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CONSTRUCTION SUPPLY CHAIN PRODUCT DATA INTEGRATION FOR LEAN AND GREEN SITE LOGISTICS

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ABSTRACT

Supply Chain Management using Construction Consolidation Centres, kitting and Third-Party Logistics were proposed to streamline material flows in construction and reduce costs. Studies also highlight potential mitigation of the environmental impacts of the Construction Supply Chain but, despite the climate emergency, these solutions struggle to become industry practice. Digitalization, especially with Building Information Modelling based processes, appears as a key enabler for this transition, but it is hindered by heterogeneous data between construction companies and suppliers (made of manufacturers and resellers). Therefore, semantic Digital Twins, that can use Product Information Management, and recent norms on Product Data Templates have been proposed, but they need to be studied through practical cases from both construction site and supply chain perspectives. Consequently, this study applies a Design Science Approach involving 3 pilot projects, a manufacturer and digital supply chain experts around the development of a proof of concept of a Digital Twin tool for Lean and green logistics in construction. We identify what limitations of classical technologies used in the pilots could be addressed by a Digital Twin, we define what product data is needed for such a use case, and we compare practical scenarios for sharing and storing this data.

KEYWORDS

Supply Chain Management (SCM), Logistics, Digitization, Digital Twin, Product information management (PIM).

INTRODUCTION

Inspired by Toyota Production System's Just-In-Time production and logistics, Supply Chain Management (SCM) is a key topic for Lean Construction since the years 2000 (Vrijhoef and Koskela, 2000; Arbulu and Ballard, 2004). The uncontrolled flows of materials in the construction sector cause many inefficiencies on site such as repetitive handling or losses, with a direct impact on productivity and costs reported by many authors (e.g., Mossman, 2008; Dakhli and Lafhaj 2018). Health impacts for workers are also considerable, for example the French health insurance office estimates that material handlings cause at least 48% of work-related accidents on construction sites (Assurance maladie, 2021). Lastly, the environmental impact of construction material flows is significant, with about 20-35% of all urban freight traffic caused by the construction sector in Europe (Brusselaers et al., 2020). In the Netherlands, 27% of all greenhouse gas emissions in 2015 are attributable to construction logistics

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(encompassing infrastructure, buildings for construction companies and building materials supply). In the context of environmental emergency, the concept of Green Lean Approaches (e.g., Rosenbaum and Gonzales, 2012) requires these issues not be treated in isolation, since improvements in the productive process can also lead to reduction of environmental impacts. These considered, supply chain management and logistics are of prime interest.

In previous research, Vrijhoef and Koskela (2000) pointed out the "myopic control" of the supply chain in Construction. Practical solutions were proposed with benefits reported both from an environmental and from a productivity perspective. For example, Mossman (2008) reported building costs at 80% of industry benchmark and a 73% reduction in CO2 emissions of material transportations thanks to the London Construction Consolidation Centre. The concept of Construction Consolidation Centre (CCC) also called Construction Logistics Centre (CLC) has since become more applied/researched (e.g., Guerlain et al., 2019; Brusselaers and Mommens, 2022). This may be used in combination with kitting where the material is delivered in batches at the exact workspace resulting in a productivity increase (Elfving et al., 2010; El Moussaoui et al., 2020; Tetik, et al. 2021). Lastly, the logistics operations may be performed by a specialized Third-Party Logistics (TPL) operator as described by Ekeskär and Rudberg (2020). Despite some differences in scope, methods, or equipment, all the examples above are similar by the fact that (1) they break existing silos within the Construction Supply Chain, or between Construction Supply Chain and construction site(s), and that (2) digitalisation is stated as key when developing/deploying these solutions.

Therefore, this article aims to investigate product data integration from the construction supply chain for lean and green logistics. Specifically, it develops its practical implications for both construction sites and manufacturers.

