

Requirements for a Physical Internet handling container

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Introduction and objectives

Funded on physical, digital and operational interconnectivity the Physical Internet (PI) has been introduced to achieve an open, global and interconnected logistics network. Next to standardized interfaces and protocols, the encapsulation of goods is one of the key pillars to realize the PI and therefore enables an order-of-magnitude improvement in the efficiency and sustainability of logistics systems ([1] and [2]).

In order to generalize and standardize the unit load design, Montreuil, Ballot and Tremblay proposed a three-tier characterization of transport-, handling- and packaging containers depicted in figure 1. Current packages will be transformed to packaging containers, basic handling unit loads and pallets will be replaced by handling containers and the current shipping containers will be evolved to transport containers [2].

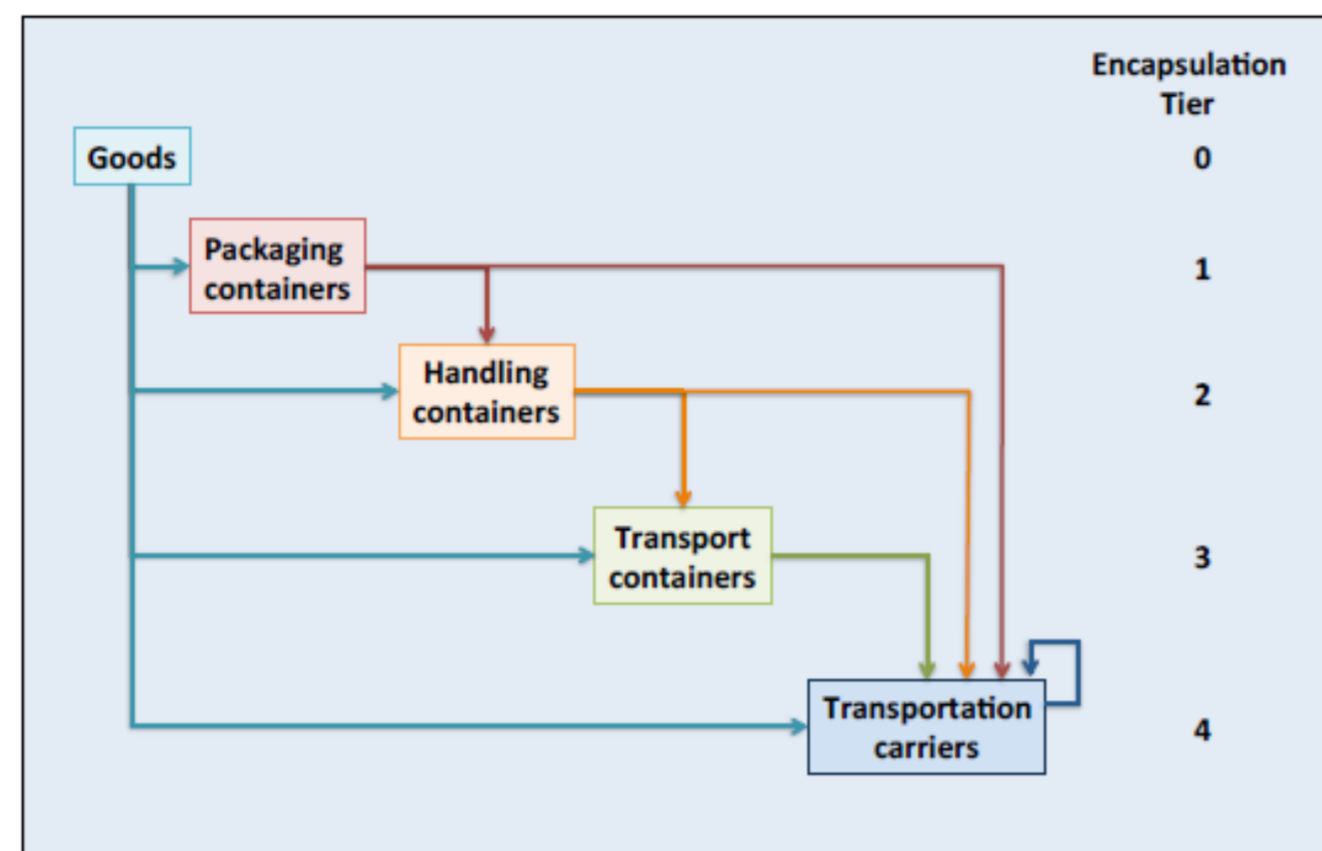


Figure 1: Proposed PI encapsulation characterization [2]

