DEVELOPING A HUMANITARIAN SUPPLY CHAIN ASSESSMENT TOOL

Ruth Banomyong[1], Paitoon Varadejsatitwong[1], Pairach Piboonrungroj[2]
[1]Centre for Logistics Research (CLR), Thammasat Business School
Thammasat University, 2 Prachan Road, Prannakorn District , Bangkok, Thailand, 10200
[2] Supply Chain Economics Research Centre (SCERC), Faculty of Economics,
Chiang Mai University, 239 Huay Kaew Raod, Chiang Mai, Thailand 50200

Introduction

Humanitarian supply chains tend to be unstable, prone to political and military influence, and inefficient due to lack of joint planning and inter-organisational collaboration (McLachlin et al., 2009). This means that humanitarian supply chain management not only deals with delivering goods, materials or information to the point of consumption for the purpose of alleviating the suffering of vulnerable people, but also to manage value for donors and other stakeholders. Many humanitarian organisations have tried to develop several performance tools in order to assess their supply chain capability such as the Post Disaster Need Assessment by UNPD and Disaster Preparedness tools by the Red Cross. However, these tools were developed from functional ghettos and so, on their own, do not fit well with more cross-functional assessment tools required by today's best organisations. Furthermore, the academic's evidence showed that the total number of research articles in this specific field of performance measurement is still low compared to the commercial sector. There are many valuable contributions based on theory and models, but the number of contributions that deal with tools developments in humanitarian supply chains performance measurement is limited (Banomyong et al., 2017).

It is therefore necessary to be able to assess humanitarian organisations' supply chain performance as their capabilities are reflected when providing humanitarian aid. Even though each humanitarian disaster is different, there is still a need to assess the initial supply chain response capability of humanitarian organisations involved in each disaster phase. The purpose of the paper is to propose a "toolbox" to assess humanitarian supply chain performance under different phases. The paper will present the scope and the main tools that are used according to disaster phases. The contribution of this proposed toolbox is to become a reference toolkit when assessing the supply chain performance of humanitarian organisations. Figure 1 define the scope of the developed Humanitarian Supply Chain Assessment Toolbox (HumSCAT).

