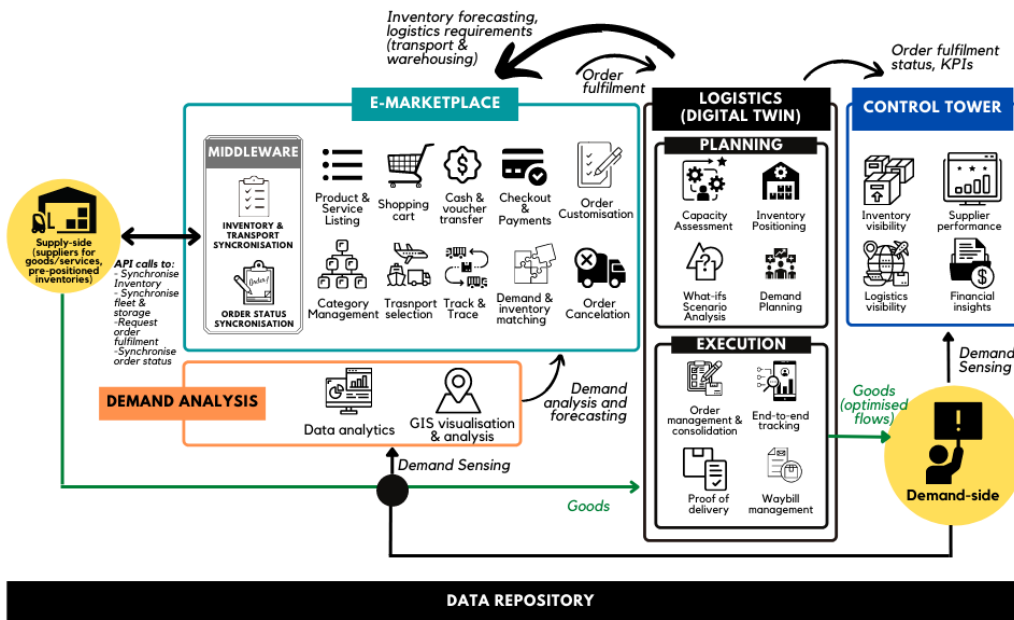


DIGITALLY ENHANCED HUMANITARIAN SUPPLY CHAIN

- A Blueprint from ASEAN - for ASEAN

Volume 22-Jul-HL



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Digitally Enhanced Humanitarian Supply Chain

- A Blueprint from ASEAN - for ASEAN

Presented at:

**Temasek Foundation – NUS – AHA Centre:
Disaster Management Programme in Southeast Asia**

6 July 2022

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1. EXECUTIVE SUMMARY

Technological advancements have created new possibilities in increasing the preparedness, readiness, and efficiency of disaster relief operations, reducing human suffering, saving more lives, and making the best use of available disaster relief funds and other resources. Yet, Information and Communication Technology is not neutral, and a critical understanding of how it can be contextually embedded to create a meaningful impact is required.

Therein, with the objective to examine supply chain strategies for improving the effectiveness and efficiency of relief operations in ASEAN through digital technologies, between July and November 2021, The Logistics Institute - Asia Pacific and the ASEAN Humanitarian Agency, with the support of Temasek Foundation International, jointly facilitated a series of professional workshops to ascertain the requirements for digitally enhanced humanitarian supply chains in ASEAN.

This whitepaper summarizes the conclusions of those workshops and presents the blueprint of a multi-level digital logistics framework to boost regional disaster preparedness, readiness, and resilience capabilities.

2. BACKGROUND AND MOTIVATION

Between July and November 2021, The Logistics Institute - Asia Pacific, National University of Singapore, and the ASEAN Humanitarian Agency (AHA Centre), with the support of Temasek Foundation International, jointly facilitated a series of professional workshops to examine supply chain strategies for improving the effectiveness and the efficiency of disaster relief operations in ASEAN. Specifically, the workshops aimed to look into ways in which information technology (ICT) could address some of the most pressing challenges faced by humanitarian stakeholders in the region.