Building on this work, the particular focus of this poster is on the requirements and functions which a future PI-handling container has to fulfil. The findings from the European MODULUSHCA project and the Austrian Go2PI projects are merged with ongoing research work in order to prioritize and show the impact of box functionality.

Methods

In Europe, one of the first projects aiming to realize the PI was the MODULUSHCA project (Modular logistics units in shared co-modal networks) which was funded by the 7th Framework Program of the European commission. Focusing on the FMCG domain 15 partners from research, logistics business, postal business and FMCG industry participated in this research project in close coordination with North American Partners and the international PI-Initiative [3]. Within the scope of the project one of the integrated working fields was to develop and prototype a set of exchangeable (IOS) modular logistics units providing building blocks for larger units – the PI-handling containers for FMCG: the MODULUSHCA box (M-box) [4].

Following the systematic approach of VDI 2221 and VDI 2222 which deals with the universal and non sector-specific principles of the methodological engineering design the MODULUSHCA box was developed in defined process steps after a common logic and practicality (see figure 2).

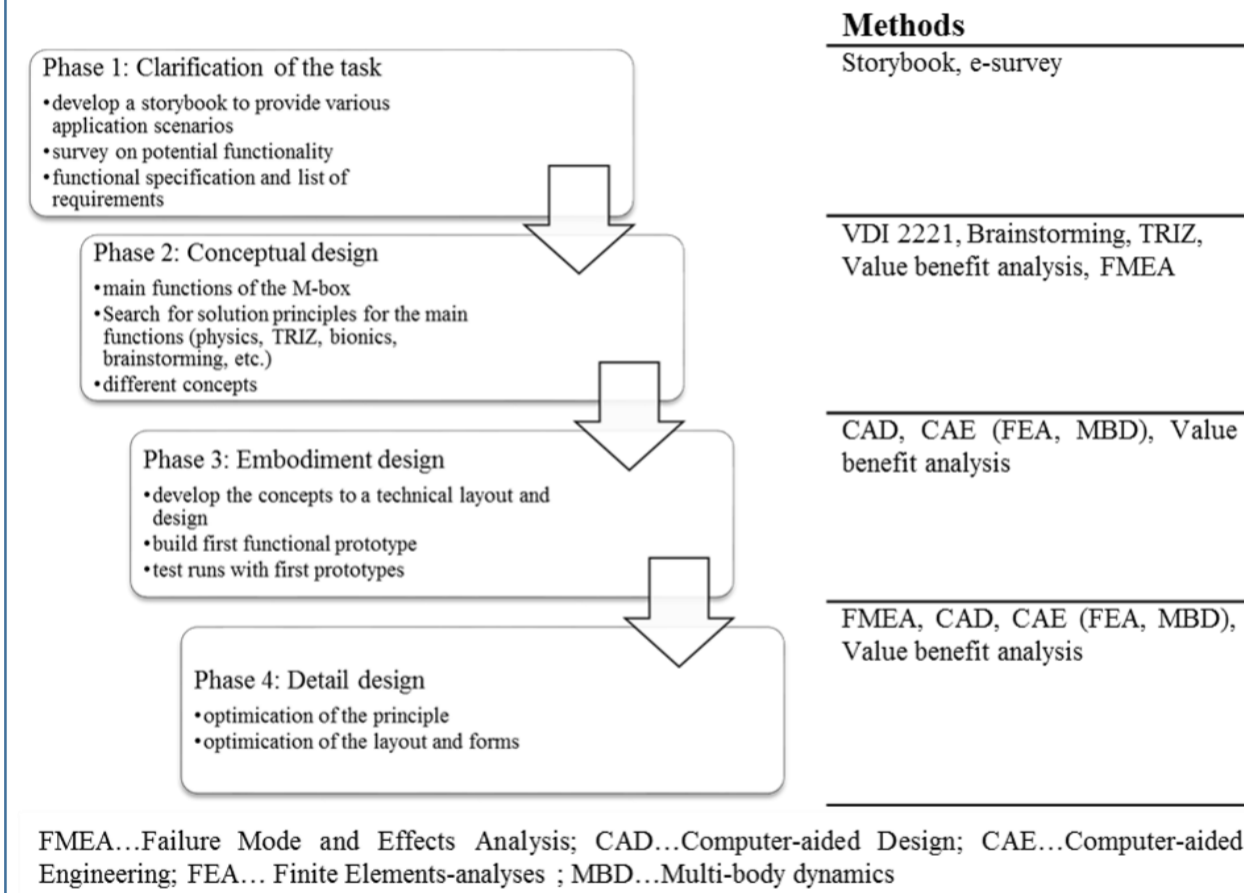


Figure 2: Different phases of the VDI 2222 applied on the development process for the container design [5]

