Supply chain agility assessment of an Indonesian humanitarian organization

Rizal Afif Rasyidi and Ratih Dyah Kusumastuti
Department of Management,
Faculty of Economics and Business, Universitas Indonesia, Depok, Indonesia

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Abstract

Purpose – The article presents an evaluation of the supply chain agility of the Indonesian humanitarian organization *Aksi Cepat Tanggap* (ACT). It discusses the flexibility, responsiveness and effectiveness of ACT's supply chain.

Design/methodology/approach – The supply chain agility metrics were assessed based on interviews with representatives from ACT and the National Agency for Disaster Management (*Badan Nasional Penanggulangan Bencana* [BNPB]). Recommendations were made based on the assessment results.

Findings – The findings of this study indicated that ACT's supply chain agility maturity was at level 2 or repeatable. This meant that ACT's humanitarian supply chain (HSC) had demonstrated agility only on limited occasions. ACT's supply chain agility can be improved by enhancing the flexibility component.

Practical implications – The study shows how to assess the supply chain agility of a humanitarian organization and identify the components/capabilities of agility that need improvement. The same assessment can be conducted by other humanitarian organizations to enhance their supply chain agility to improve their emergency response in the event of a disaster.

Originality/value – The study provides insights into the supply chain agility of a locally based humanitarian organization in an emerging country, which is rarely discussed in the literature.

Keywords Humanitarian supply chain, Relief logistics, Supply chain agility, Humanitarian organizations

Paper type Case study

1. Introduction

The number of natural and human-induced disasters across the globe has increased dramatically over the last decade. This situation poses a challenge to governments and requires collaboration between governments and other parties, such as humanitarian organizations, to increase the efficiency and effectiveness of disaster response operations. Humanitarian organizations are nongovernmental organizations (NGOs) whose main objective is to help governments respond to humanitarian crises (such as disaster events), and their existence has improved governments' ability to resolve such crises (Coppola, 2007). Humanitarian organizations must set up supply chains that gather and deliver relief supplies and other necessities to beneficiaries (Scholten *et al.*, 2010). Humanitarian/relief supply chain activities include several processes, such as preparedness and planning, procurement, transportation, warehousing and delivery (distribution) to disaster-affected residents (Thomas and Kopczak, 2005). The humanitarian supply chain (HSC) is characterized by a high level of uncertainty and complexity (Charles *et al.*, 2010). These uncertainties include relief needs (which are difficult to predict) and the availability of relief goods, which may change on a daily basis. The complexity of the supply chain, on the other hand, is influenced by the geographic extent of the disaster (L'Hermitte *et al.*, 2014), which complicates the operations, especially the transportation and distribution of relief supplies (Apte, 2010). In

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addition, the damaged local infrastructure in some disaster events also poses an additional challenge to the HSC.

Furthermore, donors ask for accountability and value for money in return for their support to humanitarian organizations (Scholten *et al.*, 2010). The increased pressure, expectations and control from donors regarding the performance and impacts of the operations activities compel humanitarian organizations to emphasize these impacts and to implement optimized and transparent operations activities (Van Wassenhove, 2006). Failure to attain humanitarian operations efficiency may cause not only human loss but also loss of donors' support for the humanitarian organizations (Oloruntoba and Gray, 2006).

Scholten *et al.* (2010) and Charles *et al.* (2010) suggested that humanitarian organizations should adopt the supply chain management techniques that are applied by commercial organizations, such as supply chain agility, to improve the efficiency and effectiveness of disaster response. According to Cozzolino *et al.* (2012), agility principles enable the tackling of uncertain situations that humanitarian emergencies present and support the effectiveness of emergency responses. Dubey and Gunasekaran (2016) and Kabra and Ramesh (2016) even indicated that supply chain agility is positively related to HSC performance. L'Hermitte *et al.* (2016, p. 173) defined agility as "the ability to develop and maintain operational responsiveness and flexibility in order to manage sudden and short-term logistics and supply chain risks and uncertainties." An agile HSC can support the effective and efficient flow of relief goods to disaster-affected residents (Dubey *et al.*, 2015) as its emphasis is on promoting adaptability and flexibility and connecting different supply chain entities through a feedforward flow of materials and feedback flow of information (Lin *et al.*, 2006).

As supply chain agility affects humanitarian organizations' performance, it is necessary to assess humanitarian organizations' supply chain agility so that they can improve the capability of their supply chains to tackle uncertain environment (Routroy *et al.*, 2015). One of the approaches that can be employed to assess the supply chain agility is by evaluating its maturity level (Charles *et al.*, 2010) using a maturity model which consists of a sequence of levels indicating the evolution path toward perfection or completeness (Becker *et al.*, 2009; Wendler, 2012). This approach enables humanitarian organizations to assess the maturity level of their supply chain agility and identify areas of improvement to achieve the desired maturity level.

However, even though disasters occur frequently in emerging countries such as Indonesia (see Figure 1), studies on humanitarian logistics and supply chains in such countries are

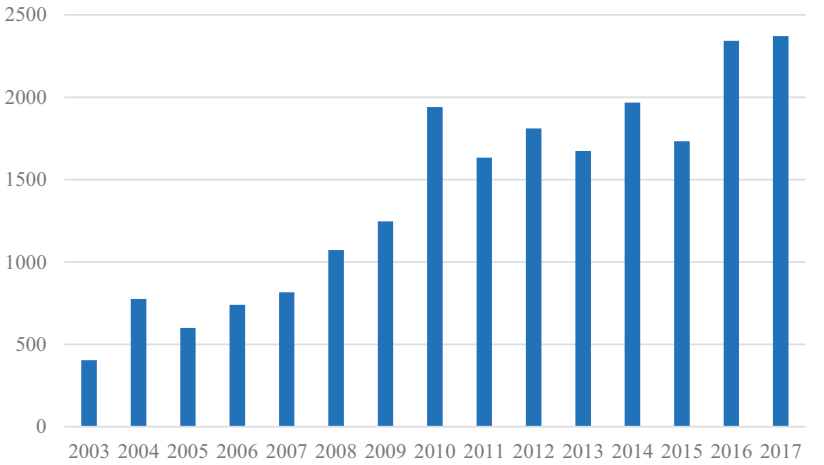

Figure 1.
Thenumber of disaster events in Indonesia, 2003–2017 (BNPB, 2018)

rarely conducted (Jabbour *et al.*, 2019). Since humanitarian organizations play a significant role in disaster management in Indonesia and agility is an important characteristic that an HSC must possess (Dubey and Gunasekaran, 2016), assessment of the supply chain agility is essential in establishing an excellent HSC network (Dubey *et al.*, 2014) as it will provide insights into what can be improved so that the organization can better respond to a disaster emergency in the country. Therefore, this paper aims to evaluate the maturity level of supply chain agility and identify areas in need of improvement of the Indonesian humanitarian organization *Aksi Cepat Tanggap* (ACT), which was established in 2005 and is actively involved in humanitarian/relief activities at national and international levels. Specifically, we will address the following research questions:

RQ1. Does ACT's supply chain demonstrate agility?

RQ2. What is the maturity level of ACT's supply chain agility?

