A Sustainability Maturity Assessment Method for the Humanitarian Supply Chain

Laguna-Salvadó, Laura; Lauras, Matthieu; Comes, Tina

Publication date
2018

Document Version
Final published version

Published in
Proceedings of the 15th ISCRAM Conference

A Sustainability Maturity Assessment Method for the Humanitarian Supply Chain

Laura Laguna Salvadó
IMT Mines Albi, France
llagunas@mines-albi.fr

Matthieu Lauras
IMT Mines Albi, France
lauras@mines-albi.fr

Tina Comes
TU Delft, the Netherlands
University of Agder, Norway
t.comes@tudelft.nl

ABSTRACT

The Humanitarian Supply Chain (HSC) is key to successful relief operations. Today, HSC managers faces many challenges: (1) the increasing gap between funding and appeals; (2) donors ask for more transparency and accountability; (3) the growing pressure to switch to sustainable development. To maintain a competitive position (order winner) in the near future, considering sustainability becomes a fundamental addition to the established effectiveness and efficiency measures. In literature, the lack of Decision Support Systems for planning and achieving of sustainability objectives is described as barrier to sustainable humanitarian operations. We propose a sustainability maturity assessment method to improve the sustainability of HSC operations. Using the information gathered from field research with the IFRC as well as from the literature a proof of concept is presented to demonstrate the relevance of the proposal.

Keywords

Sustainable performance, maturity assessment, Humanitarian Supply Chain, decision support

INTRODUCTION

Humanitarian Supply Chain (HSC) management has evolved over the past decades from a reactive 'fire-fighting' to a performance-oriented approach that is focusing on efficiency and effectiveness. To this end, Humanitarian Organizations (HOs) have invested in the professionalization of HSCs, the respective tools and skills (Jahre 2008). Until now, the main objectives of the management of an HSC have consisted in improving competitiveness by effectively managing supply flows, while minimizing costs.

However, there is increasing recognition that efficiency and effectiveness alone are not sufficient to address the global sustainability challenges. The HSC needs to evolve and consider sustainability for near-future operations management. Thus, sustainability is a new paradigm for HSC managers that has been identified as a future requirement to maintain an "order winner[1]" position.

HOs are concerned about the sustainability of disaster response, but difficulties remain for HSC decision-makers to integrate sustainability into their decisions. Therefore, there is a call for more research that addresses issues of sustainability in HSC planning and decision-making (Haavisto and Kovács 2014; Klumpp et al. 2015; Kunz and Gold 2017).

[1] The terms "order winners" and "order qualifiers" refer to the factors that may lead to competitive advantage and market success.

This paper answers to this call by exploring a maturity assessment approach to quantify the maturity level of a HSC system's sustainability. Based on literature review, we propose a maturity assessment model, and illustrate it with a use case based on the IFRC HSC network.

This contribution is part of a research project, which aims to develop concrete solutions to support sustainable decision-making in HSCs with a scientific, applied research approach. The main difficulty is to develop decision-support systems adequate for humanitarian needs and uses. One of the biggest criticisms in the HSC literature review is the barrier between scientific proposals and field acceptance (Holguín-Veras et al. 2012). Several authors conclude that field-grounded research should allow for building more adequate proposals (Chan and Comes 2014; Laguna Salvadó et al. 2015). Kunz et al. (2017) highlight the importance for both academics and practitioners to "jointly define research projects". Field-oriented research is a requirement for adequately developing applied research proposals to enhance a Sustainable HSC (SHSC). Therefore, this research process has been carried out in close relation with the IFRC, which explicitly shared the interest in moving towards an SHSC, and has contributed by providing information and feedback.

The paper is structured as follows: a background section provides an overview of HSC sustainability and maturity models. Then, a proposal section details the maturity model, which is illustrated in the IFRC use case section. Finally, a discussion and conclusions section discusses limitations of this work and outlines future research opportunities.

BACKGROUND

HSC Sustainability

Sustainability is a young topic in the field of SCM. Academic publications have appeared since the year 2000, but they are primarily of qualitative nature. Ashby et al. (2012) show that even though the concern for sustainability is widespread, there is a gap between intentions and implementation. They also warn of the gap between management research and practice.

Based on the Triple Bottom Line (TBL) model, it is widely accepted to present sustainability as the balance between environmental, societal and economic dimensions. TBL is a systemic approach developed in the mid-90s by John Elkington to "*capture the essence of sustainability by measuring the impact of an organization's activities including its profitability and shareholder values and its social, human and environmental capital*" (Savitz 2012). It stresses the need to achieve a minimum in performance for the three dimensions. However, there is no consensus regarding the trade-offs and synergies across the economic, environmental and social objectives in a humanitarian context. Moreover, there is not a standard definition for each dimension.

However, previous research set up concrete criteria, objectives and KPI sets for assessing the operations impact in the TBL approach. Figure 1 illustrates the proposed approach with the "House of Sustainable HSC Operations" (Laguna Salvadó et al. 2017).