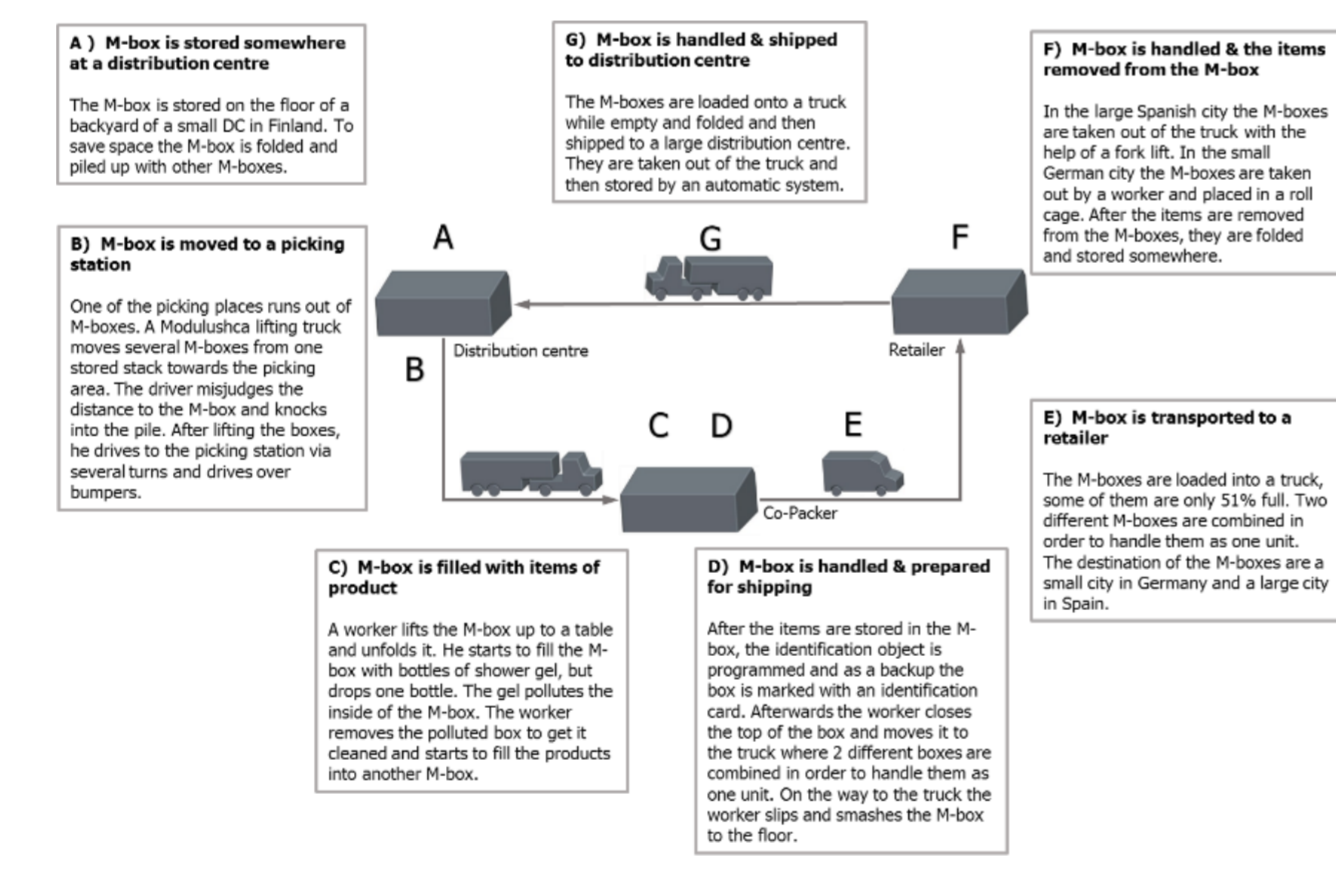


Figure 3: Storybook to sketch Supply Chain interactions [6]

A key enabler of this work was to develop a functional specification for the modular units. Therefore a pragmatic way by using a storybook approach was chosen (an example is outlined in figure 3). The storybook created a map of "typical" Supply Chain (SC) interactions between manufacturing sites, distribution centers, co-packing sites and retail outlets and was used to derive future requirements and functions for the PI-container as a basis for the conceptual design.

In addition to the MODULUSHCA project, further requirements and functions concerning the PI-handling container are derived in the Austrian research project Go2PI. The project is funded by the Austrian government and raised the question on how to lead a small and medium sized enterprise (SME) in the automotive sector towards the PI. Based on a case study, criteria and guidelines regarding aspects of technical and information systems as well as processes are evolved in order to develop a neutral and open business model following the PI vision. A proposed standard process for B-to-B (see figure 4) was developed as a basis for the storybook method and to derive further requirements and functions.