RQ3. How can ACT's supply chain agility be improved?

Singh Patel *et al.* (2017) reported that several models assessed agility in the commercial supply chain, such as those by Kumar and Motwani (1995), Sharifi and Zhang (1999), Lin *et al.* (2006), Tseng and Lin (2011) and Routroy *et al.* (2015). However, only Charles *et al.*'s (2010) model is specifically developed to assess the agility of an HSC, with good practicality (Routroy *et al.*, 2015). Thus, in this study, the agility level of ACT's supply chain is determined by using Charles *et al.*'s (2010) model, with the scope of some measures adjusted from global to national.

The remainder of the paper is structured as follows. A review of relevant literature is provided in Section 2, followed by a profile of ACT in Section 3 and the research methodology in Section 4. Findings and discussions are provided in Section 5, with conclusions presented in Section 6.

2. Literature review

2.1 Humanitarian supply chain

An HSC is established in response to specific disaster events with the aim of minimizing human loss and suffering (Dubey *et al.*, 2014), and its planning includes preparedness, response and collaboration (Bhattacharya *et al.*, 2014). The HSC is the focal point of relief operations as it acts as a bridge between disaster preparedness and response and between procurement and distribution, it influences the effectiveness and response time of relief efforts and it is one of the most expensive parts of the operations (Van Wassenhove, 2006). An HSC is defined as "the process of planning, implementing and controlling the efficient, cost-effective flow and storage of goods and materials, as well as related information, from the point of origin to the point of consumption for the purpose of alleviating the suffering of vulnerable people" (Thomas and Kopczak, 2005, p. 2).

The HSC is more complex than its commercial counterpart as it involves cooperating with teams from different organizations in uncertain and difficult situations (Overstreet *et al.*, 2011; Altay *et al.*, 2018). The HSC can be considered a "sense and respond" supply chain as it must be able to identify the needed resources, acquire them as soon as possible and make adjustments based on actual conditions (Thomas and Kopczak, 2005). When a disaster occurs, humanitarian organizations send their teams to assess the severity of the impacts and determine the required relief supplies for the affected people, and they use the assessment reports as the basis for generating relief supplies from public and private sectors. Some organizations have prepositioned stocks of standard items that can be delivered promptly to the affected areas, otherwise they need to generate donations (in the form of cash and/or relief items), procure the required relief supplies and set up the logistics to send them to the affected people (Thomas and Kopczak, 2005). Hence, an HSC is characterized by uncertainty of

demand, limited information, irregular supply patterns, shorter lead times and lack of resources (Ngwenya and Naude, 2016).

The aforementioned characteristics pose several challenges in HSCs, which are as follows: (1) on-time distribution of relief supplies is hard to control during an emergency, mainly due to the difficulty in identifying the supply sources, the complexity of coordinating supplies and the uncertain infrastructure conditions that make it difficult to respond quickly to the needs of the affected people; (2) managing resources for relief logistics is challenging because the resources may come from both private and public sectors, and the allocation requires coordination between sectors that may be difficult to achieve during an emergency; (3) the activities need the demand information in a real-time manner, but during an emergency this information is difficult to obtain; (4) HSCs experience high personnel turnover and they have no mechanisms for transferring past experience to new personnel (Sheu, 2007; Duran *et al.*, 2013).

To overcome all the challenges and complexities, previous studies have argued that HSCs must demonstrate agility (Oloruntoba and Gray, 2006; Dubey *et al.*, 2014; L'Hermitte *et al.*, 2015; Altay *et al.*, 2018), especially in the upstream part of the chain (Scholten *et al.*, 2010; Cozzolino *et al.*, 2012) and during the response stage (Pettit and Beresford, 2009; Charles *et al.*, 2010).

2.2 Humanitarian supply chain agility

Agility is an important attribute that organizations operating in highly uncertain environments (Lee, 2004), such as humanitarian organizations, must possess. Agility is needed to survive in turbulent and volatile environments (Sharifi and Zheng, 1999; Agarwal *et al.*, 2007) as it strengthens organizations' ability to quickly and effectively respond to changes (Lee, 2004). Cozzolino (2012) concluded that agility is the ability to respond to unpredicted changes in demand with short lead times, while L'Hermitte *et al.* (2015) took a strategic point of view and stated that agility is the organization's adaptive capacity to develop capabilities that assist its operational flexibility and responsiveness to cope with risks, uncertainties and opportunities in the supply chain environment. L'Hermitte *et al.* also stated that agility cannot be achieved without the deployment of organizational resources as its enablers, namely, people, process and technology, among other things, and agility requires experienced, multitasking and adaptable personnel (people), a clear definition of roles, location of authority, coordinating mechanism and open communication (process) and deployed information technology (technology).

In the supply chain, agility is the characteristic of the network design that allows for sensing temporary changes in the business environment and responding quickly and flexibly to those changes (Booth, 1996; Dubey *et al.*, 2015). Charles *et al.* (2010, p. 727) defined supply chain agility as "the ability to respond quickly and adequately to short-term changes in demand, supply or the environment." The main drivers of supply chain agility are complexity, uncertainty and heterogeneity (Xu *et al.*, 2003), and the planning of agile supply chains must incorporate adaptive mechanisms so that they can respond effectively to uncertain business environments (Oloruntoba and Kovács, 2015). In the humanitarian context, L'Hermitte *et al.* (2017) suggested that the operational agility of an HSC is influenced by four strategic-level capabilities: being purposeful, being action focused, being collaborative and being learning oriented. At the operational level, on the other hand, previous studies have argued that agile HSCs must be characterized by flexibility (Oloruntoba and Gray, 2006; Charles *et al.*, 2010; Dubey *et al.*, 2015; L'Hermitte *et al.*, 2015; Oloruntoba and Kovács, 2015; Dubey and Gunasekaran, 2016), responsiveness (Charles *et al.*, 2010; Dubey *et al.*, 2015; Jahre and Fabbe-Costes, 2015; L'Hermitte *et al.*, 2015; Oloruntoba and Kovacs, 2015; Dubey and Gunasekaran, 2016) and effectiveness (Charles *et al.*, 2010; Cozzolino, 2012; Cozzolino *et al.*, 2012; Oloruntoba and Kovacs, 2015).

Flexibility is the foundation of an agile HSC as it allows humanitarian organizations to deal with uncertainty and volatility in demand at the event of disaster (Charles *et al.*, 2010). Singh *et al.* (2019) stated that supply chain flexibility is related to the ability to meet varied and unusual demand and its 11 major dimensions are coordination, volume, physical distribution, sourcing, new product, demand management, product, manufacturing and response to market, process and expansion. Charles *et al.* (2010), on the other hand, argued that only four dimensions (or capabilities) of flexibility are relevant for an HSC: volume, delivery, mix (or demand management) and product flexibility. In addition, HSCs must also demonstrate responsiveness or the ability to deploy available resources along the supply chain (Jahre and Fabbe-Costes, 2015), so that humanitarian organizations can respond immediately to the changing needs of end users (disaster-affected people) (Oloruntoba and Gray, 2006). Charles *et al.* (2010) inferred that responsiveness can only be achieved if HSCs demonstrate reactivity (ability to evaluate demand swiftly), velocity (ability to quickly meet demand) and visibility (the extent to which all parties in the HSC have access to accurate and prompt information of product characteristics (Maghsoudi and Pazirandeh, 2016)). The other characteristic that HSCs must show is effectiveness or the ability to deliver relief supplies as needed to minimize human loss and suffering (Cozzolino *et al.*, 2012). Charles *et al.* (2010) stated that effectiveness consists of reliability (ability to deliver the correct relief supplies as needed) and completeness (ability to meet goals). These supply chain agility characteristics should be assessed and enhanced to ensure that organizations can continue to operate in uncertain environment (Routroy *et al.*, 2015).