Insights from workshops highlighted that central to many of the challenges currently faced in disaster relief operations is the fact that most humanitarian organizations still leverage organization- and execution-centric approaches to disaster management, oftentimes relying on a lot of manual, slow, resource intensive processes. The humanitarian sector's mission to reduce human suffering and save lives during major natural disasters is, all too often, hindered at the very start of operations by:

1. Lack of accurate information on the evolving needs of beneficiaries.
2. Limited ability to acquire relief goods and logistics services timelessly.

3. Limited capability to determine and predict logistics capacities requirements.
4. Limited coordination between the stakeholders involved.
5. Lack of real-time visibility on availability and utilization of logistics assets, inventories, and suppliers.

The combined effect of the above may in turn result into sub-optimal response times, over- or under-supply of necessary items, long lead times, and higher-than-expected costs.

Modern ICT has created new opportunities to increase the efficiency of disaster relief operations, reducing human suffering, saving more lives, and making the best use of available disaster relief funds and other resources (Marić et al., 2021).

Therefore, motivated by the need to empower coordinating and relief organizations through digital technologies, the series of workshops focused on ascertaining the requirements for a digitally enhanced humanitarian supply chain framework in ASEAN, notably one of the most disaster-prone and logistically challenging regions in the World.

Accordingly, this whitepaper presents, as a result of those conversations, a blueprint of the conceptualized multi-level digital logistics framework to boost speed, scale, robustness, resilience, and agility of relief chains.

The remainder of the document is structured as follows. Section 3 presents the multi-level digital logistics framework. Section 4 deep dives into the architecture of the system, introduces some of the leading questions that should guide further implementation efforts. Lastly, the last part of the report will wrap up with conclusive remarks and put forth some recommendations for the next steps.

3. A MULTI-LEVEL DIGITAL LOGISTICS FRAMEWORK

To address the humanitarian logistics challenges in ASEAN, and the underlying issues raised, the insights gathered through the series of workshops converged into the conceptualization of the blueprint for a multi-level digital logistics framework. The proposed architecture encompasses three core layers, involving e-procurement, digital twinning, control tower & management dashboarding. A high-level architecture of the framework is offered in Figure 1.

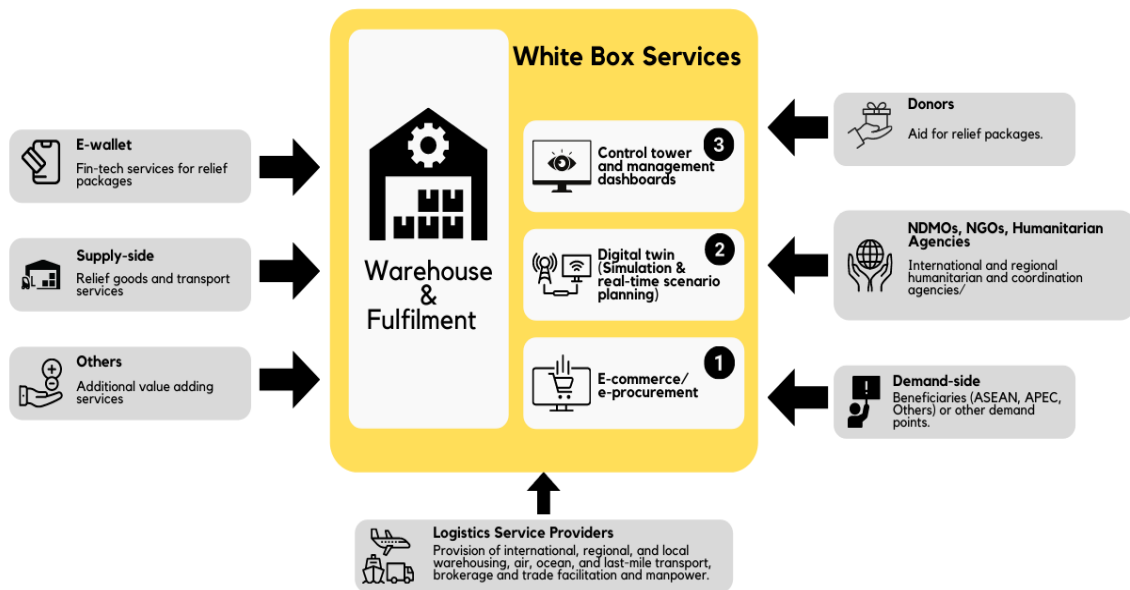


Fig. 1. Multi-level digital framework, a high-level view (Source: Authors’ own illustration)

The three levels are conceptualised to tackle the major challenges in disaster response operations, and more specifically to:

1. Facilitate timeless fundraising, procurement, transport, distribution, and delivery of goods and services through e-procurement, advanced data analytics, and GIS visualization & analysis.
2. Predict logistics capacities requirements and orchestrate resource deployment through digital twinning.
3. Gain real-time visibility on inventories and assets’ availability and utilisation through logistics control towers and management dashboards.