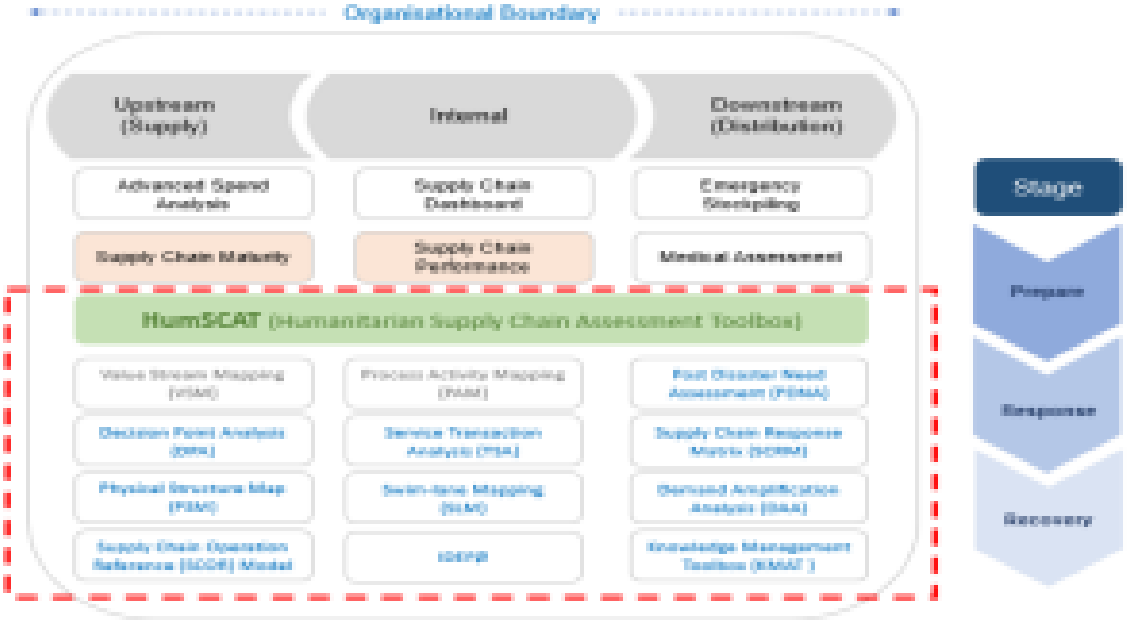

Figure 1 : HumSCAT in the Unified Humanitarian Supply Chain Reference Model

The initial version of this toolbox was developed based on the Quick Scan Audit Methodology or the QSAM which has been used in the automotive and retail industry. It was observed that the QSAM could not fully fit the humanitarian context and it is necessary to map processes within different phases of disasters. The proposed Humanitarian Supply Chain Assessment Toolbox (HumSCAT) has been developed as a diagnostic approach designed to perform health checks of a given humanitarian logistics and supply chain. The objective of the HumSCAT is to enable logistics and supply chain researchers/consultants to obtain operational assessment and accurate performance while minimising disturbance to the organisation. The HumSCAT provides a set of assessment and analytical tools in the three main phases of humanitarian supply chain; (1) prepare, (2) response and (3) recovery. HumSCAT should be used when assessing the initial preparedness capability of humanitarian organisations or after response has been delivered. The overview of the three stages of humanitarian supply chain used in the HumSCAT can be outlined according to each phases' objectives and the mapping and evaluation tools described in Figure 1.

The HumSCAT methodology

The HumSCAT is a team-based approach that includes 'key stakeholders' from the host humanitarian organisation so that both sides contribute considerably to the assessment programme. It takes four researchers one man-week each to fully audit the supply chain of a humanitarian organisation; during which period around half of the time is spent onsite disrupting managers' time. The HumSCAT allow researchers with a range of expertise to work together and build a consensus view of real-world humanitarian supply chains. To this end a battery of tools and checklists are used that ensure comparability and standardisation. There are 13 of quantitative and qualitative tools that facilitate cross-comparisons and triangulation of subjective data sources. There are seven potential tools which can contribute to the objectives of each stage and certain identified tools can even be used in more than one phase as shown in Figure 2.

Note: Some tools may be applied across stages. Data used in different tools may be integrated.

Figure 2: HumSCAT framework stages

The first phase of "prepare" is to understand the nature and characteristics of the current humanitarian supply chain so that one can design and plan accordingly. The "response" phase is when humanitarian supply chains need to be operated according to the plan and logistics need to flow as designed. The last phase is to recover the situation back to default where the objective of the toolbox is to assess the performance and create a learning culture with knowledge management (KM). Last but not the least, a critical phase of HumSCAT is the final feedback presentation, during which the improvement

opportunities are discussed, constraints regarding the proposed solutions are identified and future action plans are agreed which needs to be done for each stage. To summarise the role and expected benefits of each tool over the three phases, the following Table 1 compare the applications of each tool in each phase of humanitarian supply chain.

Tool	Prepare	Response	Recovery
Objective	**To understand**	**To respond**	**Post assessment & Knowledge Mgt.**
1) Value Stream Mapping	whole picture	To track the whole picture	To simplify the workflow
2) Decision Point Analysis	decision making process	Decision making	To synchronise the decision making (collaboration)
3) Physical structure map	physical distribution structure	physical distribution structure	NA
4) IDEFØ	I-O/Control/ Mechanism	To understand the IOCM in response	IOCM in the recovery process
5) Process activity mapping	Activities (VA/NVA/NNVA)	To map the response operations	Confirm final process
6) Swimlane mapping	service delivery by whom	Service delivery in the response	NA
7) Service transaction analysis	service quality	NA	NA
8) Supply Chain response matrix	NA	Inventory control	NA
9) Demand amplification	NA	Avoid bullwhip effect	NA
10) Post disaster assessment	NA	NA	Overall assessment
11) SCOR model	Framework	NA	Supply Chain Performance
12) SERVQUAL	NA	NA	Service Quality Gap
13) KMAT Assessment tools	NA	NA	KM capability

Table 1 : an applications of each tool in each phase of humanitarian supply chain
Source: The Authors

The 13 identified tools in HumSCAT are described hereunder:

Value Stream Mapping
The main purpose of value stream mapping (VSM) is to obtain a holistic picture of the whole supply chain. VSM include a set of symbols for players and activities in a given supply chain. Time and distance can be identified in the VSM. The knowledge of all key players in the supply chain, time and distance between each stage, information flow and methods of communication, and number of staffs are required. The expected output is the current state in order to understand what is going on in the supply chain and the future state for improvement purposes.