2.3 Humanitarian supply chain agility assessment models

Several supply chain agility assessment models for manufacturing companies have been developed in previous studies. For instance, Kumar and Motwani (1995) identified factors and subfactors that contribute to a company's manufacturing agility in the form of an agility matrix and proposed a method to determine the agility index (for the company) based on the factor-rating method. Sharifi and Zhang (1999) proposed a method to determine manufacturing agility by assessing the capabilities that are needed to achieve manufacturing agility (responsiveness, competency, flexibility and quickness) using a scoring method. Lin *et al.* (2006) suggested a fuzzy agility index for supply chains based on fuzzy logic, whereby the supply chain agility was evaluated based on its responsiveness, flexibility, competency and quickness (similar to Sharifi and Zhang, 1999). Routroy *et al.* (2015) also proposed a method to measure manufacturing agility in the form of a fuzzy agile manufacturing index based on a combination of the fuzzy analytic hierarchy process and triangular fuzzy numbers to aggregate the past, present and future performance in all agile manufacturing indicators. Tseng and Lin (2011), on the other hand, proposed a framework to evaluate enterprise agility based on fuzzy ratings and fuzzy-relation weights aggregation of agility drivers, capabilities and providers (resources). More supply chain agility assessment models for commercial supply chains can be found in AlKahtani *et al.* (2019). However, these models cannot be used directly in the humanitarian context because certain indicators may not be relevant in HSCs. Only Charles *et al.* (2010) developed a model to evaluate HSC agility and its maturity level along with metrics and their evaluation grids. The evaluation model was developed based on measurement of certain metrics in flexibility (evaluated based on capabilities in volume, delivery, mix and product flexibility), responsiveness (assessed based on capabilities in reactivity, velocity and visibility) and effectiveness (determined based on reliability and completeness of order). Charles *et al.* (2010) also proposed a house of agility, with flexibility as the foundation and responsiveness and effectiveness as the pillars of HSC agility. The model can be used to determine the HSC agility maturity level and identify areas in need of improvement.

3. The case organization: *Aksi Cepat Tanggap*

ACT is an Indonesian humanitarian organization established in 2005. In 2012, ACT established its umbrella organization (Global Islamic Philanthropy [GIP]) which also has several divisions under its wing: the Disaster Management Institute of Indonesia (DMII), Global Wakaf (which manages *wakaf* or endowments), Global Qurban (which manages *qurban* or sacrifices) and Global Zakat (which manages *zakat* or mandatory charitable contributions in Islam). ACT adopts the total disaster management (TDM) principle, that is, it provides interventions in the four phases of disaster management (mitigation, preparedness, emergency/response and recovery).

ACT is supported by donors from the public and corporate sectors (through its corporate social responsibility [CSR] programs). Currently, it has 19 representative offices nationwide and its network covers 30 provinces and 100 cities/regencies in Indonesia. In 2012, ACT also became involved in humanitarian actions at the global level, and its programs have reached 22 countries in Southeast Asia, South Asia, the Middle East, Africa and Eastern Europe.

ACT has four departments: Operations and General Affairs Department, Philanthropy Network Department (PND), Volunteer Networking Department (VND) and Humanity Networking Department (HND). The HND has three divisions: Wakaf Village (which implements community empowerment programs), Global Humanity Response (GHR, which executes responses to international disasters and humanity issues) and Disaster Emergency Relief and Management (DERM, which implements emergency responses at the national level). ACT's allocation of funds for disaster management in 2010–2016 is depicted in Figure 2. The amount allocated in each year varies depending on the frequency and severity of disasters in the respective year.

ACT's humanitarian operations are conducted at three levels: headquarters, branch office and disaster-affected areas (during the emergency response stage). Its humanitarian supply chain is depicted in Figure 3, which also describes the flow of relief goods, funds and coordination between facilities. The humanitarian activities begin when a disaster occurs. In-kind donations from the public (which can be received in normal times or during disasters) are collected at the headquarters, and the received goods are later transported to a central warehouse to be sorted and stored. In-kind donations in the form of goods from corporations are received at the central warehouse or the branch offices' warehouses. ACT procures relief supplies if the available goods at the warehouses are not sufficient for the emergency response activities. For example, since 2016, if a disaster occurs on the island of Java, ACT has procured basic food from its appointed convenience store chain (called *Sodaqo*) and other types of relief supplies (such as family kits and other tools) from the traditional market(s) in the affected area. *Sodaqo* is a minimart chain, supported by Hydro, a *wakaf* corporation under ACT's Global Wakaf. A part of *Sodaqo's* profit is donated to ACT. At the time of the interviews for this study, *Sodaqo* is available in four provinces and 15 cities in Indonesia. ACT avoids purchasing relief supplies from big supermarket chains as its policy is to support the quick recovery of the local economy in the post-disaster period.

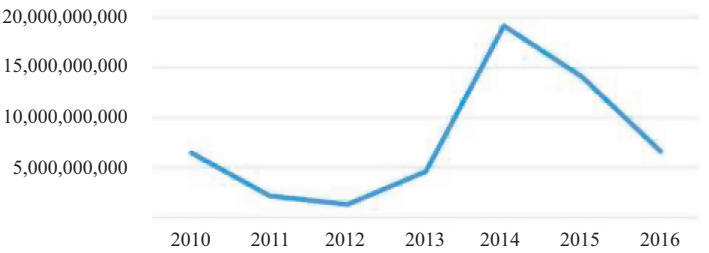

Figure 2.
Funds used for disaster management programs 2010–2016 in Indonesia (taken from *Aksi Cepat Tanggap*'s financial reports)

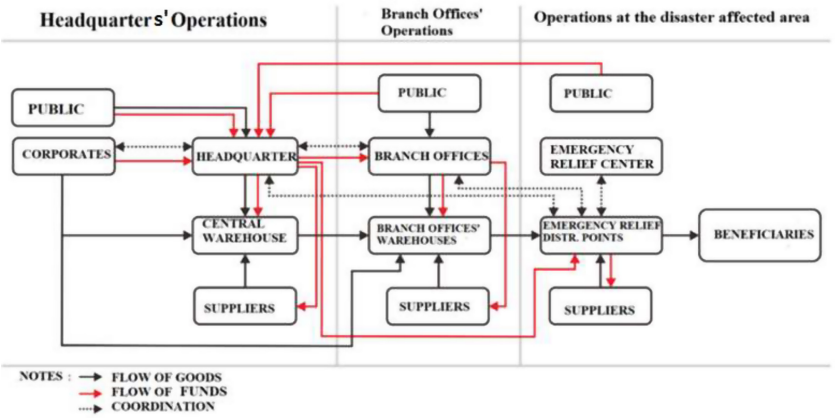

Figure 3.
Aksi Cepat Tanggap's humanitarian supply chain

If the disaster happens outside the island of Java, ACT procures relief supplies only from the traditional market(s) in the affected area. In addition, the branch offices' warehouses also receive excess relief goods from the central warehouse and, if needed, procure relief goods from the traditional market(s) in the area. The emergency relief points are established during the emergency response stage and replenished by the branch offices' warehouses; if the amount is insufficient, ACT purchases relief supplies from the traditional market(s) near the affected area. The relief supplies are then distributed to the beneficiaries.

