconnection of all humanitarian stakeholders.

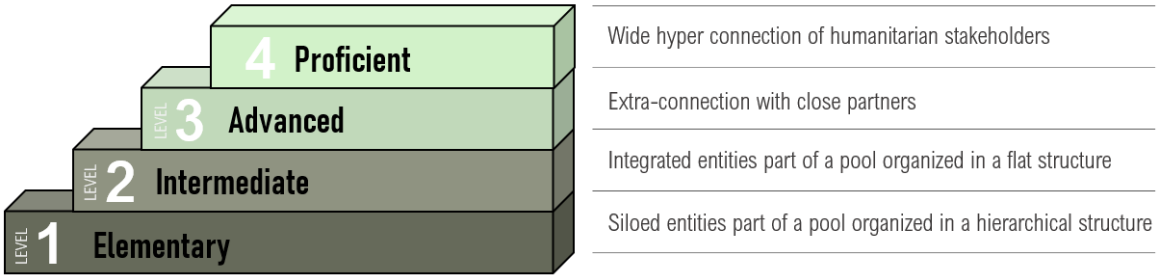

Figure 1. HSC maturity model division into four levels

Fundamentally, any organization aims at meeting the needs and expectations of a specific stakeholder with compliant products or services. At first, to fulfil this objective, an adapted strategy is defined. Then, the processes, resource and internal organization should be aligned to support such vision (Spitzer 2007). In the humanitarian context, the core activity is disaster management. To support this, functions such as logistics are crucial to be effective (Kusumastuti et al. 2010) and account for 80% of the efforts (Van Wassenhove 2006). Consequently, with this in mind, the key improvement areas of the maturity model had been determined with a focus on the supply chain (i.e. Strategy, Management and the Network design). Each key improvement area is made up of several sub improvement areas selected among the critical success factors identified by (Abidi et al. 2013; Behl et al. 2019; Lu et al. 2006; Pettit and Beresford 2009). The strategy dimension counts three subsections that are: (1) the "supply chain strategy", identified by Pettit and Beresford as crucial to ensure the appropriate service level, (2) the "disaster phase focus" with a priority order (e.g. A > B means, regarding the whole activity, A concentrates more activity than B), significant because it influences the activities to perform, according to Abidi et al.) and (3) the performance objective(s) characterizing the orientation of the performance measurement system and hence the business processes. The management section encompasses six sub improvement areas: the "strategic planning", "inventory management", "transport & capacity", "human resource management", "data management" and information management" identified by Pettit and Beresford. Four of them (the "strategic planning", the "human resource management" and "data/information management") were determined by Behl et al. as the most important causal factors. Finally, the originality of the study remains in the integration of the network design as a key area encompassing the notions of "structure", "coordination" and "collaboration" of the network nodes as underlined in many papers as a key differentiator element in supply chains best practice (Abidi et al. 2013; Altay et al. 2018; Pettit and Beresford 2009) or in crisis contexts (Fertier 2018).

Basically, the 'Elementary' level represents a reactive and repetitive approach based on experience (Hillson 2001). Consequently, decisions mainly rely on fragmented information (Tohamy 2017) such as price (Meng et al. 2011) and time and opportunities. This describes a situation of a siloed organization (Tohamy 2017) lacking supply chain visibility both internally and externally (Haight 2012). The second level, 'Intermediate' is related to organization starting to collect enough information and analyzing risks (Haight 2012) to focus on the means optimization (Beamon and Balcik 2008). At that stage, the organization gains in visibility regarding its resources and performance and can detect past errors and learn from them. It is also better connected within the pool with the other entities. However, there is still limited cooperation with the other stakeholders (Meng et al. 2011). The third level 'Advanced' depicts a stage centered on the anticipation (Tohamy 2017). Data reliability and tools and methods (Hillson 2001) are performant enough to interact closely with some supply chain partners (Tohamy 2017) and extend the visibility (Haight 2012). Arrangements are set to extend the capacity (Pettit and Beresford 2009) and enhance the organization's flexibility (Beamon and Balcik 2008). Finally, the last level named 'Proficient' reflects organizations enough mature to emphasis the reduction of non-added value operations (Pettit and Beresford 2009). As similar lean, just-in-time, etc. approaches, decisions are based on best practices (Haight 2012) and integrates a sustainable component (Salvadó and Lauras 2017) via, among other things, the participative management (Pettit and Beresford 2009) of interns or beneficiaries and also an emphasis on mitigation and preparedness (Scott 2014). Data is available in real-time (Tohamy 2017) and offers the opportunity of dynamic pre-positioning and direct negotiation (Meng et al. 2011). Finally, this stage also refers to the hyperconnection of all actors allowing collaborative logistics capacities strategies like shared warehouses or transport consolidation (Montreuil et al. 2013).