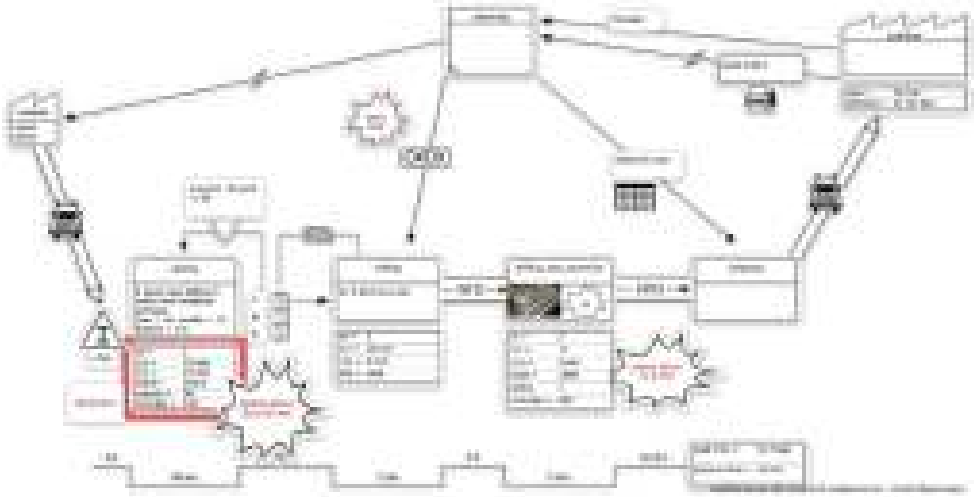

Figure 3: Value Stream Mapping

Decision Point Analysis (DPA)

The decision point is the point in the supply chain where actual demand-pull gives way to forecast-driven push. In other words, it is the point at which products stop being made according to actual demand and instead are made against forecasts alone (Hines and Rich, 1997). DPA requires access to the decision-making process for demand pulling system and forecast-based decision making in the supply chain.

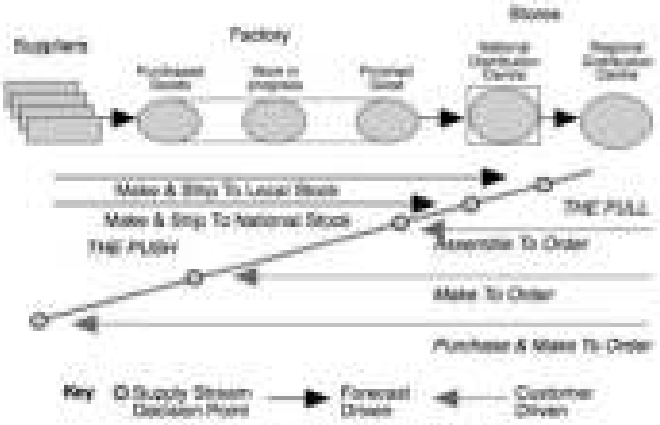

Figure 4: Decision Point Analysis

Physical Structure Map (PSM)

The physical structure map is useful in understanding what a particular supply chain looks like from an overview or industry level. The use of PSM could inform the humanitarian logistics and supply chain manager to understand how a particular supply chain may look like from an overview level. The knowledge of the structure of the event relief such as number of organisations, tiers in the humanitarian supply chain, and cost added in each tier.