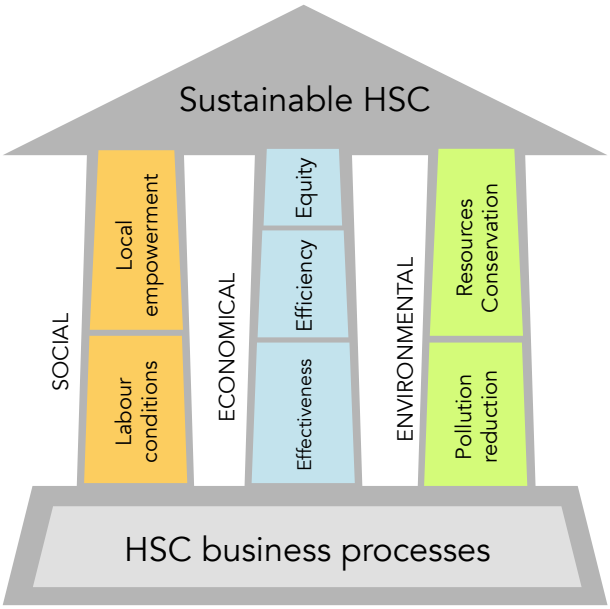

Figure 1 The House of HSC Sustainable Operations

The House of Sustainable HSC (SHSC) Operations is based on the HSC operational processes: Procurement, Warehousing and Transportation. Each pillar is built on one of the TBL performance criteria. To enhance an overall sustainable performance, the three pillars have to be balanced, so the roof is in equilibrium. This image reflects the importance of considering all the TBL performance objectives to enhance an overall sustainable performance. Carter and Rogers (2008) emphasize that organizations that seek to maximize the performance of all three pillars simultaneously will outperform organizations that only maximize the economic performance, or the ones that attempt to achieve high levels of social and environmental performance without explicit considerations of economic performance. Therefore, bypassing one of the dimensions, or focusing on just one of them does not contribute to the overall sustainability performance. Figure 2 illustrates some disequilibrium scenarios where the HSC dimensions are not balanced.

The first scenario (a) illustrates the current HSC management approach, where the economic dimension objectives drive HSC decision-making during all the disaster cycle and at all decision levels. There is little awareness of the social and environmental dimensions. This image suggests that the HSC system is not sustainable in the long term. Even if during the response the main driver of operational decision-making are the economic dimension aspects, the consideration of social and environmental dimensions is relevant, for example, at strategic decision-making level, to ensure that humanitarian operations do not jeopardize the livelihoods of communities on the longer term. The second scenario (b) is the opposite case, where the focus is only on environmental and social dimensions, but neglecting the economic sustainability of the organization. The sustainability cannot be enhanced without ensuring the economical prosperity of the organization. The third scenario (c) is a "green HSC" approach, where all efforts are put into reducing the environmental impact. As with the previous scenarios, the sustainability of the HSC is not ensured.

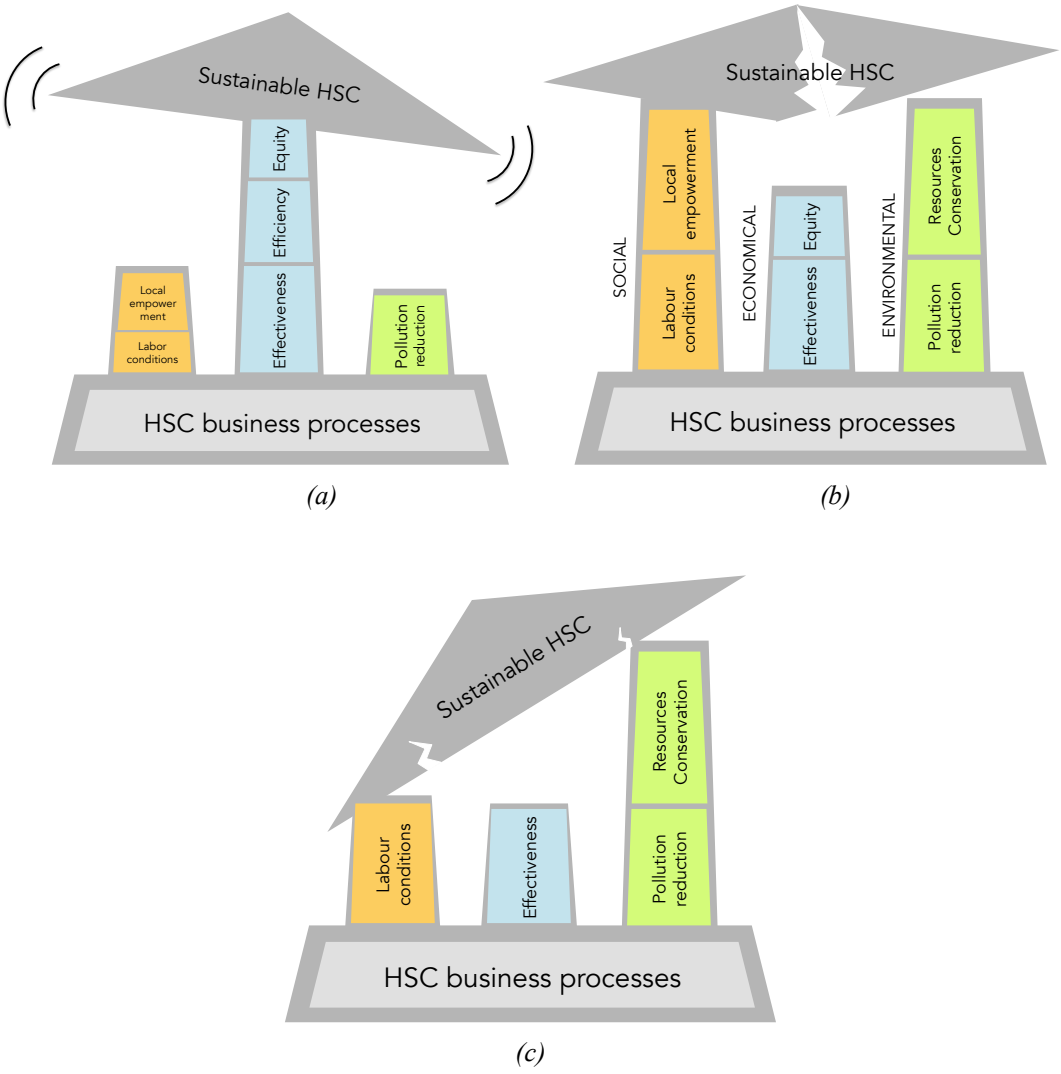

Figure 2 Illustration of HSC operations sustainability conceptual "disequilibrium"

Finally, Figure 3 illustrates the case where all the dimensions are considered, without reaching the maximum performance expectations in any of them. The sustainability is then reached, without excelling in any of the dimensions.