Evaluation

The maturity model developed is theory-driven and is accessible as a two-dimension matrix filled in with textual descriptions. The assessment does not require any third-party assistance and is more pertinent for managerial functions. The evaluation process is simple and fast and requires from the respondent a qualitative self-assessment regarding the improvement items and the likely position.

Table 2. The HSC maturity assessment model in a two-dimension matrix

Key areas	Sub areas	Elementary	Intermediate	Advanced	Proficient
Strategy[11]	***Supply chain strategy***[1]	Reactive[3]	Diagnostic[7]	Predictive[7]	Prescriptive[7]
Management[11]	***Disaster phase focus***[12]	Response > Recovery	Response > Recovery > Preparedness	Preparedness > Response > Recovery	Mitigation[8] > Preparedness > Response > Recovery >
	Performance objective	Effectiveness[4]	Effectiveness, Efficiency[4]	Effectiveness, Efficiency, Flexibility[4]	Effectiveness, Efficiency, Flexibility, Sustainability[9]
	Strategic planning[1]	Chaotic[5], Experience based[3]	Emerging analysis and risk identification[5]	End-to-end planning[5]	Best practices[5]
	Inventory management[1]	Lowest price[6]	Cost and quality[6]	Pre-planned stock arrangements[1]	Collaborative warehouse strategy[1]
	Transport & capacity[1]	Seize opportunity on a need basis	Centralized	Extended capacity via close partners[1]	Transport Consolidation[10], Dynamic routing[10]
	Human resource management[1]	Lack of resources and experts[1]	Individuals trained in basic skills[3], Variable availability of staff[8]	Committed resources with expertise[3]	Participative management[1], " in a state of readiness"[11]
	Data management[1,2]	Data silos, fragmented and after-the-fact[7]	Data harmonization and governance[7]	Data reliability[7]	Real-time, standardized and reliable data[7]
	Information management[1,2]	Ad hoc collection of tools and methods[3]	Integrated set of tools and methods[3]	Interoperable set of tools and methods[3]	Hyperconnected[10] & state-of-the-art tools and methods[3]
Network[12]	***Structure***	Isolated business[7]	Internal supply chain[7]	Extended supply chain of trading partners[7]	Open supply network[10, 7]
		Intra-organization node fragmentation	Intra-organization node connection	Intra-organization node connection & Horizontal Inter-organization node	Horizontal and vertical connection of all the nodes
	Coordination[2,12]	Hierarchical coordination	Internal coordination	Close SC partners coordination	Coordination with all the network's nodes
	Collaboration[2,12]	Confrontation or arms length[6]	Limited cooperation, tendering[6]	Negotiation or tendering[6], Favor collaboration[6]	Direct negotiation[6], Favor close collaboration[6]

Source: 1. Pettit and Beresford, 2009 - 2. Fertier, 2018 - 3. Hillson, 2001 - 4. Beamon and Balcik - 5. Haight, 2012 - 6. Meng et al., 2011 - 7. Tohamy, 2017 - 8. Scott, 2014 - 9. Salvado and Lauras, 2017 - 10. Montreuil, 2013 - 11. Spitzer, 2007 – 12. Abidi et al., 2013

APPLICATION CASE

To provide a first concrete application of the maturity model proposed, the following evaluation will be undertaken through the case of the Indonesia Red Cross (IRC) from which we gathered some information.

Indonesian Red Cross presentation

Indonesia Red Cross is the main humanitarian organization positioned in Indonesia. Across the country, it is recognized as an auxiliary to the government and guided by the 7 principles of humanity, impartiality, neutrality, independence, voluntary service, unity and universality. One of its three core missions consist of assisting and cooperating with authorities and providing humanitarian assistance in the event of natural disasters. To provide first aid items to affected people when a disaster occurs IRC relies on the logistics and above all on its logistics network. Such a network is organized following the administrative division of the country. In other words, almost every administrative level from the region to the regency, has an IRC office. The closest office is mandated when a disaster happens. If it is overwhelmed by an event, aid is requested to the closest office at the upper administrative level until reaching, if necessary, the headquarters. In a reverse way, if stocks are missing at some point, it is supplied in a cascade until reaching the distribution area. In terms of strategy, the organization reacts on a needed basis and is under pressure since disasters hit the country almost every day. Forecasts are difficult to make due to the uncertainty thus, safety stock targets for the biggest warehouses has been set based on demography. On demand, when relief items need to be moved to affected areas, the logistics department books a shipment to local transporters. Internal information is relayed via spreadsheets and smartphone applications. In terms of human resources, IRC mainly relies on volunteers to have basic skills but difficult to mobilise due to their status and constraint towards their employer.

Evaluation

After a first visit in Indonesia of ten days last July within the IRC headquarters in Jakarta where we met different representatives of the logistics function, we collected enough information to get a good understanding of the organization, management procedures and interaction with the other IRC offices. Based on the interviews, experience feedback and the maturity model developed, we were able to generate the following assessment result provided in the form of a radar chart (See Figure 2).