These three levels constitute an incremental enhancement of disaster preparedness, readiness, and resilience capabilities, with each level having the inherent ability to add value to specific aspects of disaster management operations. While each layer can operate on its own, for coordinating and relief organizations in ASEAN to extract the maximum value, an integration of layers through a common, up-to-date, accurate data repository, is desirable. Figure 2 offers a granular view of the framework’s architecture.

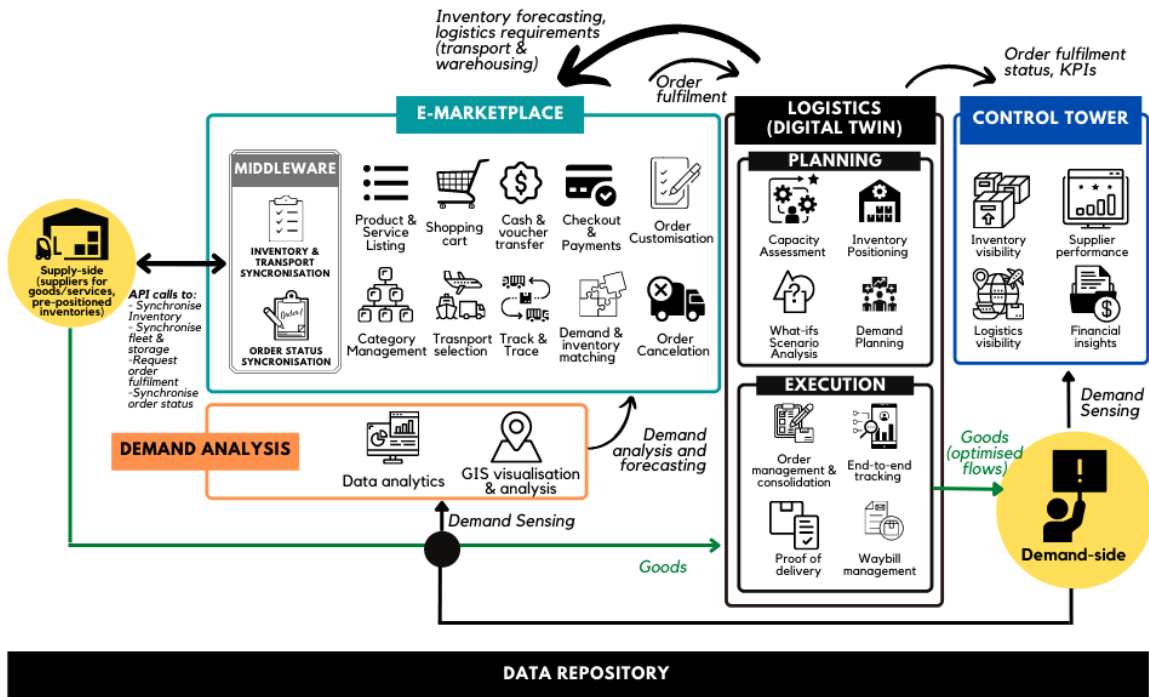


Fig. 2. Multi-level digital framework, a granular view (Source: Authors' own illustration)

As the framework's foundation layer, e-procurement¹ aims to facilitate fundraising, procurement, transport, distribution, and delivery of goods and services in a timely manner. In emergency times, the need for relief items and logistics services surges exponentially. If humanitarian organisations fail to procure efficiently and effectively, the needs of affected people might not be met (Moshtari et al., 2021). E-procurement has the inherent ability to bridge demand- and supply-side, while taking advantage of modern cloud technologies to grow and scale its scope as necessary. At the same time, it can seamlessly follow the rapid changes of requirements on the ground, anticipate and match beneficiaries' needs against available resources (inventories, fleet, storage), procure what's necessary and thus reduce the risk of over- or under-supply of relief items and services. Additionally, advanced data analytics in combination with visualization and analysis of geo-data using geographic information system (GIS) technology, can assist in the sensing and accurate forecasting of affected population's needs based on historical and current information, and boost the speed and agility of procurement (Zhao & Liu, 2018; UN WFP, 2018). In times when procurement within disaster-affected zones is a viable option, the e-procurement layer could be leveraged as a robust medium for the distribution of cash and/or vouchers through online, secure transactions.