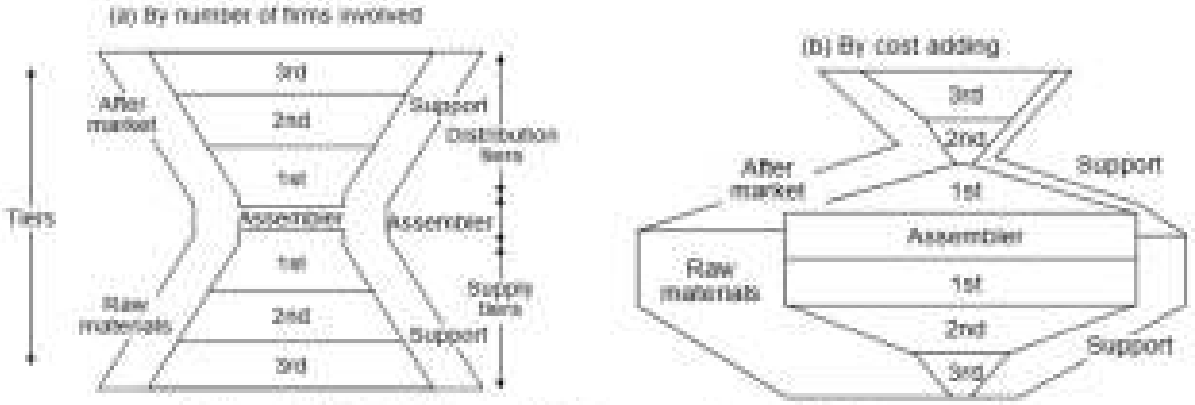

Figure 5: Physical Structure Mapping-an automotive industry example

Integration Definition for Function Modelling (IDEFØ)

IDEFØ is a method designed to model the decisions, actions, and activities of an organization or system. Effective IDEFØ models help to organize the analysis of a system and to promote good communication between the analyst and the customer. IDEFØ is useful in establishing the scope of an analysis, especially for a functional analysis. As a communication tool, IDEFØ enhances domain expert involvement and consensus decision-making through simplified graphical devices. As an analysis tool, IDEFØ assists the modeller in identifying what functions are performed, what is needed to perform those functions, what the current system does right, and what the current system does wrong. Thus, IDEFØ models are often created as one of the first tasks of a system development effort.

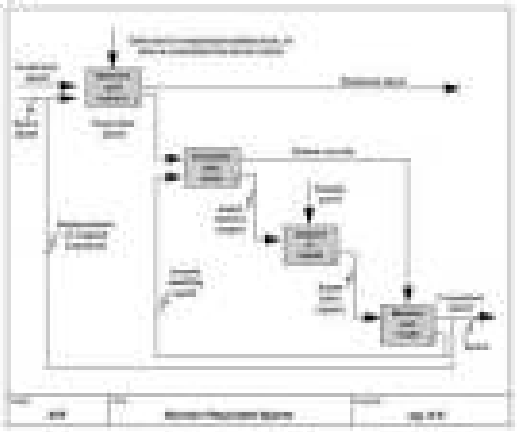

Figure 6 : IDEFØ

Process Activity Mapping (PAM)

Process activity mapping has its origins in industrial engineering. Industrial engineering comprises a group of techniques that can be used to eliminate from the workplace, waste, inconsistencies and irrationalities, and provide high-quality goods and services easily, quickly and inexpensively. The completed diagram can then be used as the basis for further analysis and subsequent improvement.

Time Use	Current Process	Improved Process	Changes
Value added activities (Minutes)	64.4	42.5	-1.9
Non-value added activities (Minutes)	318.0	90.5	-230.3
All activities (Minutes)	379.2	133.0	-236.1
Proportion of value added activities	16.97%	46.82%	177.5
Number of people in processes	10	7	-3
Number of steps	28	20	-8
Average steps per staff	2.80	2.86	4.04

Figure 7: Process Activity Mapping

Swim Lane Mapping (SLM)

Swim lane diagram is a visual element used in process flow diagrams, or flowcharts that visually distinguishes job sharing and responsibilities for sub-processes within a business process. Swim lanes may be arranged either horizontally or vertically. It is useful for service operations where there are multiple operators serving customers in each process. This fits the humanitarian supply chain context.