ACT has its own transportation fleet at its headquarters and branch offices to transport the relief goods if the affected area is relatively close to the offices. It may hire transportation companies if the affected area is considered far from the offices. It prefers to deliver goods to the beneficiaries as soon as possible, even if the amount is less than the demand. The remainder of the relief supplies is transported later in the next delivery. In the event of a disaster, ACT first assesses the severity of the impact. If the impact is not severe, ACT asks the team from the nearest branch office to respond to the disaster, otherwise the head office responds directly to the disaster. ACT provides the emergency response during the emergency period set by the National Agency for Disaster Management (*Badan Nasional Penanggulangan Bencana* [BNPB]) or the respective regional disaster management agency (*Badan Penanggulangan Bencana Daerah* [BPBD]), but the duration can be extended if necessary. The emergency response includes providing volunteers to rescue and evacuate the affected residents, paramedics, relief supplies, soup kitchens and trauma healing. The response team coordinates with the local government and BNPB or BPBD.

4. The research methodology

The main purpose of this research is to evaluate the agility of ACT's humanitarian supply chain. This is achieved through a combination of qualitative and quantitative methods (see Figure 4). Semi-structured interviews with three representatives from ACT (with a combined 20 years of experience in ACT's humanitarian operations) and a representative from BNPB (see Table 1) were conducted to gather information on humanitarian action in Indonesia in general, ACT's humanitarian supply chain and its emergency program. Interviews were conducted in March–May 2018.

This paper uses Charles *et al.*'s (2010) HSC agility assessment model. This model is used because its agility indicators are relevant to the HSC studied in this research and highly

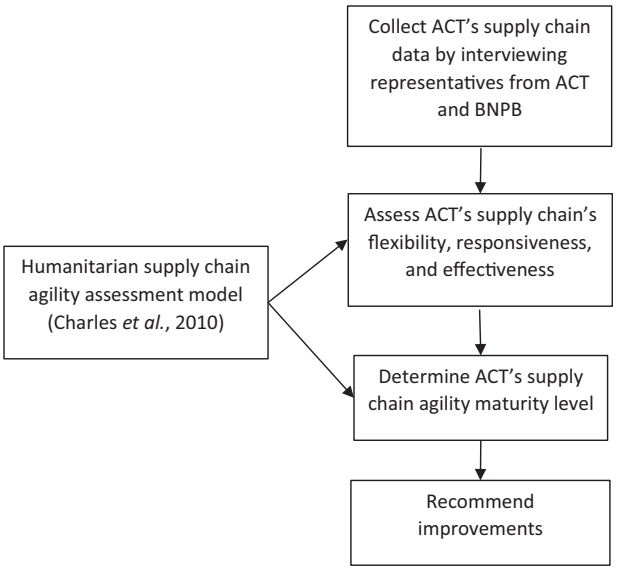

Figure 4.
Research stages

Informant #	Job title	Affiliation	Years of experience
Informant 1	Assistant manager for relief management program	ACT	12
Informant 2	Assistant manager for disaster emergency response and management	ACT	5
Informant 3	Staff member of the disaster recovery program	ACT	3
Informant 4	Head of procurement division	The National Agency for Disaster Management (BNPB)	8

Table 1.
Theprofile of interviewees

practical (Routroy *et al.*, 2015). As explained in Section 2, Charles *et al.*'s (2010) HSC agility assessment model evaluates three components of HSC agility (flexibility, responsiveness and effectiveness) and each component has several capabilities. Flexibility is the ability to make changes with small consequences in cost, time, effort and performance and consists of volume, delivery, mix and product flexibility. Responsiveness is the ability to quickly and accurately respond to changes and comprises reactivity, velocity and visibility. Effectiveness is the ability to deliver relief supplies as planned, and it is evaluated based on reliability and completeness. HSC agility components, capabilities and their metrics are presented in Table 2. Notably, however, as ACT's mandate is mainly to respond to disaster events in Indonesia, we have adjusted the scope of some of the measures from global to national (see Table 2, metrics in boldface).

Each capability is assessed based on its metrics by using the evaluation grid following Charles (2010) and Charles *et al.* (2010). The assessment of ACT's supply chain agility is carried out based on in-depth interviews with informants from ACT and BNPB, the collected secondary data, as well as standards from BNPB. The scores for each metric, each capability and the agility component range from 0 to 3. Based on the overall scores of components and

Agility components	Capabilities	Metrics
Flexibility	Volume flexibility (eight metrics): the ability to alter the aggregated output level	*The extent to which supplier lead time can be expedited/changed caused by changes in order quantity*
		The extent of flexibility (options) within supplier contracts
		Number of suppliers selected per component
		Number of components purchased per supplier
		Range of possible order sizes from suppliers
		Number of end users supported by each distribution facility, on average
		Adequacy between national-level storage capacity and needs
		Adequacy between national-level delivery capacity and needs
	Mix flexibility (two metrics): ability to modify the product range, made or delivered, within a given time period	Number of items handled by each distribution facility, on average
		Number of items per order handled by each distribution facility, on average
	Delivery flexibility (five metrics): ability to alter planned or assumed delivery dates	*Number of nationwide storage/distribution facilities*
		Percentage of user orders filled from alternate national-level facilities
		Number of adequate available delivery modes
		Number of carriers used for each type of delivery mode, on average
		Delivery lead times
	Product flexibility (one metric): ability to introduce new products or modify existing ones	Level of customization
Effectiveness	Reliability (one metric): ability to deliver products as needed to the correct user	Intermediate user (and end user) involvement in writing product specifications
	Completeness (one metric): ability to accomplish the goals	Percentage of the demand filled within an acceptable time frame
Responsiveness	Velocity (five metrics): ability to fulfill demand quickly	Percentage of workforce in self-directed teams
		Number of organizational levels
		Authority level at which risks can be taken and decisions are made
		Presence/exhaustiveness of contingency plans
		Number of emergency response teams
	Reactivity (one metric): ability to evaluate and take needs into account quickly	Frequency of intermediate (and end user) needs assessment
	Visibility (one metric): ability to know the identity, location and status of entities transiting the supply chain	Availability and diffusion of information regarding identity, location and status of entities transiting the supply chain (e.g. people, items, etc.)