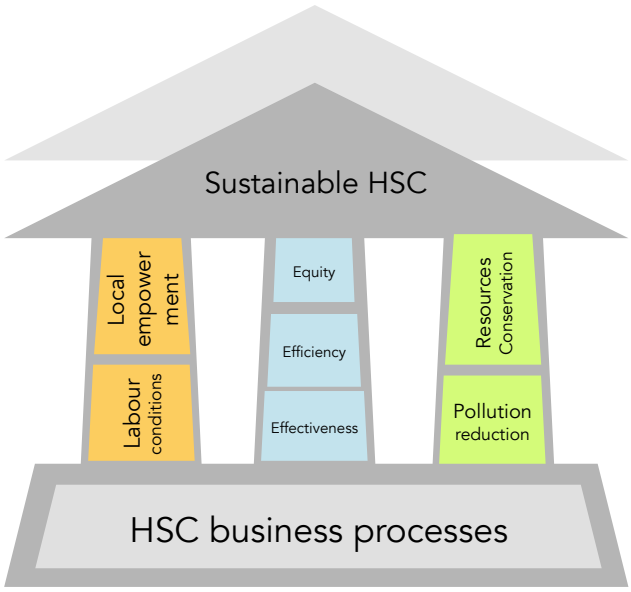

Figure 3 A balanced SHSC performance

Maturity Models

A maturity model is defined by (Battista and Schiraldi 2013) as:

> "*A framework conceived to evaluate the maturity of an organization through the definition of a set of structured levels that describe how well behavior, practices and processes can reliably and sustainably produce required outcomes*".

The origin of maturity models comes from the "Capability Maturity Model" (Paulk et al. 1993), which is used to assess an organization on a scale of five process maturity levels. Each level ranks the organization according to its standardization of processes in areas as diverse as software engineering, systems engineering, project management, risk management, system acquisition, information technology (IT) services and personnel management (Correia et al. 2017).

The use of maturity models to analysis and optimize processes has seen exponential growth in recent years, with encouraging results. Therefore, many authors have focused on the development of SC sustainability specific domain models (Baumann 2011; Golinska and Kuebler 2014; Kurnia et al. 2014; Okongwu et al. 2013; Reefke et al. 2014; Srai et al. 2013). (Correia et al. 2017) recently published a literature review on the topic, and identified the potential uses of Maturity Models as:

- A descriptive tool for the evaluation of strengths and weaknesses
- A prescriptive instrument to help develop a guide (roadmap) for performance improvement
- Comparative tool to evaluate the processes/organization and compare them with standards and best practices from other organizations
- Enablers for internal and external benchmarking

Typically, a method to assess a maturity level consists of measures and questionnaires, which allow the organization to perform self-assessment and benchmarking of their sustainability level. However, there is no standard definition of maturity levels. As an example, Baumann (2011) proposes an analytical evaluation model to characterize the global performance of an SC based on performance measurement aggregation, which is built on the TBL dimensions. The maturity of sustainable practices is defined on 4 levels proportional to the degree of implementation.

PROPOSAL: SHSC MATURITY ASSESSMENT

In the background section, we have defined the elements that impact the sustainability of a HSC. Once sustainable performance dimensions and sub-dimensions have been defined with the "House of HSC sustainable operations",

the challenge remains to measure them. This section suggests a maturity assessment model that enables quantification of SHSC performance.

The assessment model it involves both benchmarking and monitoring SHSCs. Benchmarking allows internally or externally different systems or sub-systems to be compared, for example disaster responses, or for the case of the IFRC, the Regional Logistic Units (RLUs) (Laguna Salvadó et al. 2016). Monitoring enables the evolution of a system over time to be assessed, and therefore drive the performance.

Assessment model

A performance maturity level assessment, based on the TBL dimensions and sub-dimensions, is a way to measure the sustainability of the HSC. For this specific purpose, we suggest using a quantitative and symbolic modeling approach (Figure 4). The SHSC maturity is built on the maturity of each of the TBL dimensions, defined here by five levels:

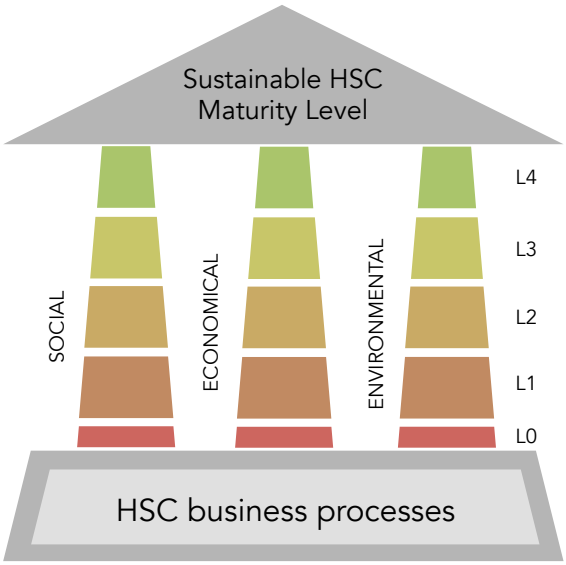

Figure 4 HSC sustainable performance maturity levels

- L0 – Unaware: The sustainable performance dimension is not considered at all by decision-makers. There is no information.
- L1 – Beginner: Decision-makers are aware, but quantitative/qualitative results are not satisfactory.
- L2 – Medium: The performance dimension results are mitigated or insufficient.
- L3 – Good: The performance dimension is well considered and results are satisfactory.
- L4 – Expert: Decision-Makers are able to make decisions in alignment with the objectives of this dimension and considering the whole HSC (upstream and downstream). The quantitative results are excellent.