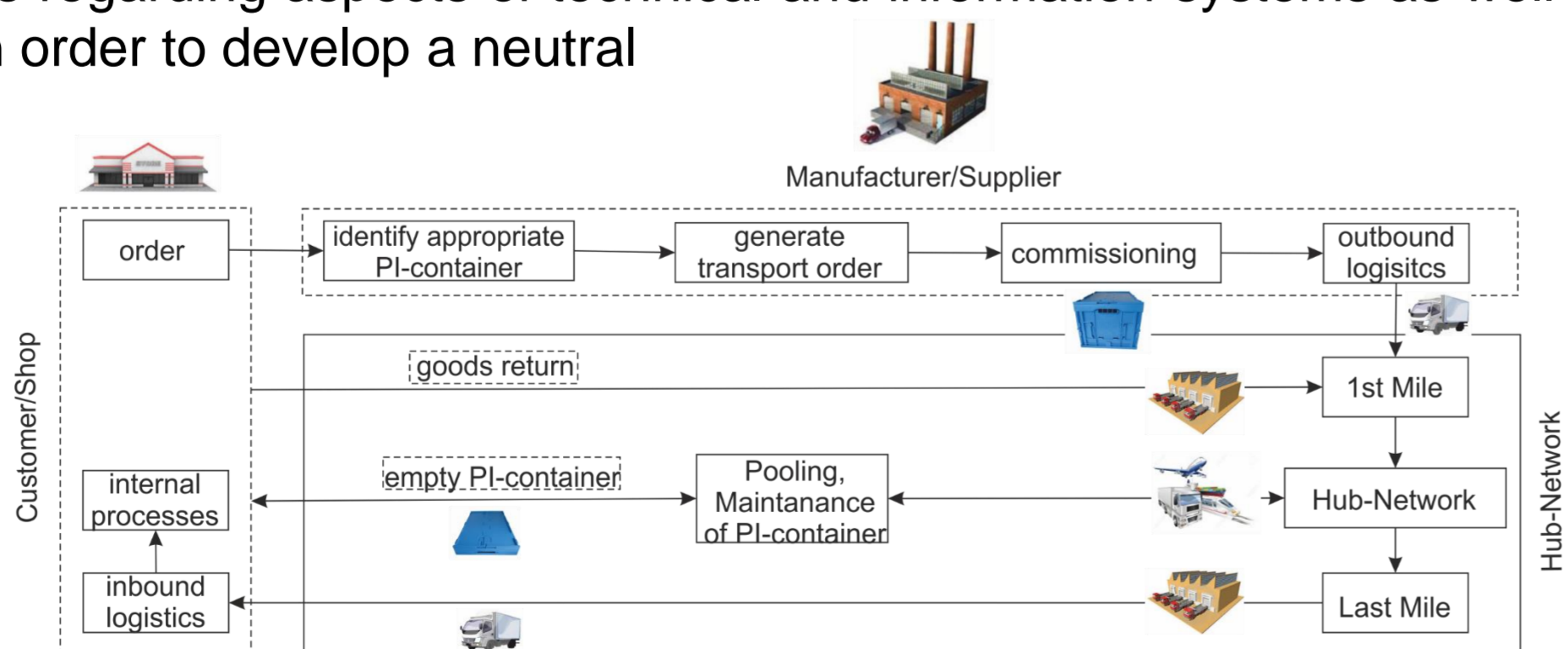


Figure 4: proposed standard process for B-to-B in a future PI [7]

Results

Within the MODULUSHCA project it was possible to derive multiple requirements for a future PI-handling container in FMCG logistics. Taking this requirements to a survey and capture stakeholder inputs for a better understanding of cross-industry and sector views, resulted in a list of main functions and also requirements for the design presented in figure 5. Based on the main functions a prototype was designed and manufactured with 3D printing (see figure 6). More detailed information and further results of the MODULUSHCA project are presented on the MODULUSHCA webpage [3] and in the work of Landschuetzer, Ehrentraut and Jodin (2015) [4].

Supplementary to the requirements for the FMCG logistics the Go2PI project derived further requirements and functions in the field of an SME in the automotive sector. Additional requirements are in particular the interaction with handling assets used in production, environmental conditions in production sites and the interaction with regular high-rack storage. Additional information is presented by the work of Gasperlmaier et al (2016) [9].