Note(s): As ACT's mandate is mainly to respond to disaster events in Indonesia, the authors have adjusted the scope of the measures in italic from global to national

Table 2.
Humanitarian supply chain agility components, capabilities and metrics

capabilities, the HSC agility maturity level is determined, and the evaluation results are then analyzed to identify areas for improvement in ACT's supply chain.

Charles *et al.* (2010) proposed five levels of HSC agility maturity: *ad hoc*, repeatable, defined, managed and optimized. However, they only provided rough correspondence between the agility maturity and capability levels. Therefore, we add Table 3 to describe and

HSC agility maturity level		Description	The required minimum scores of agility components/ capabilities for each level				
			Flexibility	Responsiveness			
				Visibility	Reactivity	Velocity	Effectiveness
1	*Ad hoc*	HSC does not show the ability to respond quickly and adequately to short-term changes in demand, supply or the environment	0	0	0	0	0
2	Repeatable	HSC occasionally shows the ability to respond quickly and adequately to short-term changes in demand, supply or the environment	1	0	0	0	0
3	Defined	HSC frequently shows the ability to respond quickly and adequately to short-term changes in demand, supply or the environment	2	0	1	1	0
4	Managed	HSC mostly shows the ability to respond quickly and adequately to short-term changes in demand, supply or the environment	2	1	2	2	2
5	Optimized	HSC always shows the ability to respond quickly and adequately to short-term changes in demand, supply or the environment	3	2	3	3	3

Table 3.
Description and required minimum scores for each humanitarian supply chain agility maturity level (adapted from Charles (2010))

clarify the required minimum overall scores of agility components and capabilities for each HSC agility maturity level.

As flexibility is the foundation of HSC agility, for the first two levels of agility maturity, flexibility becomes the main consideration. A flexibility component score of 0 indicates that the HSC cannot perform changes with small consequences in cost, time, effort and performance; hence, its agility maturity is at level 1 (*ad hoc*) or the HSC does not show the ability to respond quickly and adequately to short-term changes in demand, supply or the environment. Likewise, the HSC agility maturity level is 2 (repeatable or occasionally showing agility) if the flexibility score is at least 1 (HSC can perform some changes with small consequences in cost, time, effort and performance). For the next three higher agility maturity levels, however, flexibility must be complemented by responsiveness and effectiveness. HSC agility maturity is at level 3 (defined or HSC frequently shows agility) if the score of flexibility is at least 2 and both reactivity and velocity scores are at least 1. The HSC agility maturity level is 4 (managed or HSC mostly shows agility) if the scores of flexibility, reactivity, velocity and effectiveness are at least 2, while the score of visibility is at least 1. Finally, the HSC agility maturity level is 5 (optimized or HSC always shows agility) if the scores of flexibility, reactivity, velocity and effectiveness are 3, while the score of visibility is at least 2. The model

indicates that HSCs with an agility maturity level of 4 or 5 must also have the capability of visibility as it provides insights into the disaster relief and makes coordination between organizations easier (Maghsoudi and Pazirandeh, 2016).

5. Findings and discussion

In this section, the paper discusses the results for each main component of supply chain agility, flexibility, effectiveness and responsiveness and provides recommendations for improvement.

5.1 Flexibility

Table 4 presents the results for flexibility (cells in boldface indicate the scores for the respective metrics). The results indicate that the scores for volume, delivery, mix and product flexibility are 1, 2, 3 and 3, respectively, and the overall flexibility score of ACT is 1 (i.e. ACT's supply chain can only perform some changes with small consequences in cost, time, effort and performance). This is mainly due to the score for volume flexibility, which is only 1, indicating that ACT has limited ability to change the order quantity with suppliers, which limits its ability to adjust the quantity of relief supplies in response to changes in beneficiaries' requirements during the response stage.

Specifically, this low score is the result of three metrics in flexibility capability for which the scores are 1 or lower: the extent to which supplier lead time can be expedited/changed caused by changes in order quantity, the extent of flexibility (options) within supplier contracts and the number of end users supported by each distribution facility (on average). As previously mentioned, in responding to disaster events, ACT mostly uses supplies from in-kind donations and, if necessary, buys supplies from the local traditional market(s), while in some cases where available, ACT also gets supplies from the *Sodaqo* minimarket (through a cooperation agreement). Hence, ACT does not have a formal supply contract and it cannot shorten the supplier lead time or have options within supplier contracts. Moreover, due to the facility capacity, the end users are supported by at least two facilities, causing the low score of the third abovementioned metric.

Concerning delivery flexibility, the score of 2 indicates that ACT has sufficient flexibility in delivering relief supplies. The metric with the lowest score in this capability (1) is the number of adequate available delivery modes. This is because ACT mostly uses land transportation to deliver relief supplies. It uses other transportation modes (such as waterways and airways) only when the land transportation infrastructure is damaged and cannot be used. For the other two flexibility capabilities (i.e. mix and product flexibility), the scores indicate that ACT has good flexibility in these capabilities; ACT's warehouses can handle more than 50% of the product mix and, as the warehouses are assigned to specific areas, they usually handle every item in the order during the response stage. Finally, all the branch offices have the authority to decide the types of items to be stored in their warehouse and, thus, they can customize most of their products, if needed.

5.2 Effectiveness

The score for effectiveness is 2 (see Table 5), meaning that ACT's supply chain is relatively effective in delivering relief supplies to most of the affected residents. The relatively high score for reliability is mainly because ACT implements the needs assessment, which involves the affected residents, through observations and interviews. In addition, the validity of the initial assessment results is evaluated every day during the response stage and this is continued until the recovery stage, thus providing relief supplies that match the needs of affected residents. The score for completeness, however, is 1 because, on average,

Table 4.
Aksi Cepat Tanggap's flexibility score

Capabilities	Metrics	Score = 0	Score = 1	Score = 2	Score = 3	Remark
Volume flexibility	The extent to which supplier lead time can be expedited/ changed caused by changes in order quantity	*Change is never accepted*	Minor change (in days) accepted. Change must be made more than one week prior to planned delivery	Major change (in weeks) accepted. Change must be made more than two days prior to planned delivery	Any realistic change is accepted	ACT has a cooperation agreement with *Sodaqo* minimart for the procurement of relief items. As *Sodaqo* operates only in certain areas, ACT also purchases relief items directly at traditional markets near the affected areas without any purchasing contract. Thus, basically, the supplier lead time cannot be changed
	The extent of flexibility (options) within supplier contracts	*No option in contracts, no pre-disaster contract*	Supplier contracts have a limited number of options	Every supplier contract has options, but their range is limited	Every contract stipulates explicitly that any realistic change is accepted	ACT only has a procurement agreement with *Sodaqo*, which is only available in certain areas and most relief items are actually bought from the local traditional markets without contracts. Thus, basically, there are no options in contracts
	Number of suppliers selected per component	No clear list of suppliers	One supplier selected per component	*One, sometimes two, suppliers selected per component*	At least two suppliers selected per component	The number of suppliers for each component varies, depending on its availability at the suppliers. On average, ACT can buy one component from two suppliers
	Number of components purchased per supplier	No idea	Two or three; not enough to be considered a regular customer for the supplier	*Four or five; enough to be considered a regular customer for the supplier*	>5; enough to be an important regular customer for the supplier	In the procurement of relief supplies, especially for basic foods, one supplier can provide 3–5 components
	Range of possible order sizes from suppliers	Always the same order size	Order size can vary, but there is a minimum and maximum order size	*Order size can vary, but small or big orders require specific conditions*	Any size accepted	The order size varies depending on suppliers' capability and the demand. For procurement from *Sodaqo*, large order sizes are accepted