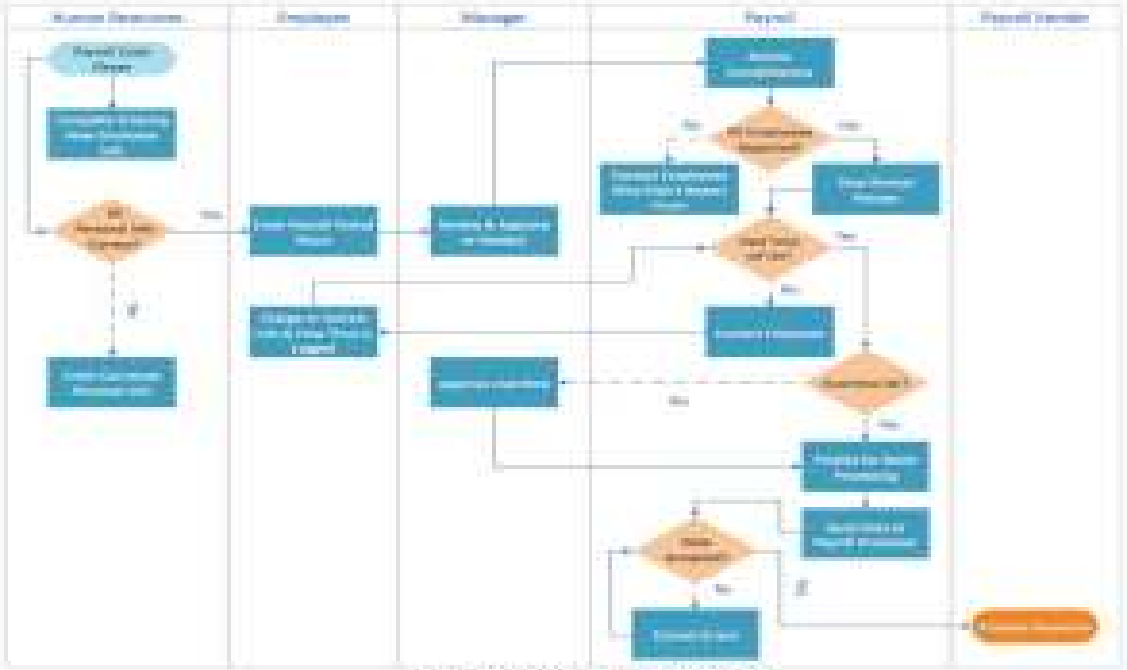

Figure 8: Swim Lane Mapping

Service Transaction Analysis (STA)

Customer experience, along the service process and transactions can be assessed and mapped along with the processes in service operations, using the tool called "Service Transaction Analysis" or STA.

This technique could be implemented by either in-house operators or external consultants (Johnston, 1999).

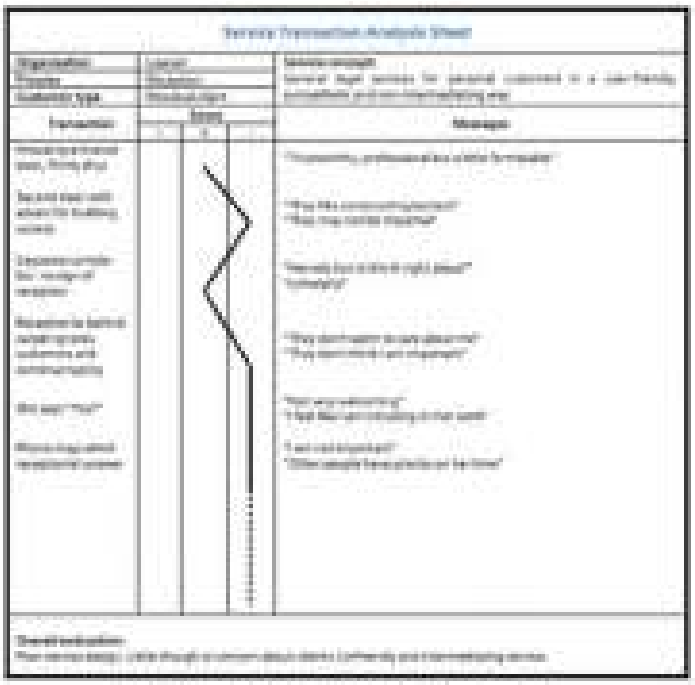

Figure 9: Service Transaction Analysis

Supply Chain Response Matrix (SCRM)

Supply Chain Response Matrix focus on logistics operations and their time-constrained. It was used by New (1993) and by Forza et al. (1993) in a textile supply chain setting. This mapping approach seeks to portray in a simple diagram the critical lead-time constraint for a particular process.