LITERATURE REVIEW

The combined application of Building Information Modelling (BIM), Lean and Supply Chain Management can guide the whole sector towards improved procurement and execution performances (Le et al., 2018; Guerriero et al., 2018). While BIM does not only include geometric information, more and more data related to the processes and detailed product specifications are covered under standards such as the Industry Foundation Classes (IFC) (BSI, 2013). The BIM is complemented by the Digital Twin (DT) concept, which has the potential to enrich existing BIM data with dynamically sensed datasets, leveraging on real-time monitoring and the synchronicity of the cyber-physical bi-directional data flows (Boje et al., 2019). More specifically semantic-based digital twin applications promise the ability to link heterogenous datasets. This could be applied to link data silos between construction supply chain actors (manufacturers, resellers, etc.) and thus facilitate a shift towards BIM-and DT-based processes.

According to Peltokorpi and Seppänen (2022), Product Information Management (PIM) is a core component in achieving this shift. The study identifies use cases and proposes an applicable process for PIM where product data comes from manufacturer as 'standard' data and is enriched with 'instance' and 'process' data. Consequently, systematic PIM is stated as an essential part in the effort for lean construction. Notably regarding logistics, PIM allows better coordination of material supply using identification codes such as Global Trade Identification Number (GTIN) from GS1 (Daskalova et al., 2019) with tracking tools and linking product libraries and project data. To provide product data in a structured and standardized way, manufacturers need to know what information they should provide and how it should be presented. Hence, Product Data Templates are suggested (Meda et al., 2020). They are defined by product type based on ISO 23386 and ISO 23387 (International Organization for Standardization, 2020) in compliance with ISO 12006 and they enable the identification of properties and groups of properties. To maintain classifications and property sets, buildingSMART offers an online service called buildingSMART Data Dictionary (bsDD)

(Buildingsmart, 2021). However, according to Peltokorpi and Seppänen (2022), "more practical research is needed to test the process and integration of the solutions". Most notably, further research should study how to efficiently link product standards, instance and process information with BIM and test the applicability of product Data Templates from a supply chain and construction material provider's point of view.

Consequently, this paper investigates how PIM and the Digital Twin concept can contribute to supply chain integration and logistics optimisation in construction. We assume that breaking data silos is a first necessary step to break decisional silos between the construction sites and their supply chain and that it will serve a lean and green perspective. We investigate in practice, from both the construction sites and the supply chain perspectives, how product data integration from the manufacturer could be used to support and upscale Supply Chain Management methods for reduced costs and environmental impacts of construction logistics.

METHODOLOGY

To cover practical implications and perspectives of product data integration from both sides of the supply chain, a Design Science Approach was chosen. With the participation of site managers from several case studies, a global construction product manufacturer and Supply Chain digitalisation experts, it aimed to develop a Proof of Concept (PoC) of a semantic Digital Twin for construction logistics optimisation. Therefore, this research was conducted as a use case of the Digital Supply Chain in Built environment group (Daskalova et al., 2019). Created from a memorandum of understanding between BuildingSMART and GS1, this consortium involved Construction Supply Chain companies to promote data driven collaboration.

The overarching research is tackled by the following questions (fig.1):

- Why Digital Twin and PIM are important for lean and green logistics on site? (Q1)
- What data is needed from the manufacturer to enable logistics optimisation? (Q2)
- How can this data be efficiently provided by manufacturers? (Q3)