(*continued*)

Capabilities	Metrics	Score = 0	Score = 1	Score = 2	Score = 3	Remark
	Number of end users supported by each distribution facility, on average	One customer assigned per facility	*Each customer can be supported by at least two facilities*	Each facility can support more than half the customers	Any facility can send to any customer	In every disaster response, the requirement of the affected people can be fulfilled by at least two closest warehouses
	Adequacy of national-level storage capacity to meet needs	No idea	Stock-out occurs more than three times a year	Stock-out occurs less than three times a year	*Available stocks are sufficient to prevent any stock-out*	ACT's branch warehouses can provide relief supplies 48 h after a disaster occurs in its operational area
	Adequacy of national-level delivery capacity to meet needs	No idea	Delivery capacity is dimensioned on standard customer orders only	High volumes can be delivered but not always within an acceptable time frame	*Any customer order can be delivered within an acceptable time frame*	All relief supplies can be delivered by ACT. In cases where it needs more transportation vehicles, it will rent them from a third party
	Assessment of volume flexibility	$\sum\left(\begin{matrix}\text{Scores}\\ \text{of}\\ \text{metrics}\end{matrix}\right) < 8$	$8 \le \sum\left(\begin{matrix}\text{Scores}\\ \text{of}\\ \text{metrics}\end{matrix}\right) < 16$	$16 \le \sum\left(\begin{matrix}\text{Scores}\\ \text{of}\\ \text{metrics}\end{matrix}\right) < 22$	$\sum\left(\begin{matrix}\text{Scores}\\ \text{of}\\ \text{metrics}\end{matrix}\right) \ge 22$	The total score for volume flexibility metrics is 13. Hence, the score for volume flexibility is 1
Delivery flexibility	Number of nationwide storage/ distribution facilities	None	1	2	*3 or more*	ACT has one central warehouse and 12 branch-office warehouses
	Percentage of user orders filled from alternate national-level facilities	None	Less than 30%	*Between 30 and 60%*	More than 60%	During a large-scale disaster emergency response, in-kind donations are generated at all ACT offices. All warehouses check the availability of the relief supplies and deliver them to the beneficiaries or otherwise ask other warehouses to also fulfill the required supplies. Based on experience, the percentage of orders fulfilled by other warehouses is around 50%

(*continued*)

Table 4.

Table 4.

Capabilities	Metrics	Score = 0	Score = 1	Score = 2	Score = 3	Remark
	Number of adequate available delivery modes	No idea	*Usually 1 or 2, but not always for extreme situations*	At least 2 for standard orders, 1 for most extreme situations	At least 2, even for extreme situations	When delivering the relief supplies, ACT uses trucking due to its flexibility. In extreme conditions, such as when the land transportation infrastructure is severely damaged, ACT sometimes delivers supplies using other modes of transportation, such as by water or air
	Number of carriers used for each type of delivery mode, on average	No idea	1 or 2	*2 or 3*	At least 3	The number of vehicles in the transportation fleet used by ACT is allocated according to the amount of relief supplies to be delivered. On average, ACT uses 2–3 transportation vehicles
	Delivery lead times	No idea	Delivery may take more than a week	Delivery is possible within five days	*Delivery is possible within 24 h*	Depends on the location of the disaster. If the location is in the islands of Java and Sumatra, the delivery lead time is within 24 h
	Assessment of delivery flexibility	$\sum\left(\begin{matrix}\text{Scores}\\ \text{of}\\ \text{metrics}\end{matrix}\right) < 5$	$5 \le \sum\left(\begin{matrix}\text{Scores}\\ \text{of}\\ \text{metrics}\end{matrix}\right) < 10$	$10 \le \sum\left(\begin{matrix}\text{Scores}\\ \text{of}\\ \text{metrics}\end{matrix}\right) < 14$	$\sum\left(\begin{matrix}\text{Scores}\\ \text{of}\\ \text{metrics}\end{matrix}\right) \ge 14$	The total score for delivery flexibility metrics is 11. Hence, the score for delivery flexibility is 2
Mix flexibility	Number of items handled by each distribution facility, on average	No idea	Less than 10% of the product mix	10–50% of product mix	*More than 50% of the product mix*	Relief supplies that are stored in ACT warehouses are nonperishables. Every warehouse prepares its own budget and list of needed items based on the characteristics of disasters that have occurred in the area. However, every warehouse may still need other relief items in every emergency response

(*continued*)

Capabilities	Metrics	Score = 0	Score = 1	Score = 2	Score = 3	Remark
	Number of items per order handled by each distribution facility, on average	No idea	Less than 50% of items per order	50–95% of items per order	Usually every item per order	Every ACT warehouse prepares its own budget and conducts the procurement for the required items based on the characteristics of disasters that have occurred in the area
	Assessment of mix flexibility	$\sum\left(\begin{matrix}\text{Scores}\\ \text{of}\\ \text{metrics}\end{matrix}\right) < 2$	$2 \le \sum\left(\begin{matrix}\text{Scores}\\ \text{of}\\ \text{metrics}\end{matrix}\right) < 4$	$4 \le \sum\left(\begin{matrix}\text{Scores}\\ \text{of}\\ \text{metrics}\end{matrix}\right) < 5$	$\sum\left(\begin{matrix}\text{Scores}\\ \text{of}\\ \text{metrics}\end{matrix}\right) \ge 5$	The total score for mix flexibility metrics is 6. Hence, the score for delivery flexibility is 3
Product flexibility	Level of customization	Less than 20% of products can be modified if needed	Between 20 and 60% of products can be modified if needed	Between 60 and 90% of products can be modified if needed	*More than 90% of products can be modified if needed*	Every branch office is authorized to determine the types of items to be stored in its warehouse, and each office can adjust more than 90% of the total items according to what is needed in the area
Flexibility	Overall score of supply chain flexibility	$\sum\left(\begin{matrix}\text{Scores of}\\ \text{Volume,}\\ \text{Delivery,}\\ \text{Mix and}\\ \text{Product}\\ \text{Flexibility}\end{matrix}\right) < 4$	$\sum\left(\begin{matrix}\text{Scores of}\\ \text{Volume,}\\ \text{Delivery,}\\ \text{Mix and}\\ \text{Product}\\ \text{Flexibility}\end{matrix}\right) \ge 4$	$\begin{cases}\text{Volume flexibility} \ge 2\\ \text{Delivery flexibility} \ge 2\\ \text{Mix flexibility} \ge 3\\ \text{Product flexibility} \ge 1\end{cases}$	$\begin{cases}\text{Volume flexibility} = 3\\ \text{Delivery flexibility} = 3\\ \text{Mix flexibility} = 3\\ \text{Product flexibility} \ge 2\end{cases}$	The scores for volume, delivery, mix and product flexibility are 1, 2, 3 and 3, respectively. Hence, the score for flexibility is 1

Note(s): Cells in italic indicate the scores for the respective metrics

Table 4.