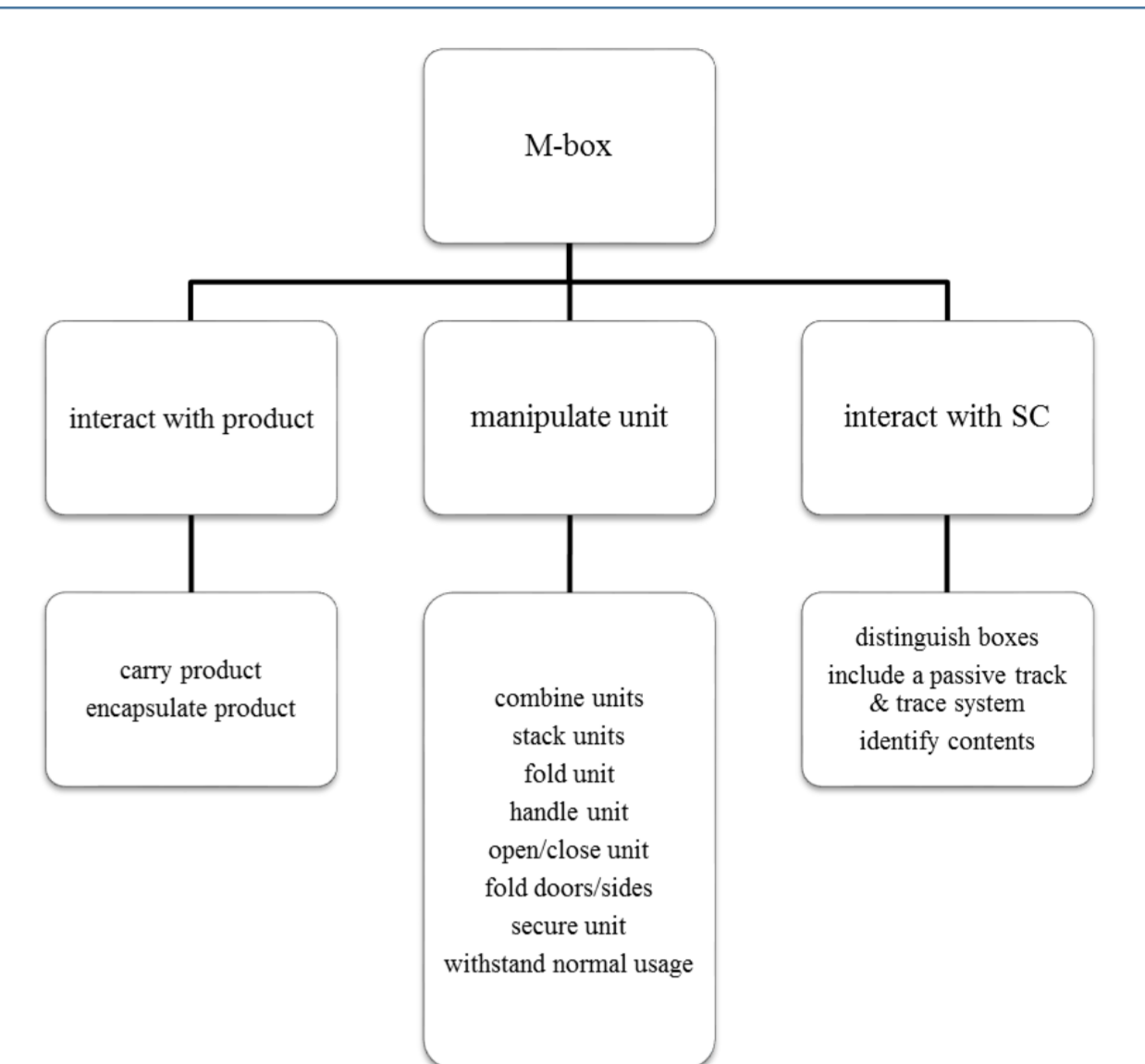


Figure 5: Key functions of the PI-handling container [8]