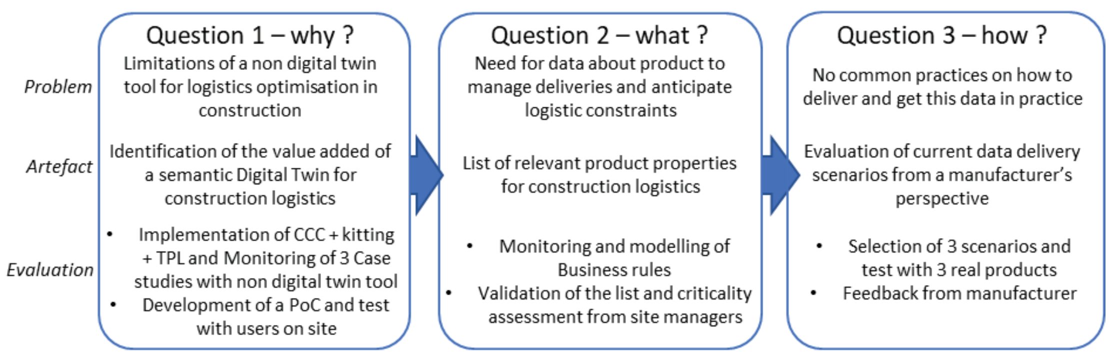

Figure 1: Research process with a Design Science Approach

As illustrated in figure 1, the questions were treated sequentially, and the DSA framework was applied for each question to deliver specific and replicable artefacts for the various stakeholders of the construction supply chain. Question 1 aimed to allow construction companies, logistician, and related practitioners to identify some expected value added of a PIM and Digital Twin tool towards Lean and Green logistics compared to a standard web platform. Therefore, innovative supply chain management methods were implemented by a General Contractor in Luxembourg (CLE- Compagnie Luxembourgeoise d'Entreprises) on 3 projects described in table 1. Previous publications about this project confirmed the strong potential for cost reduction and environmental impacts mitigation of a Lean Supply Chain Management while also emphasizing the key role of digitalisation (Berroir et al., 2021 and Maatar et al., 2022). The limitations faced by the teams with the web data platform used were collected through interviews. A PoC based on the digital twin concept (Boje et al., 2019) was designed to answer these limitations, and developed so that it could be tested on site with site managers (for predefined scenarios).

Question 2 aimed to provide to manufacturers, digital supply chain experts, standardisation bodies and researchers a set of product properties that are relevant for construction logistics based on the pilots. Therefore, logistic constraints on site (e.g., if an operator must unpack a package because it is too wide to cross a corridor) were collected during the monitoring of the pilots and modelled as a logical sequence, forming a so-called business rule. Accordingly, the product properties needed by these business rules could be listed, cross-checked with several existing classifications, and reviewed with sites participants for validation.

Lastly, based on this list of properties, question 3 aimed to provide practical feedbacks on data sharing and storing. 3 scenarios were identified and compared for 3 products from Knauf Insulation with the support of digital supply chain experts and BIM consultants.

CASE STUDIES DESCRIPTION

The 3 pilots involved overall 15 General Contractor's managers (from superintendent to director) from 2019 to 2023. More details on the projects are available in the following table:

Table 1: Description of the 3 case studies

Project	AUREA (in Differdange – LU)	OMNIA (in Esch-Belval – LU)	GRAVITY (in Differdange – LU)
Description	14 floor residential tower with 138 apartments	15 floor residential tower with 106 apartments	4 residential buildings (of 6 to 15 floors) with 205 apartments
Timeline	11/2019 to 07/2020	04/2021 to 05/2022	10/2021 to 03/2023
Trades involved	Tilling, floors, HVAC, bathtubs/showers, sanitary eq., joineries	Tilling, HVAC, bathtubs/showers, sanitary eq., plasterboards	
SCM/logistics innovations tested	Kitting, CCC, TPL	Kitting, CCC, TPL, multisite roundtrip with reverse logistics and some material picked up at close supplier	
Number of kits	1100	850	~1800 (ongoing)
Nb. of product types (references)	~900	~700	~300
Product choices	(Almost) fully flexible choices from the buyer		Choices from a shortlist
Digital tool and delivery management process	A Customized web data management platform on the software Airtable enabled to manage lists of kits and deliveries and to link it with files, photos, status, and planning on the cloud in real time. (See Maatar et al. 2022). It was used as a support for Last Planner System's meetings (Make-ready process).		

A benchmark conducted by the research team showed that most construction logistics software found on the market were focused on managing a delivery planning and on booking storage capacities or resources on site. This has little to do with enabling the detailed inventory of kits and the distributed management of deliveries between a logistic operator and the construction site(s). Thus, the general contractor designed and implemented its own web data platform for the pilots using the software Airtable. The detailed pros and cons of this precise software are not relevant for this study. The point is that, similarly to the other software found, it was representative of a "non-digital Twin" tool in the sense that it had no real-time (at least partly) automated data collection from the real world, no automated feedbacks to the real world, no simulation/problem solving capacity and no machine-readable product data integration.