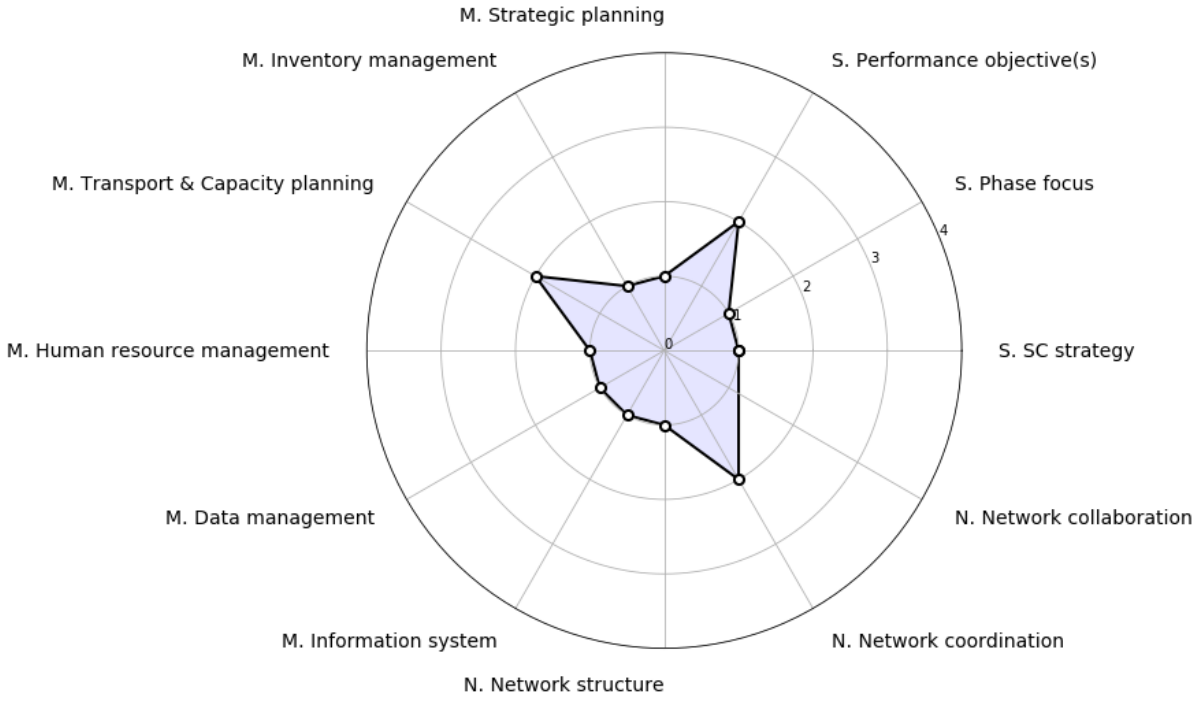

Figure 2. IRC supply chain assessment results regarding the 4 different maturity levels displayed in a radar chart. 'S.' stands for strategy 'M.' for management and 'N.' for network.

Discussion

As it can be seen, two third of the improvement areas are positioned in the first level while the rest remains in the

second level. Such result is not completely surprising, in the sense that, Van Wassenhove in 2006 has already underlined the delay of humanitarian organization compared to the private sector regarding efficient supply chain. It is also encouraging and shows where IRC's attention should be focused on the future. Moreover, quite recently, before the access to this evaluation, they feel the need for developing and integrating their data management tools to gain in visibility and embarked on the path toward more efficiency.

CONCLUSION & FURTHER RESEARCH

Over the past years, humanitarian organizations have largely been criticized for their lack of effectiveness regarding their mission of assisting vulnerable populations (Haavisto and Goentzel 2015). However, few research have investigated what ideal should humanitarian organization tend toward and the path to undertake in such transformation. In this perspective, this paper intends to overcome this situation by proposing a supply chain maturity model specifically addressed to the humanitarian sector. In the form of a two-dimension matrix, the table aims at: 1) objectify one organization's position regarding its transformation journey 2) shows the next improvement areas to concentrate on as a roadmap. For now, such a model has been developed with only a theoretical approach with concepts extracted from a literature review. Next step would be to take the pulse of practitioners regarding the model and discuss the vision behind. Same with the assessment result that is subjective and produced according to your perception of the organization. Moreover, we are aware that the placement on the grid is a bit subjective for now. Particularly, if the respondent feels puzzled in situations where the capability is performed but not fully controlled. To overcome this absence during the assessment, probably a survey should be developed integrating a Likert scale where the respondent could fill in the intensity of the behavior regarding the statement (strongly disagree, …, strongly agree). Finally, it is important to recall that this model should not remain static and is expected to evolve. Indeed, according to Spitzer, there is no end road in being more performant. It is a cyclic process that coordinates with an ever-changing context and expectations.

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