Table 5.
ACT's effectiveness score

Capabilities	Metrics	Score = 0	Score = 1	Score = 2	Score = 3	Remark
Reliability	Intermediate and end users' involvement in writing product specifications	Neither intermediate nor end users is involved	Intermediate users are involved on a yearly basis. No involvement of end user	Intermediate and end users are involved on a yearly basis	*Intermediate users are involved on a monthly basis and end users at least once a year*	In accordance with BNPB's assessment standard, assessment is conducted at the beginning of the response stage based on observation and interview results with representatives of the affected people and the community leaders
Completeness	Percentage of the demand fulfilled within an acceptable time frame	Less than 50%	*Between 50% and 90%*	Between 90 and 97%	More than 97%	About 80% of demand can be fulfilled by ACT within an acceptable time frame
Effectiveness	Overall assessment of supply chain effectiveness	$\sum\begin{pmatrix}\text{Scores}\\\text{of}\\\text{metrics}\end{pmatrix} < 2$	$2 \leq \sum\begin{pmatrix}\text{Scores}\\\text{of}\\\text{metrics}\end{pmatrix} < 4$	$4 \leq \sum\begin{pmatrix}\text{Scores}\\\text{of}\\\text{metrics}\end{pmatrix} < 5$	$\sum\begin{pmatrix}\text{Scores}\\\text{of}\\\text{metrics}\end{pmatrix} \geq 5$	The scores for reliability and completeness are 3 and 1, respectively. Hence, the score of effectiveness is 2

Note(s): Cells in italic indicate the scores for the respective metrics

ACT can only satisfy about 80% of the demand within the acceptable time frame during the response stage. When the demand is larger than the warehouse's capacity, ACT assigns the demand to the closest warehouses.

5.3 Responsiveness

The score for responsiveness is 2 (see Table 6), revealing that ACT can respond to most changes within a reasonable time. This is because of high scores in the three capabilities (velocity, reactivity and visibility). The score for velocity is 2 because ACT responds to emergencies with a structured approach. The teams have good coordination with the head office and have authority to respond to most changes happening in the affected area.

Furthermore, the score for reactivity is 3 because ACT assesses needs in accordance with BNPB and International Federation of Red Cross and Red Crescent Societies (IFRC) guidelines. Hence, the relief supplies match the needs of the end users. Finally, the visibility score is 2 because ACT shares most information regarding the locations and supply chain entities, even though the information sharing is only among the field team(s), especially the logistics personnel.

Although the score for responsiveness is relatively high, the scores in the two metrics of velocity are only 1. First, the number of organizational levels is six, indicating a long chain of command that may slow the decision-making process. Second, in terms of contingency plans, ACT has only rough guidelines instead of a formal contingency plan. The response mechanism is usually discussed in the daily meetings during the response stage.

5.4 Aksi Cepat Tanggap*'s overall supply chain agility*

The agility assessment of ACT's supply chain is presented in Figure 5. Based on Table 3, the agility maturity of ACT's supply chain is at level 2 or repeatable. This means that ACT's supply chain demonstrates agility but only on limited occasions.

The results reveal that ACT's supply chain is still in the early stage of agility maturity, mainly due to its limited flexibility, especially volume flexibility (indicating the supply chain's capability to satisfy changing demand). The limited capability in volume flexibility is mostly because ACT, apart from the cooperation agreement with *Sodaqo* minimart, does not have any formal purchasing contract with suppliers due to its policy to support the recovery of the local economy as soon as possible. Hence, in responding to a disaster, depending on the location and the scale, ACT uses its inventory and, if needed, purchases the required relief supplies from traditional markets near the affected area or directly from local farmers. The policy brings challenges to the response team, as stated by informant 1:

> Sometimes, the stock of relief items at the local traditional market or the nearest store is not sufficient; hence, the response team must look for the relief items in the other nearby area. Sometimes we even need to go to 2, 3, or 10 stores to get the required items.

As a result, ACT does not have full control to ensure that relief supplies can be provided at the required time and in the required quantities and, in some situations, this can result in longer response time. The arrangement also makes it challenging for ACT to meet changes in demand (in terms of lead time and quantity) from the affected people. In addition, limited capability in volume flexibility also stems from the limited amount of relief supplies in ACT's warehouses. Informant 1 stated that each branch warehouse can only meet about 50% (sometimes less than 50%) of the total needs of the affected people. Even though it is understandable to limit stock to minimize inventory costs, limited stock means a lower service level and may affect the response time.

Table 6.
Aksi Cepat Tanggap's responsiveness score

Capabilities	Metrics	Score = 0	Score = 1	Score = 2	Score = 3	Remarks
Velocity	Percentage of workforce in self-directed teams	Less than 20% of workers are organized in teams	Between 20 and 60% of workers are organized in teams	Between 60 and 80% of workers are organized in teams	*More than 80% of workers are organized in teams*	In every emergency response, ACT forms an emergency team, led by the head of *Masyarakat Relawan Indonesia* (MRI) (Indonesian Volunteer Society) at the regency/city level. The team works independently and in a self-directed manner
	Number of organizational levels	More than six organizational levels	*Five or six organizational levels*	Three or four organizational levels	Less than three organizational levels	The organizational structure of ACT consists of four levels, while the level of the emergency team is 2, so the total is 6
	Authority level at which risks can be taken and decisions are made	No authority at field level	Field workers must wait for the person in charge of them to approve before acting	*Significant changes need approval from hierarchy*	Worker can act if necessity is there	Significant changes occurring in the field must be communicated to and approved by headquarters
	Presence/ exhaustiveness of contingency plans	No contingency plan exists	*Presence of a contingency plan but rough*	Presence of a contingency plan but not sufficiently detailed	Presence of an exhaustive contingency plan	ACT conducts daily meetings to discuss changes and response mechanisms during the emergency stage. The contingency plan is still in the form of rough guidelines
	Number of emergency response teams	No emergency teams	Some emergency teams but just enough to cope with less than 50% of uncertainties	Some emergency teams but just enough to cope with 50–90% of uncertainties	*Enough emergency teams to cope with uncertainties*	ACT has enough emergency teams to handle a disaster event. If necessary, it can recruit additional emergency personnel from external sources
	Assessment of supply chain velocity	$\sum\left(\begin{matrix}\text{Scores}\\ \text{of}\\ \text{metrics}\end{matrix}\right) < 5$	$5 \le \sum\left(\begin{matrix}\text{Scores}\\ \text{of}\\ \text{metrics}\end{matrix}\right) < 10$	$10 \le \sum\left(\begin{matrix}\text{Scores}\\ \text{of}\\ \text{metrics}\end{matrix}\right) < 14$	$\sum\left(\begin{matrix}\text{Scores}\\ \text{of}\\ \text{metrics}\end{matrix}\right) \ge 14$	The total score for velocity metrics is 10. Hence, the score for velocity is 2

(*continued*)