RESULTS

EXPECTED VALUE ADDED OF A DIGITAL TWIN FOR LOGISTICS ON SITE (Q1)

As reported by Maatar et al. (2022), site managers were able to manage deliveries in kits with such a platform. Although preparing and maintaining the platform was time consuming, measurement showed that this outweighed the time that they usually lose in firefighting activities related to logistics.

However, in absence of machine-readable data, the web platform was not suitable for detailed product management inside kits and for multi-project and multi-criteria optimisation: the Omnia and Gravity sites were relatively close from each other (5km), but managers and logisticians couldn't plan complex roundtrips with the level of information they add and tended to schedule separate deliveries. Moreover, delivery times were often miscalculated because of unchecked delivery constraints (especially for products such as plasterboard). These limitations reported by site managers through interviews are summed up in the table 2. As proposed by Boje et al. (2019), a semantic Digital Twin may answer them. A PoC called TWISCO was designed to specifically illustrate how the DT concept can overcome these limitations. Tests on site (with tests data sets) confirmed the relevance of these features for site managers (fig. 3).

Table 2: Proposition of a Digital Twin application for Grean + Lean Construction logistics

Main limitations of web data platform used in pilot projects	**Features implemented in the TWISCO Proof of Concept (PIM + Digital Twin)**
Construction site's stakeholder and TPL operator need to know in detail what needs to be packed together, how and what are the characteristics of each package (e.g., weight)	A Kit management view allows to manage separate instances of products in each kit with their own properties and to manage and calculate the properties of the resulting kit.
Consistency between deliveries coming to the CCC and kit to be delivered need to be checked	Unique tracking of product instances in the kits using serialized GTIN (sGTIN) from GS1
Construction site's stakeholder and TPL need to assess when a kit should or not be delivered and what would be the impacts?	Planning integration + Space status management (may be automated with sensors) *Example: if there is humidity in the apartment delivery of wooden door should be postponed.*
As operators have a limited window of time to perform deliveries, delivery time need to be calculated considering constraints on site	Customizable constraint modelling through a "Business rules engine" *Example: a kit is too wide to cross a corridor, operator will lose time to unpack it and carry in separate batches*
TPL operator needs to be able to minimize both cost impacts and environmental impacts of complex multi-site roundtrips	Optimisation module with multicriteria optimization (using Genetic Algorithm)

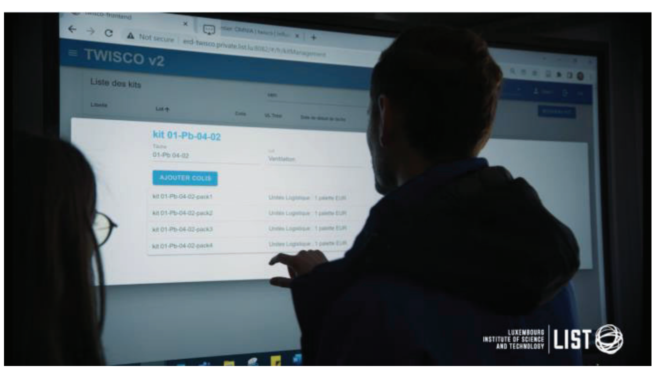

Figure 2: Testing on site of the TWISCO Proof of Concept

PRODUCT PROPERTIES FOR CONSTRUCTION LOGISTICS (Q2)

As a practical contribution to the 'Coordinating material deliveries on site' case for PIM stated by Peltokorpi and Seppänen (2022) and to enable tests with actual products, a list of the relevant 'standard data' for construction logistics was needed. The business rules, used to model the logistic constraints reported on the pilots, had product properties as a parameter, that could be extracted towards a first data model. With the support of experts from DSCIBE, it was crossed with existing standards such as ETIM and Peppol (OpenPeppol, 2017), which resulted in the list of properties hereafter. This list did not aim to be exhaustive nor definitive, but to contribute to the elicitation of key product data and to be representative of the type and amount of data needed to implement a semantic Digital Twin concept in practice. This list was submitted to the site managers to check the alignment with the characteristics they had to consider during pilots. Not all properties were of the same importance according to the feedbacks: While some characteristics such as weight or GTIN were mandatory to the concept proposed, other were situational. Accordingly, 'Must have' properties were highlighted by site managers, that encompass the most impacting problems faced. To help readability and future uses, the list was split in several sub cases ('purpose') and further explanations are proposed in description.