In this case, it is the cumulative lead time in a distribution company, its suppliers and its downstream retailer. In Figure 10 the horizontal measurements show the lead time for the product both internally and externally. The vertical plot shows the average amount of standing inventory (in days) at specific points in the supply chain.

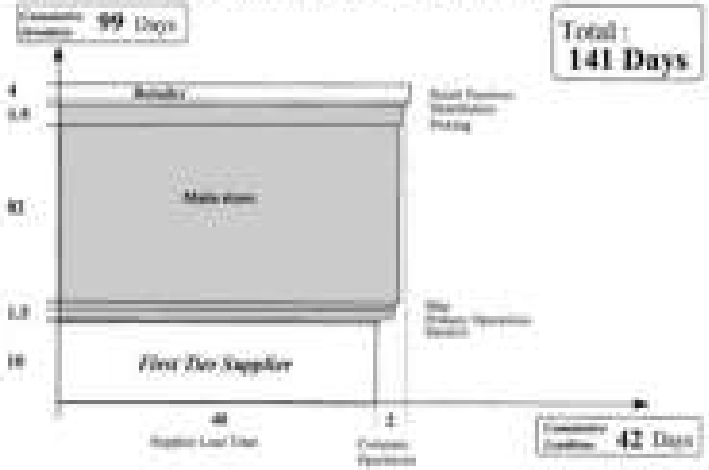

Figure 10: Supply Chain Response Matrix

Demand Amplification Analysis (DAA)

Demand Amplification Analysis aim is to detect a supply chain problem when variation of demand is amplified from downstream to upstream, called the "Bullwhip Effect". This problem may cause increased supply chain cost and lower service level. DAA required the knowledge of:

(1) Ordering demand at each stage of supply chain, and;

(2) Ordering policy of each supply chain member.

This simple analytic tool can be used to show how demand changes along the supply chain in varying time buckets.

This information then can be used as the basis for decision making and further analysis to try to redesign the value stream configuration, manage the fluctuations, reduce the fluctuation or to set up dual-mode solutions where regular demand can be managed in one way and exceptional or promotional demand can be managed in a separate way.

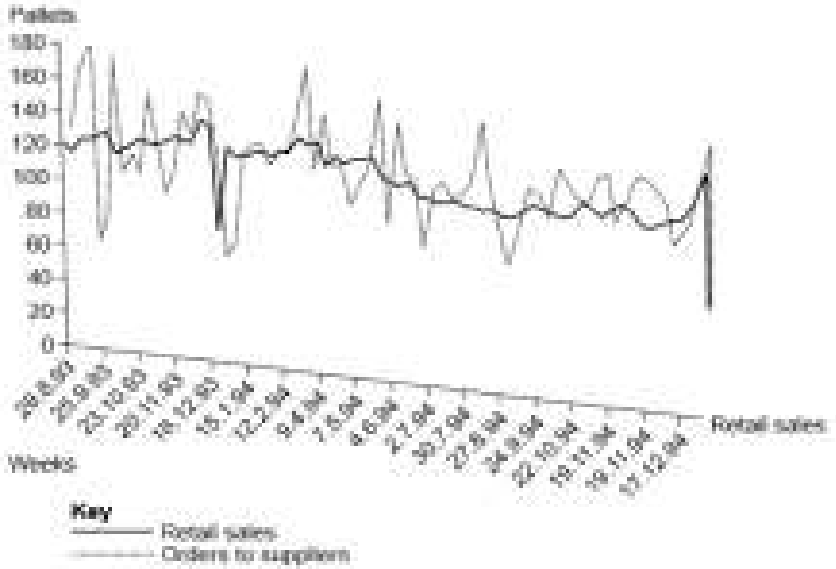

Figure 11: Demand Amplification Analysis

The Post Disaster Need Assessment (PDNA) Guide

The overarching purpose of the PDNA Guide is to provide improved support to governments in post-disaster recovery assessments and planning through a more coordinated approach. The more immediate objective of the PNDA Guide is to provide an agreed framework and predictable arrangements for effective and efficient coordinated support from the EU, the UN and the WB to governments requesting international assistance for post-disaster recovery and reconstruction.