Assessment method

To define the maturity level of the SHSC, first of all, each of the maturity sub-dimensions has to be assessed. The suggestion is to use either qualitative or quantitative metrics, with an assessment grid that makes it possible to define one maturity level per sub-dimension.

Secondly, once the sub-dimensions are assessed, the maturity level of each dimension of sustainability is deduced by taking the lowest sub-dimension maturity level. All the sub-dimensions are considered of equal importance because the objective is to enhance equilibrium.

Finally, a global HSC sustainability maturity level can be deduced. Based on the House of SHSC principle, which encourages equilibrium within the TBL dimensions, the method to deduce the global level is also to take the

lowest dimension level. Therefore, as long as one of the dimensions is mostly ignored, the symbolic global level will remain at L0. The objective is to highlight which are the dimensions that should be improved as a priority in order to improve sustainability with a balanced approach.

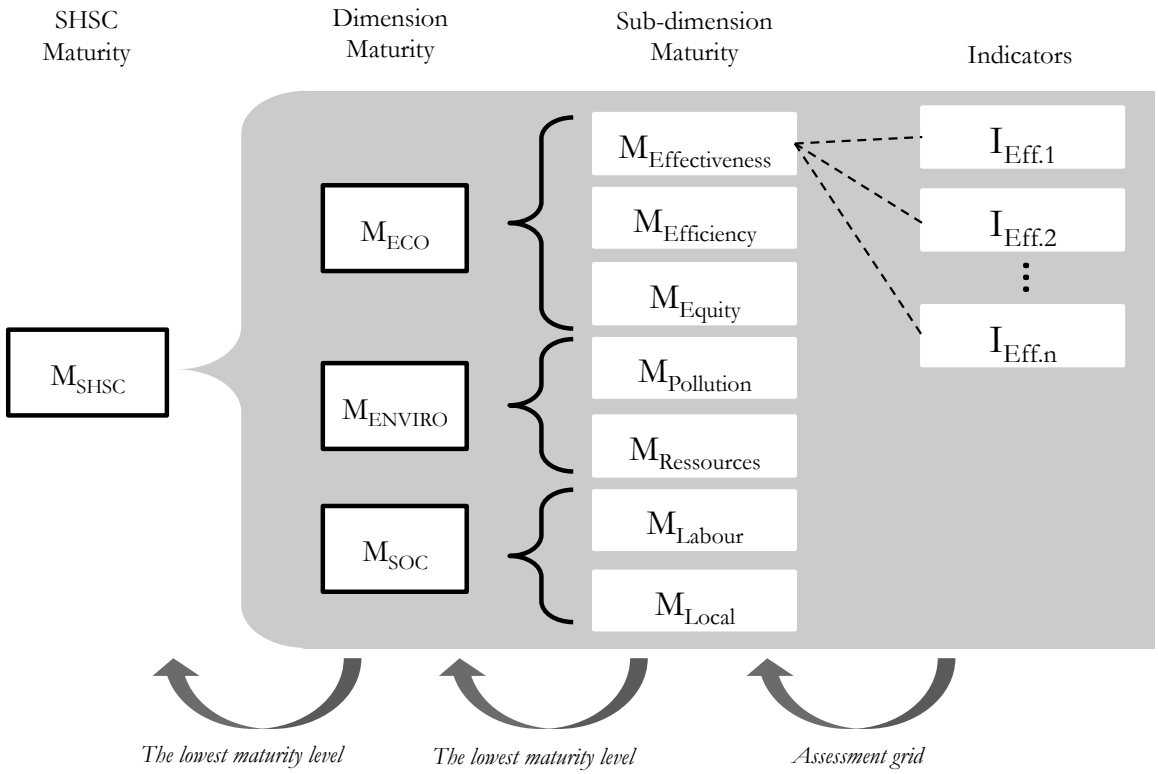

Figure 5 SHSC Maturity assessment method

A PROOF OF CONCEPT: ASSESSING THE SUSTAINABILITY OF IFRC HSC

The network of the IFRC HSC upstream is composed of five Regional Logistics Units (RLU) strategically located in Panama, Kuala Lumpur, Nairobi, Beirut and Budapest, which holds contingency stocks to respond to humanitarian needs. Moreover, sub-regional logistics units (LU) based at the country level with the support of the NS are connected to each RLU. This second layer, which responds to the need to get closer to beneficiaries, is still under deployment. LU stocks are located inside (IFRC National Societies) NS warehouses as part of the RLU contingency stock. The operational mode is linear: the regional hub manages all warehouse procurement, and each sub-regional warehouse distributes only to internal country needs.