Table 3: Product Data for Construction Logistics: General data

Property	Purpose	Criticality	Description
Product identification (GTIN)	General	**Must have**	Global Trade Identification number 13-digit code
Seller Identification	General	Nice to have	GLN number of the company.
Manufacturer Identification	General	**Must have**	GLN or identification number
Key words (synonym)	General	Nice to have	Plain text
Product category	General	**Must have**	Categorization of the product type (e.g., windows). Should refer to existing categories in IFC, GPC or UNSPSC class.
Description	General	Nice to have	Plain text
Name	General	Nice to have	Plain text

Table 4: Product Data for Construction Logistics: Ordering, accounting, and kit definition

Property	Purpose	Criticality	Description
Ordering unit	Ordering, accounting, kit definition	**Must have**	Unit in which the order is expressed (square meters, linear meters, kg, pieces, …)
Minimum ordering quantity	Ordering/ accounting/ kit definition	Nice to have	If a threshold is defined for orders
Minimum package per pallet	Ordering/ accounting, kit definition	Nice to have	Minimum number of instances of the product type that can/must be stacked on one pallet (of the defined pallet type)
Maximum package per pallet	Ordering, accounting, kit definition	**Must have**	Maximum number of instances of the product type that can be stacked on 1 pallet.

Table 5: Product Data for Construction Logistics: Handling and transport

Property	Purpose	Criticality	Description
Gross product weight	Handling, transport	**Must have**	Value in kg. May include packaging
Net product weight	Handling, transport	Nice to have	Value in kg without packaging (useful only if packaging is a big part of the weight)
Pack quantity	Handling, transport	Nice to have	The number of packed units that are in the orderable unit. E.g., if the orderable unit is a pallet that contains 30 boxes then the packed units are BOX and the packed quantity is 30.
Roll diameter	Handling, transport	Nice to have	Specific to cylinder products
Product density	Handling, transport	Nice to have	Only useful to determine weight if not given.
Product volume	Handling, transport	Nice to have	Relevant for truck optimisation with stackable products
Product length (packaged)	Handling, transport	**Must have**	Deep dimension of the packaged product
Product width (packaged)	Handling, transport	**Must have**	Latitudinal dimension of the packaged product
Product height	Handling, transport	Nice to have	Needed when products can be stacked or to check if product can go through some doors/lifts
Numeric pack size	Handling, transport	Nice to have	Consumable unit quantity Specifies the number of consumable units that are in each orderable unit. E.g., if the orderable unit is a pallet that contains 30 boxes, then the packed units are box and the packed quantity is 30 and the numeric pack size 30*orderable unit
Type of handling unit	Handling, transport	**Must have**	Type of pallet used (pallet EUR, destructible pallets, no container, other (e.g. backrest pallets)
Handling instructions	Handling, transport	**Must have**	Plain text: comments of the manufacturer on how to use / or manipulate the material
Is it fragile	Handling, transport	**Must have**	Boolean, high risk of breaking

Table 6: Product Data for Construction Logistics: Installation

Property	Purpose	Criticality	Description
Vapour permeability	Installation	Nice to have	If available, can be used to determine the sensitivity to humidity. Potentially useful for further Use cases other than logistics
Thermal resistance	Installation	Not relevant for logistics	R-value, if necessary, a use or storage temperature should rather be given
Use temperature	Installation	Nice to have	Range of acceptable temperature for using the product as intended
Storage temperature	Installation	Nice to have	Range of acceptable temperature for storage