To manage the equally important logistics fulfilment, digital twinning can assess and anticipate logistics capacity requirements, manage demand surges & supply shortfalls,

¹ In the context of this document, e-procurement and e-marketplace are used interchangeably

optimise inventory pre-positioning & local sourcing, and orchestrate resource deployment (Timperio et al., 2020a; Timperio, et al, 2020b). What-if scenario analysis using a combination of historical- and real-time data and stochastic parameters, notably the heart and soul of digital twins, can boost the robustness of the logistics fulfilment process and mitigate risk factors that can detriment supply chain performance, while generating and continuously updating contingency plans for greater robustness and resilience (Ivanov, et al., 2017; EY, 2021; TCS, 2021).

To boost collaborative decision-making, real-time visibility of inventory and assets' availability and utilization is crucial. Logistics control towers and management dashboards aim to equip decision-makers and responders with real-time situational awareness and reduce guesswork. With access to real-time, accurate information on beneficiaries needs via demand sensing capabilities, items held in the suppliers' and pre-positioned inventories, as well as availability and utilization of transport and storage assets, responders will be able to identify where the greatest needs are and determine ways to deploy resources to meet those needs (EY, 2021). With the help of alerts, notifications, and updates, decision-makers can have persistent awareness of the situation in real-time and they can react appropriately to what's happening or predict what is about to happen (TCS, 2021).

4. DECONSTRUCTING THE ARCHITECTURE AND DEFINING THE BASIC FUNCTIONAL REQUIREMENTS

This section will delve deeper into the building blocks of the of the digital logistics framework, highlighting the key functional requirements, and introducing some of leading questions that are deemed to guide the subsequent assessment and development phases of a deployable ICT system.

4.1 The Foundation Layer: e-Procurement

As the foundation layer of the digital framework, e-procurement is the fundamental module to build upon. A timely acquisition of much needed resources, including goods and services, stands at very core of the humanitarian and coordinating agencies' ability to provide humanitarian assistance. A detailed illustration of the conceptualised e-procurement architecture is offered in Fig. 3.

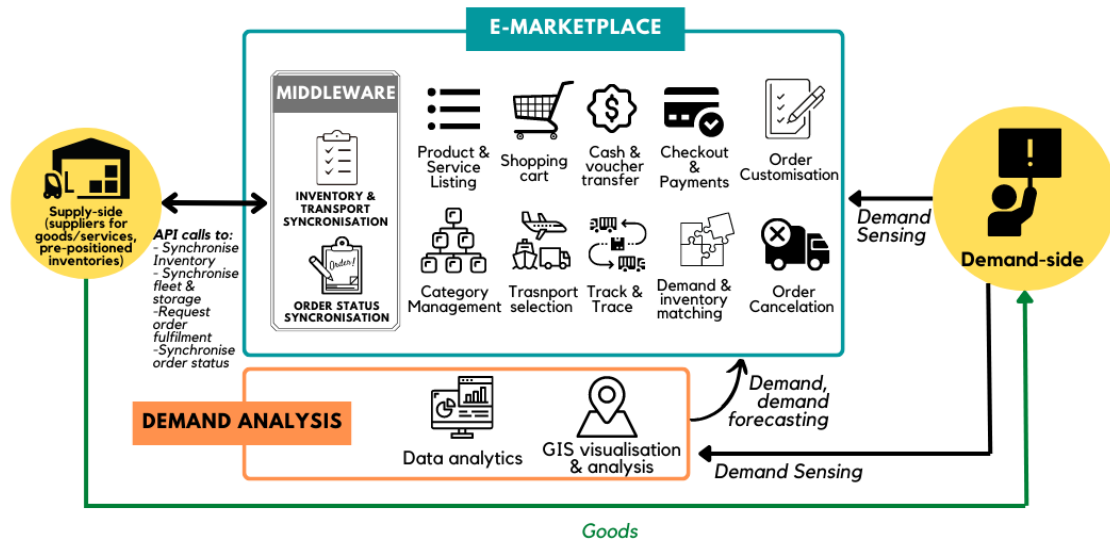


Fig. 3. E-procurement architecture, a detailed view (Source: Authors' own illustration)