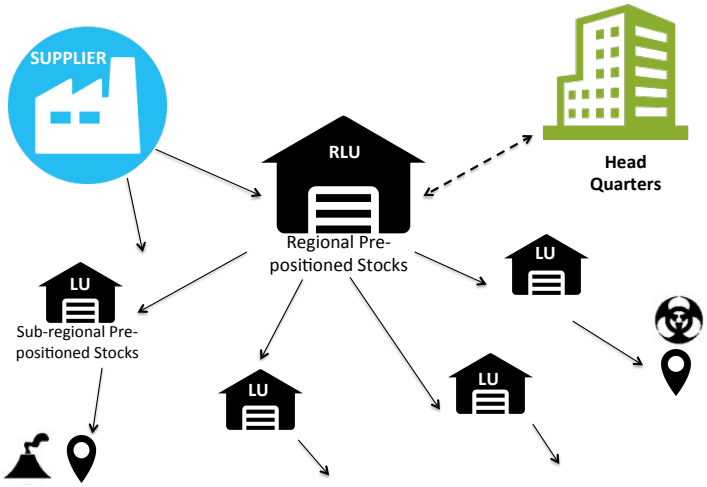

Figure 6 IFRC Regional HSC network design

To illustrate how to use the SHSC maturity assessment model, we built a use case based on the IFRC American & Caribbean (A&C) RLU operations. First, a set of the metrics and the assessment grid are defined, and secondly, the results are given and interpreted.

Assessment metrics & grid

The metrics to assess the sustainability performance can be either quantitative or qualitative. As long as the objective is to define a performance level for each of the sub-dimensions, we consider a quantitative measure if possible (a ratio can be defined). Otherwise, we have defined a qualitative assessment of the criteria, which is based on the practitioner's appreciation of the dimension (i.e. for the labor conditions). The metrics are inspired by previous discussion, and are illustrative. Depending on the HO, the criteria to define each of the sub-dimensions, as well as the measures, may be different.

Table 1 Sustainability performance metrics per dimension

TBL	Sub-dimension	Criteria	Typology	Measurement
Economic	**Effectiveness**	Demand satisfaction	quantitative	$\frac{\text{Needs coverage on time}}{\text{total demand}}$
	Efficiency	HSC Cost ROI	quantitative	$\frac{\text{(Net incomes-HSC Cost)}}{\text{Net incomes}}$
	Equity	Non-discriminatory distribution	quantitative	Gini Index (beneficiary inequality)
Environmental	**Pollution reduction**	Carbon footprint	qualitative	Appreciation
	Resource conservation	Reduction resource consumption	qualitative	Appreciation
Social	**Local community development**	Local procurement	quantitative	$\frac{\text{CHF expended locally}}{\text{CHF total expenses}}$
	Labor conditions	Employee management	qualitative	Appreciation

All economic sub-dimensions are quantifiable. For effectiveness, the ratio between the total needs over a time period, and the needs covered on time are considered. For efficiency, we consider a HSC Costs RoI (Return of Investment). A negative RoI result implies that the HSC system loses money, and a positive gives the margin that is generated. The equilibrium is around 0, considering that the objective is not to make a profit but to maintain the activity. For equity we propose using the Gini Index, as suggested by (Tzur 2016). It allows the inequalities within the distribution to be determined, where 0 indicates that there is no inequality.

The environmental sub-dimensions are both qualitative. The overall objective is to reduce both the carbon footprint and the consumption of resources. Given that it is not possible to normalize these absolute values, we define different maturity levels in Table 2. The Carbon Footprint levels are based on the LCA assessment approach, which seeks to include the whole product lifecycle (from raw materials to end of life). For resource conservation (reducing consumption) the levels are similar, considering consumption of resources such as water, energy, packaging, etc. Therefore, expertise is reached when the Carbon Footprint and LCA sub-dimensions are managed upstream and downstream. The high level is also reached by using LCA and resource consumption assessments while planning operations.

Last but not least, for the social sub-dimension, we consider one quantitative and one qualitative factor. Local community empowerment (local procurement) is measured as the ratio of local investment over total investment. At the IFRC, it is not expected that 100% of local investments will be reached in the short term, due to the difficulties in finding some emergency items locally owing to strict requirements, and also because of the framework agreements the organization has with global suppliers. Labor conditions (employee management) are assessed through internal and provider audits. The high level is reached when the labor conditions are considered in the planning phase.

Table 2 SHSC performance assessment grid

		UNAWARE	BEGINNER	MEDIUM	GOOD	EXCELENT
TBL	**Sub-dimension**	**L0**	**L1**	**L2**	**L3**	**L4**
Economic	**Effectiveness**	<10%	10% ≥ Indicator <50%	50%≥Indicator <75%	75% ≥ Indicator <90%	≥ 90%
	Efficiency	<-10%	-10% ≥ Indicator < -5%	-5% ≥ Indicator < 0%	0% ≥ Indicator < 5%	≥ 5%
	Equity	>50%	50% ≥ Indicator >30%	30% ≥ Indicator <10%	10% ≥ Indicator <0%	0%
Environmental	**Pollution reduction**	no info	The Carbon footprint is assessed occasionally	The Carbon emissions are assessed systematically	LCA: The Carbon emissions are assessed internally + externally (upstream and downstream)	SC flows are planned based on LCA impact
	Resources conservation	no info	Resources use is assessed occasionally	A management system for pollution and energy use is in place systematically	A global management system is in place (upstream and downstream)	SC flows are planned to reduce resources consumption
Social	**Local community development**	0%	0% ≥Indicator <30%	30% ≥Indicator <50%	50% ≥Indicator <70%	≥ 70%
	Labor conditions	no info	Occasional Internal assessment	Systematic Internal assessment	Suppliers assessment	SC flows are planned based on labor conditions

Illustrative results

Based on the IFRC A&C field observations and discussion with practitioners, the following illustrative data set was built, with its related sub-dimensions maturity levels.