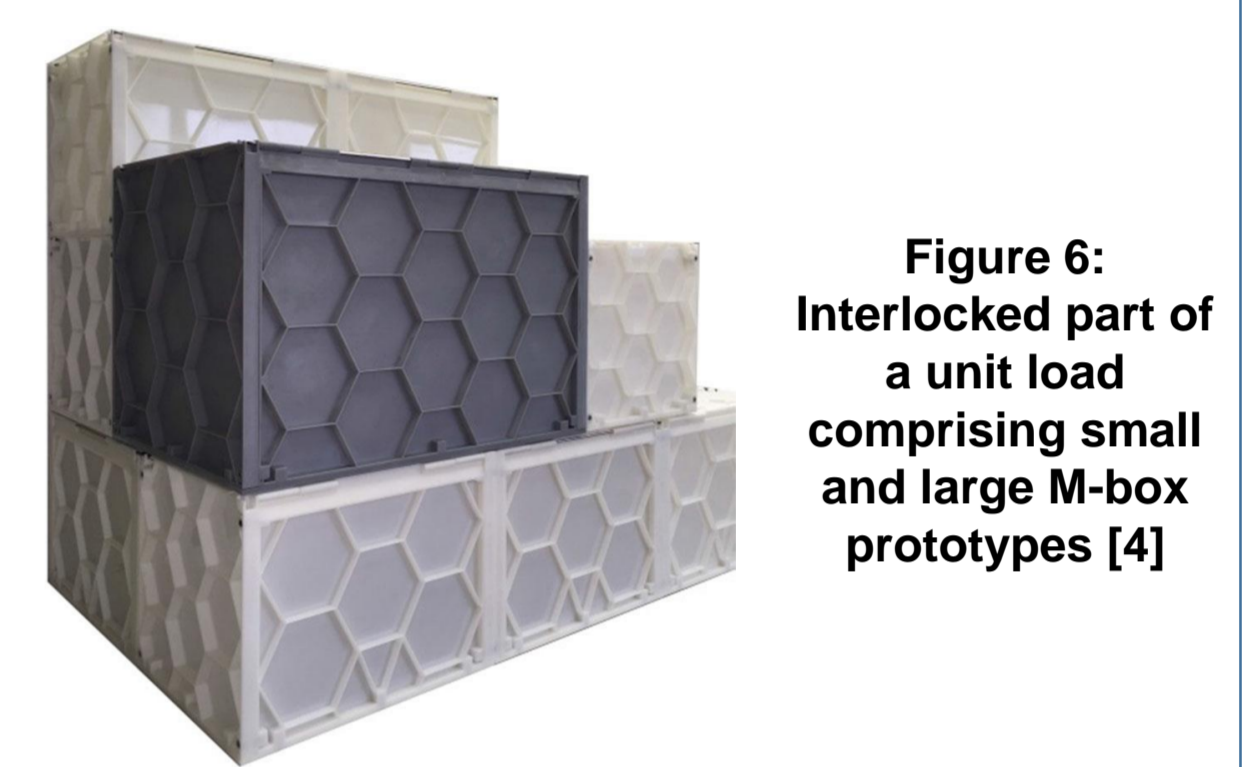


Figure 6: Interlocked part of a unit load comprising small and large M-box prototypes [4]

Conclusion and outlook

The PI aims to introduce many beneficial aspects to today's SCs and the PI-containers are one of the main elements to realize the PI-vision. The presented methods and findings show main requirements and functions of a future PI-handling container derived from two different research projects.

Next steps to carry on and elaborate the research and the development of PI-handling container are:

- Investigate in reusable packaging material
- Further develop the idea of building PI-containers out of modular panels (see Fig. 7).
- Derive further requirements and functions for the PI-handling containers by investigating other industrial sectors (by the Austrian research project "ProtoPI")
- Develop physical assets and processes to automatically handle and build unit loads

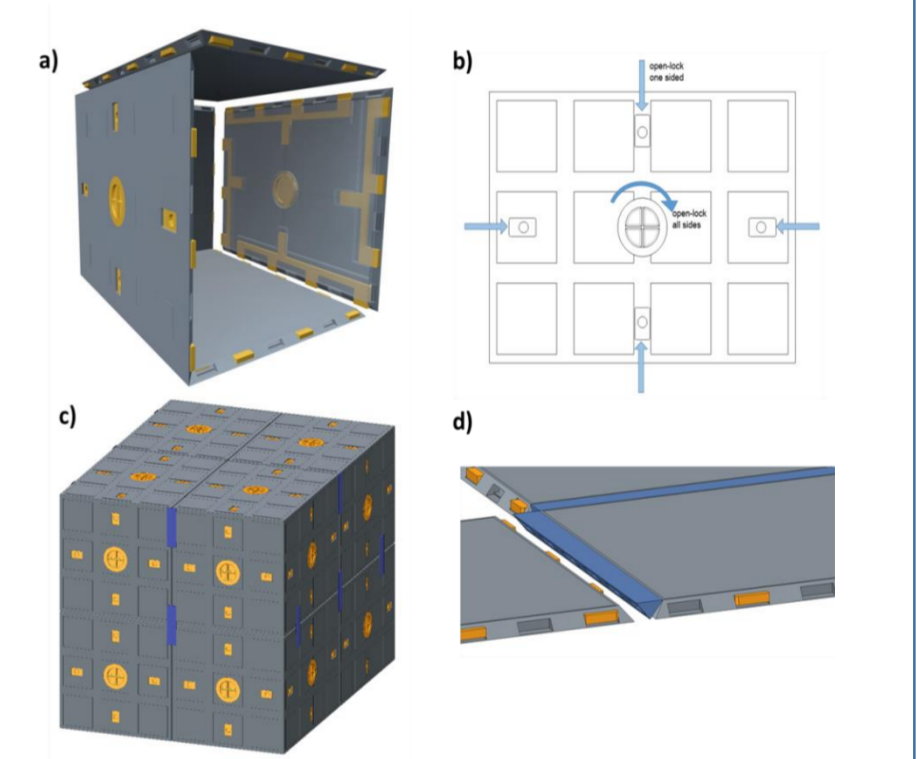


Figure 7: PI-container built out of modular panels [10]

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