Table 7: Product Data for Construction Logistics: Installation

Property	Purpose	Criticality	Description
Maximum storage humidity	storage	**Must have**	Maximum humidity conditions before risk of degradation / property losses for the product
Maximum storage temperature	storage	**Must have**	Maximum temperature conditions before risk of degradation / property losses
Minimum storage temperature	storage	**Must have**	Minimum humidity conditions before risk of degradation / property losses for the product.
Sensibility to sun light	storage	Nice to have	Some material might be for example discoloured if they are left exposed to the sun

Table 8: Product Data for Construction Logistics: Reverse, Waste management

Property	Purpose	Criticality	Description
Packaging plastic sheet	Reverse, waste management	Nice to have	Amount of plastic with usual packaging. Can be useful for reverse logistics
Packaging wooden pallets	Reverse, waste management	Nice to have	Amount and type of wooden pallet with usual packaging. Can be useful for reverse logistics

PRODUCT DATA DELIVERY FROM THE MANUFACTURER (Q3)

In the 3 pilot sites, only the "must have" properties of the products managed would represent more than 20 000 values. For a construction company, filling and maintaining such a database is unrealistic and cost-ineffective, even if data would come in a machine-readable format. Particularly in these cases where product choices validated by the buyer at a very late stage of the project. This responsibility falls then on manufacturers, but from a supplier's perspective, knowing how to provide the data requires tackling practical questions 1° and 2° below, that were tested for 3 products from Knauf Insulation (e.g., https://knauf.be/fr/produit/acoustifit).

1° Where to store data so that it can be managed in time, at minimal cost?

The purpose of these experiments was not to find the best solution on the market from an economical or technical perspective, but to compare several approaches different by nature from a supply chain perspective. Accordingly, three patterns were identified and tested: data can be stored in common data bases/databanks (1), data can be stored in the BIM objects (2), or data can be piggybacked to e-procurement messages (3).

Using a common product data bank (GDSN)

An approach based on National databases is emerging in many countries especially regarding standardized Life Cycle Assessment Data (e.g., https://www.oekobaudat.de/). For the tests, a product data base called "GDSN" (which was originally designed and used for food) was used.

Pros: - Minimal needs in terms of software or pre-existing data (apart from a GTIN) from both sender and receivers' point of view

- Consistency with GS1 regulations (for the case of GDSN)

Cons: - The system was closed, meaning that adding properties or bypassing asked fields was not possible. This might not be the case for all solutions of type "databank"/common database, but the flexibility of the system raises questions in front of unanticipated data need or changes in the standards raises questions.

Integrating all (the required) properties in the BIM file

Alternatively, several big manufacturers provide access to BIM libraries where an IFC file (or other BIM formats) can be downloaded for each product (e.g., bimlibrary[5] from Saint-Gobain). In some cases, it is even possible to generate BIM file for a system of several products assembled including products of other manufacturers as for example in Knauf Insulation (2022).

Pros: - All information is standardized.

- Fully customizable within available properties at manufacturers level. Example: https://test.hybrid.pl/knauf_insulation/bim/bim_generator/form.php?id=7977
- Considered as more convenient from a (big) manufacturer's perspective

Cons: - May be less effective procurement-wise
- Requires having BIM libraries of the products
- May restrict the access to data for software outside of BIM environment

Sending data (and some potential meta data) as a message for e-procurement (Peppol)

Peppol allows a network of eProcurement partners to be connected and exchange standard-based documents (OpenPeppol, 2017). Thus .xml files can automatically be sent by any internal system and 'translated' at the receiver's level with customizable integrators.

Pros: - Considered as more convenient from a procurement and multi-level supply chain, - Natively supports logistics workflow

- Data to deliver is easily customizable, and can be aligned with Data Templates

Cons: - At receiving end, using Peppol may entail to maintain multiple copies of the same product data instead of maintaining a single catalogue of product types

- Harder to implement on manufacturers side (new system of data sharing)

2° How to structure data in sync with existing classifications to ensure interoperability?

In all three scenarios above, the key to identify a property is its Uniform Resource Identifier (URI), identified thanks to data templates through the bsDD. Every property in the list (Tables 3 to 8) were looked after in the bsDD, in some of the main product data classifications available (ETIM, eClass) and in the Peppol standards as shown in table 9.