To guide the further assessment and development efforts of the e-procurement layer and contextualisation in the ASEAN context, additional workshop sessions and focus group discussions are needed. Such sessions might be guided via selected leading questions such as the following.

1. Which set of items should be listed in the e-marketplace? Should the e-marketplace focus on a limited set of basic relief items only, or should it also allow the purchase of ad-hoc relief items and services based on specific request to respond to particular emergencies?
2. Should the e-marketplace allow both general public and institutional donors to donate through the purchase of listed items and services, or would it be advisable to limit the audience to specific groups?
3. Should the e-marketplace allow only pre-approved vendors to list their goods and services, or should it be kept open to vendors that show interest to offer their goods and services also on ad-hoc basis and specific emergencies, provided they meet set requirements?
4. How would a sustainability model for the e-marketplace look like?
5. Should the e-Marketplace be connected with the activities & systems of the UN Global and regional logistics cluster? And if so, how could the two platforms be integrated?

4.2 Towards Logistics Orchestration: Digital Twinning

Different disasters come with unknown operating uncertainties, spikes in demands and delays mostly due to logistics shortfalls. Delays cause loss of lives, increase waste of resources due to lack of information (data), supply chain systems & governance (visibility, finance etc.). The ability to achieve readiness to respond to multiple types of disasters, to mitigate high operating uncertainties, and to balance sudden and sporadic surges in demand and supply, are utmost desirable, particularly in the humanitarian context in ASEAN.

In this regard, digital twinning is an instrumental tool to plan as well as execute fulfilment operations.

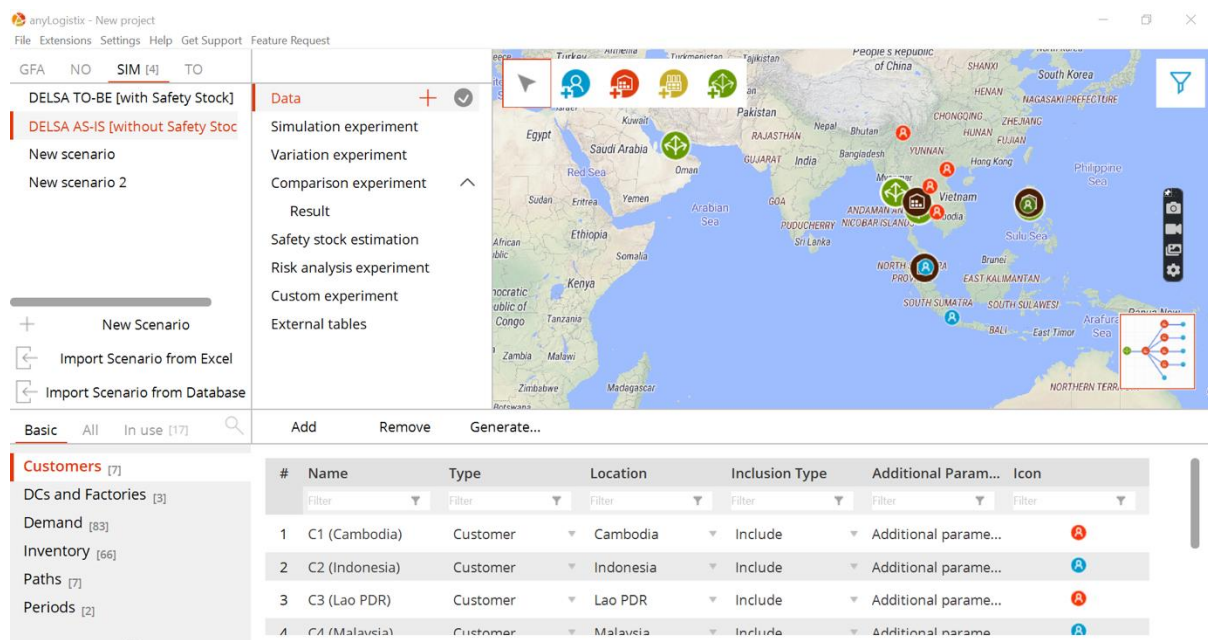


Fig. 4. An example of digital twin (Source: Authors' own illustration using AnyLogistix (2020) version 2.15)

A detailed view of the digital twin and control tower architecture is offered in Figure 5.