Effectiveness

Table 3 Data set to assess effectiveness

Order #	Lead time	Grand Total (CHF)	Value delivered on time (<1 week)
1	10.00	650	
2	8.00	9107	
3	7.00	554	554.00
4	28.00	17831	
5	22.00	15000	
6	36.00	5000	
7	5.00	50000	50000.00
8	18.00	50000	
9	9.00	58000	
10	5.00	5000	5000.00
11	1.00	16000	16000.00
12	11.00	28000	
13	15.00	17000	
14	5.00	35000	35000.00
15	5.00	136000	136000.00
16	5.00	32000	32000.00
	TOTAL	**475142**	**274554**
	RATE	**58%**	

The effectiveness is computed as the proportion of orders delivered on time. The data from 2015 A&C IFRC operations do not consider an expected delivery time. For the illustration, the hypothesis is made that an acceptable delivery lead-time is one week (7 days) since orders placed will usually be urgent (Table 1).

Efficiency

In a standard year, it is obvious that response to crises does not generate enough rotation to cover the fixed cost of RLUs. Based on the data of the A&C RLU activity between January and September 2015, an amount of nearly 760,000 CHF was charged to customers for a total number of 41 orders. From this total amount, 56,000 CHF corresponds to a service fee (around 7%), and the rest to the procurement costs (704,000 CHF). The income value, extrapolated over a year, results in a total income of around 1,000,000 CHF, and the procurement costs 940,000 CHF (

Table 4).

The holding inventory costs correspond to the expenses generated due to the inventory's existence (i.e. waste, infrastructure, handling). This value is evaluated at between 20 and 30% of the mean inventory level value for the industry, depending on the deterioration and obsolescence risks. Considering that the A&C IFRC infrastructure is of basic standard, and that emergency items are robust, and only hygiene kits are perishable in the long term, we diminish this value to 10% to make the estimation. Appendix A contains the A&C RLU contingency stock value on September 2015. Considering the hypothesis that this value is close to the mean over the year, the Holding

Costs of the region are around 90,000 CHF over the year (

Table 4).

Table 4 Data set to assess efficiency

	HSC Costs (year)	HSC Incomes (year)
Procurement costs	940,000 CHF	
Holding costs (including handling, waste and infrastructure)	90,000 CHF	
Service Provision Income		1,000,000 CHF
TOTAL	1,030,000 CHF	1,000,000 CHF
RATE	-3%	

If we compute the effectiveness indicator with this data set, considering that the HSC annual Costs are around 90,000, and that the net income (without the procurement costs) is around 75,000:

$$HSC\ Cost\ ROI = {(1{,}000{,}000 - (1{,}030{,}000 +)}/{1{,}000{,}000} = -3\%$$

Without a full data set, it is difficult to establish an exact value for the effectiveness indicator. However, the A&C RLU has clearly stated the difficulties it has in covering the costs (IFRC 2013, 2014)

Equity

In the assessment grid it is suggested that the equity should be assessed based on the Gini Index. The value of this index is between 0 and 1, and represents the level of inequality within a studied population. In this case it is the satisfaction of the customer orders of the HSC. The red line in Figure 7 represents the Lorenz curve (Gastwirth 1972), which plots the proportion of the variable observed of the population (y axis) that is cumulated by the bottom x%. The Gini index is equal to the A area divided by the sum of the A and B areas, that is to say: Gini = A / (A + B). The bigger A is, the higher is the level of inequality.

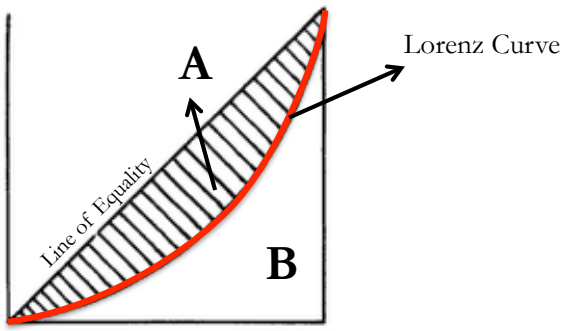

Figure 7 Gini Index

The IFRC A&C decision-makers ensure that if there is a situation where they have to share the upstream resources within different demand points, this will be done equitably (although this situation is not common upstream). Therefore, the Lorenz curve of such a situation is at 45°, and the Gini Index equal to 0, with a perfect equality.

Pollution reduction

There is no data available to compute the CO2 emissions.

Resources conservation

There is no data available to assess the resource consumption.

Local community development

The indicator for this sub-dimension is the proportion of procurement value from local suppliers. Let us consider

the following dataset:

Table 5 Local procurement data set

Order #	Origin	Grand Total (CHF)	Value from local suppliers
1	International	5000	
2	International	2000	
3	International	36000	
4	International	2500	
5	Local	300	300
6	International	2100	
7	International	3000	
8	International	1000	
9	Local	580	580
10	International	600	
11	Local	3000	3000
12	Local	2500	2500
13	International	6000	
14	International	260	
15	Local	1000	1000
	TOTAL	**65840**	**7380**
	RATE		11%

Labor conditions

There is a general standard for the staff rules at the IFRC, approved by the general assembly in 1976. Therefore, it is assumed that there is a systematic internal assessment of the Labor conditions. As part of the supplier selection process, it has to be guaranteed that suppliers:

- Adhere to the Fundamental Principles of the International Red Cross and Red Crescent Movement
- Maintain ethical business practices always
- Are not involved in any form of corruption or any fraudulent activities
- Do not engage in any collusive or coercive practices

The sub-dimensions maturity levels can be deduced using the assessment grid (Table 2).