Table 9: Identification of targeted data in current classification

	number of properties	bSDD	ETIM	eClass	Peppol
All properties	34	71%	42%	32%	84%
Only "Must have"	14	73%	45%	36%	100%

The percentages in table 9 indicate that as new use cases or applications are developed, a significant amount of the properties might be out of available classifications. More importantly, these properties were spread in several classifications, which made their identification tedious and thus, limited replicability and efficiency from a manufacturer's perspective.

DISCUSSION

Construction Logistics and Digital Twin on site

Although TWISCO was usable for tests and demonstrations, it is still a PoC with a TRL5 (Sadin 1988). As such it is not fully functional, and the value added of the Digital Twin Concept proposed in table 2 needs to be confirmed and potentially extended with its full implementation

[5] https://bimlibrary.saint-gobain.com/

in real conditions. TWISCO's business rules engine could be used as a framework for bottom-up identification of logistic constraints through new case studies. These should also consider the potential limitations of Digital Twins in construction regarding the human related aspects highlighted by Noueihed and Hamzeh (2022). Sensor's implementation on construction sites and automated tracking from the supplier proposed by the TWISCO PoC should also be more studied. Indeed, these technologies may contribute to the Last Planner System by enabling a more trusted Make Ready Process. Moreover, the environmental impact mitigation from a multi-site delivery optimisation algorithm should be demonstrated in practice as well.

Predefined Group of properties in the Product Data Templates for specific use case

Product data templates are defined by product type. Based on current work, authors call for more generic predefined group of properties based on use cases such as "logistics". This paper is a contribution towards such a standardized set of property for construction logistics. Authors emphasize that such a group of properties should not be restricted to the "handling or transport properties" as other aspects were identified as necessary to optimize logistics based on Just-in-time principles (for example installation aspects). This list is however preliminary and limited in scope. More project types, product types, and logistics scenarios (e.g., multi modal logistics optimization, reverse logistics, logistics for reused materials) need to be investigated. Other similar applications such as the circular economy with the 'Product Circularity Data Sheet' (Mulhall et al., 2022) may benefit from such a standardization effort.

Manufacturer's perspective on PIM

To encourage manufacturers to openly give access to their data, there is a need to either set regulatory obligations or clarify the business model and competitive advantage. Therefore, understanding and awareness should be raised in the industry. From the manufacturer's perspective, this might require simplifying and clarifying the concepts used (standards, data formats, data templates, data sheet, data sets, classifications, norms, data dictionary, properties, attribute, etc…). Moreover, this study indicates that there might not be a "silver bullet" solution, but different options depending on the type of products, experience with BIM and PIM, the number of reference or ERP system used, etc. This should be elaborated in further studies.

CONCLUSIONS

This paper investigated how data continuity may be achieved in construction and how it could support data driven logistics aiming at reduced environmental impacts and costs. Based on operational feedbacks from 3 projects with almost 4000 kits delivered from a CCC, limitations of a classical web data platform were identified and a proof of concept of semantic Digital Twin was proposed to answer them. This PoC enables to manage 'instance data' of products (e.g., unique reference of material within a delivery) which facilitates kit management. It can be subsequently linked with 'process data' (e.g., delivery status) which are essential to manage the process in the sense of Lean Construction and to integrate 'standard data' which encompasses physical characteristics of a type of product (e.g., weight). What standard data should be exchanged and how it can be practically delivered was studied with real products from both ends of the supply chain. Accordingly, this research contributes to Lean Construction by identifying some potential benefits and perspectives of Digital Twin and PIM for SCM. It contributes to the fields PIM, BIM, and Digital Twin by presenting use case of these technologies with concrete implication in the execution phase, by comparing several patterns for delivering the data and by reporting a limit in current definition of Product Data Templates. Thus, authors advocate for predefined sets of properties for specific use cases such as logistics or circularity in the Data Templates (that could be built upon the list proposed in this article) and highlight the need to raise awareness amongst the industry through more practical cases.

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