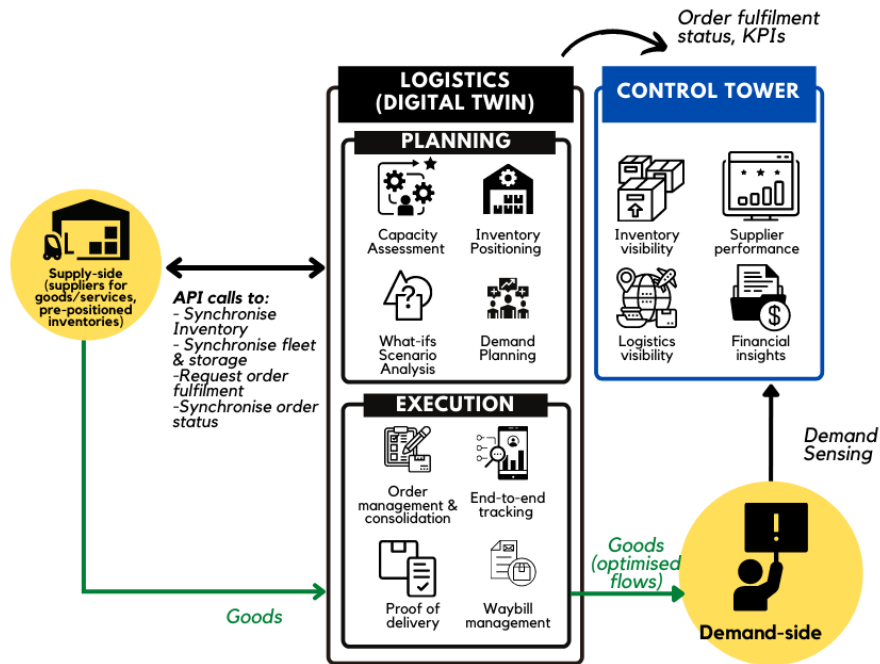


Fig. 5. Digital twin and control tower architecture, a detailed view (Source: Authors' own illustration)

To guide the further assessment and development efforts of the digital twin and control tower layers, the following leading questions should be thoroughly analysed, e.g., through additional workshop sessions and focus group discussions.

1. What would be the most ideal configuration for a digital twin to plan and manage execution of logistics fulfilment in ASEAN?
2. Which supply chain echelon should the digital twin focus its attention on? Should it plan and executive the first mile, the last-mile, or broaden its scope end-to-end and include "inside the four walls" business processes?
3. Which what-if scenarios should the digital twin test out, and what historical- and real-time data should be injected and analysed?
4. What disruption risks shall the digital twin take into consideration?
5. Should the digital twin be connected with the activities & systems of the UN Global and regional logistics cluster? And if so, how could the two platforms be integrated?

4.3 Enabling Collaborative Decision-Making: Control Tower & Dashboarding

As the reporting layer to enable collaborative decision-making, control tower and management dashboarding aim to provide decision-makers with persistent awareness of the

situation in real-time in order to reduce guesswork and provide full visibility on deployable resources. A high-level reference architecture is in Figure 6.

To guide the further assessment and development efforts of the control tower layer, the following leading question should be thoroughly analysed, e.g., through additional workshop sessions and focus group discussions

1. What key performance indicators (KPIs) should be made available to decision-makers and logistics practitioners?
2. Would it be advisable to create ad-hoc management dashboards to specific personas?
3. What extent of inventory and assets' visibility is necessary?