For the economic dimension, both effectiveness and efficiency performance are well developed, but still far from optimal. The high immobilization of stocks, and the low turnover of inventory cause the level of efficiency to be negative. Regarding effectiveness, the response time is still long, in most cases. Equity is considered as achieved, given that it is considered as a constraint by IFRC decision-makers.

For the environmental dimension, nothing is done to assess and reduce the carbon footprint and resource consumption.

For the social dimension, local procurement is being developed, but it is still difficult to find suppliers that satisfy the requirements in most countries. This indicator could be improved with the development of sub-regional LUs. Regarding the Labor conditions, the IFRC standards are satisfactory, but no information was found on the assessment of their supplier's labor conditions.

Table 6 Illustrative assessment of the A&C RLU

TBL	Sub-dimension	L0	L1	L2	L3	L4	Dimension Maturity level
Economic	**Effectiveness**			x			**L2**
	Efficiency			x			
	Equity					x	
Environmental	**Pollution reduction**	x					**L0**
	Resource conservation	x					
Social	**Local community development**		x				**L1**
	Labour conditions				x		

To increase the readability of the assessment grid, these results can be presented in the form of a radar graph (Figure 8). Each TBL dimension is then assessed as the lowest one within its sub-dimensions levels (

Table 6). The global maturity level of the A&C RLU is also defined by the lowest dimension level (L0), as showed in Figure 9.

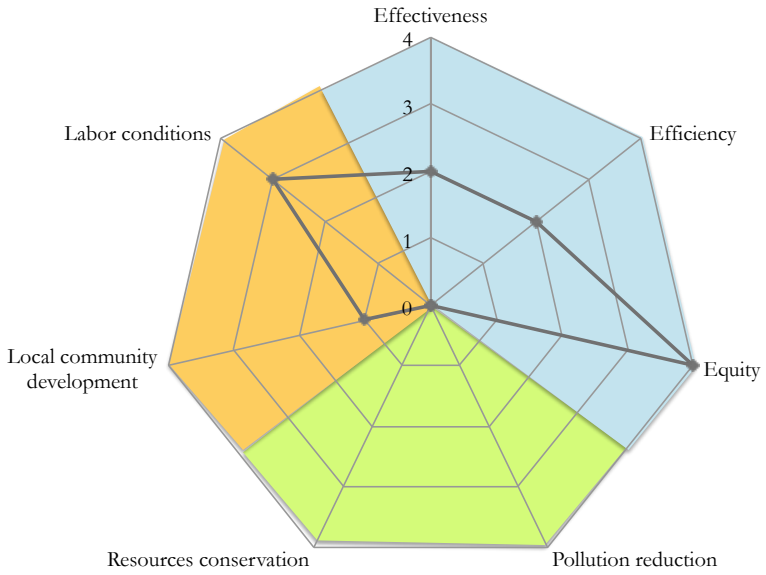

Figure 8 A&C RLU SHSC sub-dimensions performance maturity level (radar graph)

A simple analysis of the results from the SHSC maturity assessment allows us to identify the sub-dimensions that have to be prioritized in order to achieve a more balanced sustainability performance.

This result shows that the environmental dimension is completely overlooked by decision-makers at the A&C RLU. Based on this model approach to improving the overall SHSC performance, the priority should be to work on both environmental sub-dimensions. The social dimension also remains in a lower maturity level than the economic dimension, as is predictable, given that the SHSC is still in its infancy.

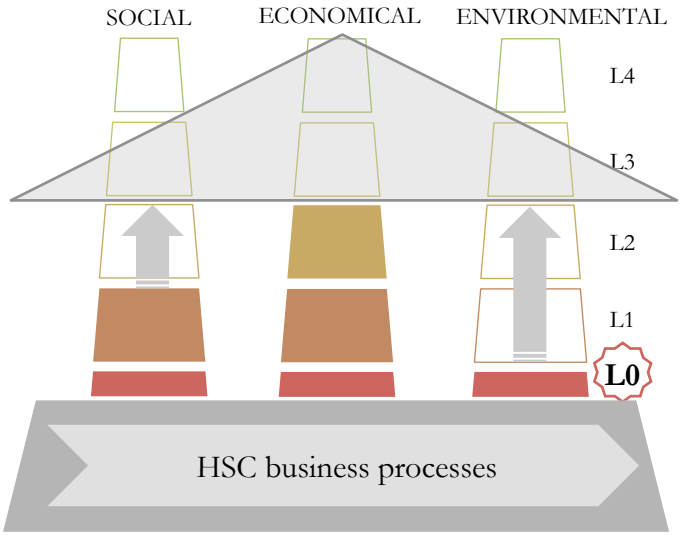

Figure 9 A&C RLU SHSC performance maturity level

DISCUSSION & CONCLUSIONS

The literature review and previous research show the challenge for HOs to consider sustainability in their decision-making processes. Based on the TBL performance approach, environmental and social dimensions should be added to the economic performance dimension. The objective of this paper is to use the "House of SHSC operations" framework for assessing the performance of SHSC operations.

The "House of SHSC operations" is a general framework that stresses the need to consider the three TBL dimensions to enhance SHSC operations (procurement, warehousing, transport). The criteria have been defined considering the literature review on sustainable SC and the impact that HSC processes (procurement, warehousing and transport) have on the different sub-dimensions. With this inputs, a model and method to assess SHSC performance maturity is suggested. To illustrate the use of the maturity assessment model, a proof of concept has been built based on the IFRC HSC use case.