The SCOR Model

One of the more famous supply chain diagnostic methods which has been used, referred, and implemented so far is the, "Supply Chain Operations Reference Model" (called as SCOR model). The implementation of a SCOR Model within a firm could benefit the business through the benchmarking of a holistic view of the supply chain, both internally and externally. This important supply chain model was created and developed by the Supply-Chain Council. The latest version of SCOR model is 9.0.

The SERVQUAL

The SERVQUAL (service quality) model was developed by Parasuraman, Zeithaml and Berry in 1988.

It highlights the main components of high quality service. The SERVQUAL authors originally identified ten elements of service quality, but in later work, these elements were collapsed into five dimensions: reliability, assurance, tangibles, empathy and responsiveness.

Businesses using SERVQUAL to measure and manage service quality deploy a questionnaire that measures both the customer expectations of service quality in terms of these five dimensions, and their perceptions of the service they receive. When customer expectations are greater than their perceptions of received delivery, service quality is deemed low. Key outputs of SERVQUAL is the knowledge of the 7 gaps in the current state of services.

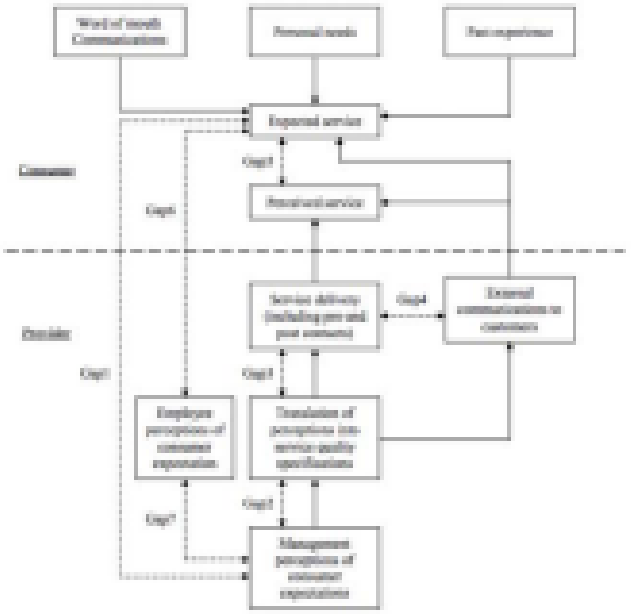

Figure 12: SERVQUAL

The Knowledge Management Assessment Tools (KMAT)

The KMAT was developed jointly by Arthur Andersen and the American Productivity and Quality Center. The database currently contains data from more than 140 companies, ensuring benchmarking of the highest quality. KMAT aims to assess knowledge management of an organization. KMAT focuses on five sections: (1) Process; (2) Leadership; (3) Culture; (4) Technology; and (5) Measurement. KMAT is a diagnostic survey that helps an organization determine the effectiveness of its knowledge management practices. Includes a thirty-question survey, administer and employee scoring sheets, and scoring interpretation instructions.

Summary

The purpose of the paper was to propose a "toolbox" to assess humanitarian supply chain performance under different phases. The identified tools can effectively be applied, singularly or in combination to the requirements of the individual disaster phase. The HumSCAT has been designed to be largely conceptual in nature and it is useful to suggest a number of missing pieces or unresolved issues in our knowledge and application of humanitarian logistics and supply chain management. The main development of HumSCAT is to offer a set of appropriate assessment and analytical tools in the three main humanitarian phases: (1) prepare, (2) response and (3) recovery. In each phase, seven potential identified tools can contribute to the objectives of each stage as highlighted in Table1. Some tools can be used in more than one phase so in total there are 13 tools available within HumSCAT. Such tools are adapted from those used in manufacturing and service based supply chain.

The limitations of HumSCAT is that it: (1) requires a considerable amount of tactic knowledge from the team members; (2) is not easily transferable to organizations as a change management tool; and (3) requires considerable amount of training of team members for them to be conversant in the various tools. In order to mitigate these limitations while retaining the strengths further validation and research is being undertaken to improve the HumSCAT. The HumSCAT is intended to be a self-assessment toolbox so that individual organisations may undertake their own diagnostic and enable the participation of all stakeholders in evaluating overall humanitarian supply chain processes. In undertaking this task, it is necessary to further validate the various tools in HumSCAT within a number of humanitarian supply chains so as to finalise the toolbox.

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