Capabilities	Metrics	Score = 0	Score = 1	Score = 2	Score = 3	Remarks
Reactivity	Frequency of intermediate and end user needs assessment	Neither intermediate nor end use needs is assessed	Intermediate users' needs are assessed on a yearly basis. No assessment of end user needs	Intermediate users' needs are assessed on a monthly basis, end user needs at least once a year	*Evaluation and assessment of all user needs is done on a weekly or daily basis*	ACT branch warehouses conduct needs assessments of relief supplies once a year. The required supplies are determined based on historical data. During the emergency response, needs assessments are conducted daily
Visibility	Availability and diffusion of information on entities transiting the supply chain	No systematic capture of information	Information about people and products is captured but not circulated	*Information about people and products is captured but only partially circulated*	Supply chain is structured around information flow	ACT does not use an information technology system in its humanitarian supply chain. Information about relief goods is only known by field teams, especially logistics personnel
Responsiveness	Overall assessment of supply chain responsiveness	$\sum \begin{pmatrix} \text{Sores of} \\ \text{Velocity.} \\ \text{Reactivity,} \\ \text{Visibility} \end{pmatrix} < 3$	$\sum \begin{pmatrix} \text{Sores of} \\ \text{Velocity.} \\ \text{Reactivity,} \\ \text{Visibility} \end{pmatrix} \geq 3$	$\begin{cases} \text{Velocity level} \geq 2 \\ \text{Reactivity level} \geq 2 \\ \text{Visibility level} \geq 1 \end{cases}$	$\begin{cases} \text{Velocity level} = 3 \\ \text{Reactivity level} = 3 \\ \text{Visibility level} \geq 2 \end{cases}$	The scores for velocity, reactivity and visibility are 2, 3 and 2, respectively. Thus, the score for responsiveness is 2

Note(s): Cells in italic indicate the scores for the respective metrics

Table 6.

Agility Capabilities	Level			
	0	1	2	3
Volume Flexibility		x		
Delivery Flexibility			x	
Mix Flexibility				x
Product Flexibility				x
Reliability				x
Completeness		x		
Reactivity				x
Velocity			x	
Visibility			x	

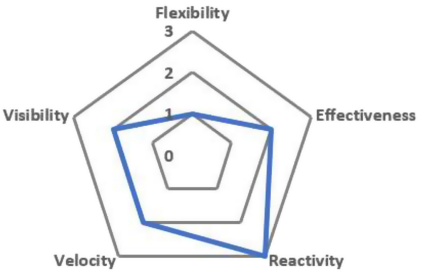

Figure 5.
Results of agility assessment of *Aksi Cepat Tanggap*'s supply chain

5.5 Improving Aksi Cepat Tanggap*'s supply chain agility*

Based on Figure 5, we suggest that the agility of ACT's supply chain can be improved by increasing the score in the flexibility component. A flexible supply chain requires flexible supply chain partners (Singh *et al.*, 2019); hence, ACT's supply chain flexibility can be achieved by improving its procurement management. This is needed to ensure the availability of relief supplies as a *Sodaqo* minimart may not be available near the affected area or its capacity may not be sufficient to satisfy the demand. Furthermore, the relief supplies may not always be available at the local traditional market(s). In addition, in certain situations, the local market(s) may also be affected by the disaster and, thus, relief supplies can only be purchased partially or sometimes not at all from the local market(s). Purchasing relief supplies from other areas may take time and increase ACT's response time.

ACT's reluctance to establish a long-term contract with suppliers is mainly due to its policy to support the quick recovery of the local economy by procuring supplies near the affected area and also because of uncertainties in donors' funding and beneficiaries' demand (Balcik *et al.*, 2010). However, formal long-term supply contracts have some benefits for the buyer, such as the ability to control the price, quality and quantity of relief supplies (Li *et al.*, 2010). Hence, by establishing a supply contract, ACT can better manage its procurement of relief supplies, leading to improved volume flexibility and completeness capabilities.

Another alternate worth exploring is cooperative procurement (Pazirandeh, 2016), in which ACT cooperates with other Indonesian humanitarian organizations in joint procurement activity to increase the organizations' bargaining power. With this arrangement, efficiency can be improved due to economies of scale, transaction and labor cost reduction, lower product price, improved access to market, shared resource network and capabilities and reduced supply uncertainties (Pazirandeh, 2016). In addition, improved effectiveness can be achieved by means of accumulated knowledge, resources and capabilities (Bakker *et al.*, 2006).

When long-term supply contracts do not apply, ACT can develop a database containing potential stores in the traditional market(s) in disaster-prone areas, along with the type of relief supplies that the stores can provide. The database can be built and updated periodically, based on input from branch offices and/or volunteers in disaster-prone areas. Therefore, when a disaster strikes, ACT can act quickly to purchase the required relief supplies and provide them to the affected residents to minimize the survivors' suffering.

Finally, ACT's supply chain agility can be further improved by enhancing the velocity capability, notably by simplifying the decision hierarchy during the

emergency stage and establishing detailed guidelines to develop a contingency plan for emergency response.

6. Conclusions

We have presented a study that evaluates the supply chain agility of an Indonesian humanitarian organization (ACT) by assessing its agility components: flexibility, responsiveness and effectiveness. We pose three research questions. In response to the first and second research questions, we find that ACT's supply chain demonstrates agility and the supply chain agility maturity level is 2 or repeatable. This means that ACT's supply chain shows agility only on limited occasions or the supply chain has a limited ability to respond to sudden changes due to uncertainties in supply and demand during the emergency stage. This is mainly caused by the low score for the flexibility dimension, which is due to the low score for the volume flexibility capability. In response to the third research question, ACT's supply chain agility can be improved by enhancing its procurement management to ensure that relief supplies are delivered as required and by improving the velocity capability by simplifying the decision hierarchy and establishing guidelines for contingency plans during an emergency response.

The main contribution of this study is to advance the understanding of the HSC agility assessment model in humanitarian communities, so that humanitarian organizations can conduct a supply chain agility assessment to identify areas that need improvement. This will allow them to enhance their supply chain performance and achieve the goal of minimizing the suffering of disaster-affected people. A second contribution is to provide insights into the supply chain agility of an Indonesian humanitarian organization. The results of the assessment can be used to argue the need for long-term supplier contracts as well as joint purchasing activity among Indonesian humanitarian organizations to increase their bargaining power and enhance their supply chain agility.

This study has certain limitations. First, we adjust the supply chain agility assessment model proposed by Charles *et al.* (2010). However, the number of indicators in each agility component is somewhat unbalanced. For instance, the flexibility component has many indicators, while the effectiveness component has only a few. Moreover, the importance levels of each component and capability are not represented in the model; hence, all components and capabilities are assumed to have a similar level of importance. Further research is needed to refine the assessment model to better capture the HSC agility. Second, this study is based on cross-sectional data and captures ACT's agility at a particular time. Future research can investigate the agility maturity level over time in a longitudinal study. Finally, this study is a step toward understanding the HSC agility of locally based humanitarian organizations in disaster-prone emerging countries. Similar studies are needed to improve HSC performance and minimize human loss and suffering in such countries.

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Corresponding author
Ratih Dyah Kusumastuti can be contacted at: ratih.dyah@ui.ac.id