This paper contributes significantly to the discussion of HSC sustainability. It bridges the gap between high-level sustainability theory and the concrete assessment of HSC operations sustainability, which still seems difficult in many disciplines.

The contributions have been developed thanks to inputs from IFRC field research. The practical application to various humanitarian relief operations is yet to be done.

The SHSC maturity model presented in this chapter is a decision-support system that allows measuring and benchmarking the sustainability of a HSC system "a posteriori". The main practical implications of using this method are to make evidence of the sustainability weakness on a given HSC system, and encourage a continuous improvement dynamic towards sustainability.

Nonetheless, it does not permit to anticipate the sustainable performance of decisions (i.e. operations planning). Therefore, as sustainability is a multi-dimensional concept, with conflicting objectives, the next step is to address these trade-offs and synergies across the economic, environmental and social dimensions.

REFERENCES

Ashby, Leat, and Hudson-Smith. (2012). "Making connections: a review of supply chain management and

sustainability literature." *Supply Chain Management: An International Journal*, 17(5), 497–512.
Battista, C., and Schiraldi, M. (2013). "The Logistic Maturity Model: Application to a Fashion Company." *International Journal of Engineering Business Management*, 1.
Baumann, E. (2011). "Modèles d'évaluation des performances économique, environnementale et sociale dans les chaînes logistiques." Phd thesis, INSA de Lyon.
Chan, J., and Comes, T. 2014. "Innovative Research Design – a Journey into the Information Typhoon," *Procedia Engineering* (78), pp. 52-58.
Correia, E., Carvalho, H., Azevedo, S., and Govindan, K. (2017). "Maturity Models in Supply Chain Sustainability: A Systematic Literature Review." *Sustainability*, 9(1), 64.
Gastwirth, J. L. (1972). "The Estimation of the Lorenz Curve and Gini Index." *The Review of Economics and Statistics*, 54(3), 306–316.
Golinska, P., and Kuebler, F. (2014). "The Method for Assessment of the Sustainability Maturity in Remanufacturing Companies." *Procedia CIRP*, 15, 201–206.
Haavisto, I., and Kovács, G. (2014). "Perspectives on sustainability in humanitarian supply chains." *Disaster Prevention and Management: An International Journal*, 23(5), 610–631.
Holguín-Veras, J., Jaller, M., Van Wassenhove, L. N., Pérez, N., and Wachtendorf, T. (2012). "On the unique features of post-disaster humanitarian logistics." *Journal of Operations Management*, 30(7–8), 494–506.
IFRC. (2013). *Global Logistic Services Annual Report*. IFRC.
IFRC. (2014). *Global Logistic Services Annual Report*. IFRC.
Jahre, M. (2008). *The organisational change of logistics in International Federation of the Red Cross and Red Crescent Societies*. Case Study, HUMLOG-NET Project.
Klumpp, M., De Leeuw, S., Regattieri, A., and de Souza, R. (2015). *Humanitarian Logistics and Sustainability*. Springer.
Kunz, N., and Gold, S. (2017). "Sustainable humanitarian supply chain management – exploring new theory." *International Journal of Logistics Research and Applications*, 1–20.
Kunz, N., Wassenhove, L. N. V., Besiou, M., Hambye, C., and Kovács, G. (2017). "Relevance of humanitarian logistics research: best practices and way forward." *International Journal of Operations & Production Management*, 37(11), 1585–1599.
Kurnia, S., Rahim, M. M., Samson, D., and Prakash, S. (2014). "Sustainable Supply Chain management capability maturity: framework development and initial evaluation." *ECIS 2014 Proceedings*.
Laguna Salvadó, L., Lauras, M., and Comes, T. 2015. "Towards More Relevant Research on Humanitarian Disaster Management Coordination," *ISCRAM,* Palen, Buescher, Comes and Hughes (eds.), Kristiansand.
Laguna Salvadó, L., Lauras, M., and Comes, T. (2017). "Sustainable Performance Measurement for Humanitarian Supply Chain Operations." *Proceedings of the International Conference on Information Systems for Crisis Response and Management*, Albi, 775–783.
Laguna Salvadó, L., Lauras, M., Comes, T., and Grenade, M. (2016). "A study on the sub-regionalization of Humanitarian Supply Chain: the IFRC case." *Proceedings of the International Conference on Information Systems for Crisis Response and Management*, Rio de Janeiro.
Okongwu, U., Morimoto, R., and Lauras, M. (2013). "The maturity of supply chain sustainability disclosure from a continuous improvement perspective." *International Journal of Productivity and Performance Management*, (L. D. Huaccho Huatuco, Jairo Rafael Mo, ed.), 62(8), 827–855.
Paulk, M. C., Curtis, B., Chrissis, M. B., and Weber, C. V. (1993). "Capability maturity model, version 1.1." *IEEE Software*, 10(4), 18–27.
Reefke, Ahmed, and Sundaram. (2014). "Sustainable Supply Chain Management—Decision Making and Support: The SSCM Maturity Model and System." *Global Business Review*, 15(4_suppl), 1S–12S.
Savitz, A. (2012). *The Triple Bottom Line: How Today's Best-Run Companies Are Achieving Economic, Social and Environmental Success -- and How You Can Too*. John Wiley & Sons.
Srai, Alinaghian, and Kirkwood. (2013). "Understanding sustainable supply network capabilities of multinationals: A capability maturity model approach." *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture*, 227(4), 595–615.
Tzur, M. (2016). "The humanitarian pickup and distribution problem." Hamburg.