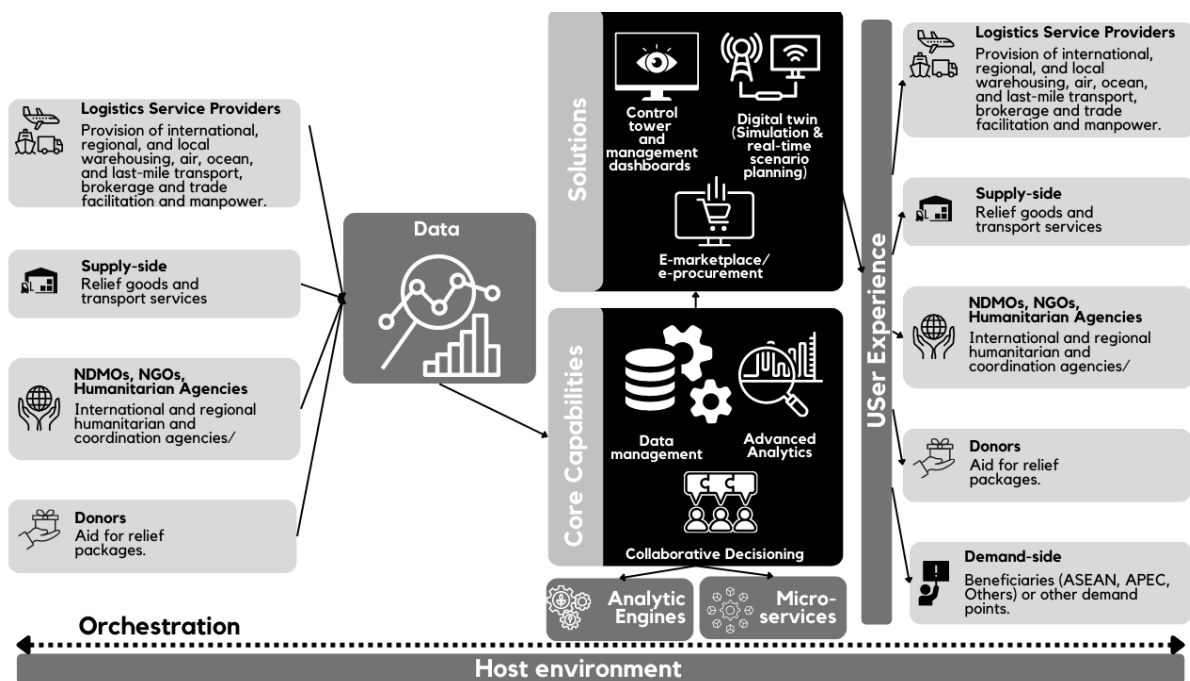


Fig. 6. System's architecture (Source: Authors' own illustration)

5. CONCLUDING REMARKS

This whitepaper presented the blueprint of a multi-level digital logistics framework to boost disaster preparedness, readiness, and resilience capabilities in ASEAN. This framework is the result of a requirements gathering exercise conducted over the course of a workshop series held between July and November 2021. Aside to conceptualising the blueprint, the workshop series shed light on a few equally important considerations.

The first major observation is that the vision set by leading coordinating and humanitarian agencies in ASEAN to transit from physical-storage locations into building supply-chain systems that are supported by virtual platforms is a common vision of most humanitarian agencies in the region. Throughout the workshop series, in fact, most participants highlighted the need for digital technologies as a key enabler to do more with less, scale, speed, and resilience of their relief chains.

As a second major observation, the series of workshops highlighted the need to leverage e-procurement as the central pillar for digitally enhanced humanitarian supply chains. The limitations of traditional humanitarian procurement, which often result in significant demand and supply mismatch and delays are, all too often, detrimental. At the same time, e-procurement enables humanitarian agencies to practice their strict ethical guidelines namely accountability, equality, non-discrimination, and transparency.

As a third major observation, it is evident that a greater end-to-end supply chain visibility, with continuous monitoring and situational updates, paired with enhanced logistics orchestration capabilities, is key for the effective provision of humanitarian assistance in the region. Visibility on demand, inventories and assets can not only allow swift replenishments and avoidance of risks of stock-out, but, most importantly, it allows a coordinated allocation of resources. In this regard, what-if scenario analysis, digital twin and control tower can provide is a first solid step towards analytics-driven decision making.

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