ASSESSING CONTRACT LOGISTICS FACILITIES: RESULTS FROM A SURVEY IN ITALY

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Abstract – *E-commerce and retailing companies have recently been experiencing a rise in their revenues. This has led to the search for new logistics facilities compliant with their needs. Such research of new spaces and top-quality facilities has driven the logistics real estate industry to an unexpected rebirth after the slowdown caused by the last economic crisis. Some examples of assessment models for industrial buildings are reported in literature, but they mainly evaluate warehouses from a sustainability perspective. Conversely, the measurement of quality and functionality has scarcely been addressed thus far. The paper aims to fill this gap by describing the state of the art of contract logistics warehousing in Italy using an original model to assess logistics buildings. The model allows for identifying, structuring and rating the most significant features for two main types of logistics buildings, namely warehouses and cross-docking platforms. The proposed model builds on previous literature and integrates the practitioners' perspective. It is structured into four sections, each representing the most important features for the evaluation of logistics buildings: location, external spaces, technical characteristics, and internal areas. Each sub-section contains multiple-choice questions. The significance of each section is given by specific percentage weights defined by the experts involved during multiple semi-structured interviews. Finally, the rating model was validated by pilot tests. The model was applied extensively on 65 contract logistics facilities located in Italy, ranging from 2,000 to 150,000 square metres.*

Keywords – *Benchmarking, building performance and sustainability, warehousing, logistics real estate, rating system.*

INTRODUCTION

The rebirth of logistics real estate has been supported by industries such as e-commerce (Mangiaracina et al, 2016) and retailing, which are looking for facilities compliant with their logistics or global supply chain needs (Dablanc et al., 2012). Logistics facilities are also sought by logistics service providers (LSP) involved in the distribution of goods for these industries; they are looking for top-class buildings that are able to satisfy their operating needs and the quality requests desired by their customers (Raut et al, 2018). In recent years, the search for new space has led to a 40% reduction of warehouse vacancy rate and an increase of more than 50% in new construction in terms of floor area compared to 2015.

Nowadays, companies searching for logistics buildings essentially focus their evaluation on size (e.g. in terms of floor area) and few other aspects, without referring to a shared holistic procedure and without a structured model of classification and evaluation of the quality of the facility. The lack of a reference model for qualitative assessment represents a significant limitation, since logistics building quality is defined by several different elements that are essential to performing a logistics activity, and cannot be simplified focusing only on size (Mattarocci et al, 2017). Therefore, in order to identify the top-class logistics buildings, the need has emerged for measuring both the quality (e.g. architectural and equipment features) and functionality (i.e. compliancy with logistics requirements) of warehouses.

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The literature reports a number of assessment models for industrial buildings, especially from a sustainability perspective, such as LEED and BREEAM certifications (Mattoni et al, 2018; Berardi, 2012). However, the measurement of their functionality and overall quality has scarcely been addressed thus far.
To fill this gap, the present paper develops an original model to assess logistics buildings, identifying, structuring and rating the most important features of a warehouse. Moreover, it illustrates the results of the application of the model developed on a sample of contract logistics facilities located in Italy.
The remainder is organized as follows: Section 2 reports the analysis of the existing literature related to logistics real estate. Section 3 describes the objectives and research questions, whereas Section 4 illustrates the methodology adopted. Section 5 describes the proposed model and Section 6 presents the findings related to its implementation on the examined sample of logistics facilities. Finally, the last section discusses the main conclusions and identifies the future research opportunities in this field.

LITERATURE

Rating systems have always been adopted in the real estate industry to evaluate the marketability of different types of buildings or properties, i.e. apartments, offices, industrial buildings, and others (Mattarocci et al, 2017). In the real estate value chain, the evaluation is performed by different players, such as real estate agents, appraisers, assessors, mortgage lenders, brokers, property developers, investors and fund managers, lenders, market researchers and analysts, and tenants (Pagourtzi et al, 2003). The presence of all these players justifies the need for a deep understanding of the asset, since the product under assessment is a durable long-term asset, with great economic value, characterised by high differentiation and located in a specific site (Wyman et al, 2011).
Regarding industrial building, the real estate literature reports several evaluation models that mainly focus on sustainability and safety aspects, such as limitation of gas emissions, energy consumption, and the application of green regulation during the design and construction activities (Ding, 2008). Indeed, due to the institutional pressures on building sustainability performance, considerable attention has been paid to the environmental assessment. Even the logistics field has been affected by sustainability issues, leading to multiple studies about best-in-class policies to reduce gas emission during logistics activities (Colicchia et al., 2016).
Looking at sustainability, a number of models have also been developed – i.e. the so-called Green Building Rating Systems (GBRS) – to assess the degree of sustainability in the real estate industry. The most significant are also recognised as international standards, such as LEED, BREEAM, Green Star, Green Globes, SB Tool, and national versions such as CASBEE for Japan, DNGB for Germany, and ITACA for Italy (Mattoni et al., 2018). These models have generally been designed for industrial buildings. Some adjustments have been made to fit the logistics context, but the attention is merely on the environmental assessment of the building.
Focussing on the logistics real estate industry, little attention has been given so far to the development of assessment models that consider the quality of logistics buildings from a multi-dimensional perspective. As stated above, the existing literature focuses mainly on sustainability aspects and on quantitative issues related to facility location and site selection, often neglecting other elements related to the building structure. Still, this latter aspect is becoming more and more of a concern, given the growth of the contracts logistics industry (Marchet et al., 2017) and the need of Logistics Service Providers' (LSPs) customers to inspect and evaluate the buildings in order to ensure they receive good quality service (Marchet et al, 2017).
Besides sustainability aspects, other features in the literature have been found to be of importance (Baglio et al., 2018): location, technical/construction characteristics, external and internal spaces, utilities and "green" systems.
The location is considered to be one of the most important features in real estate, according to Diziain et al. (2014). Regarding the specificity of a logistics building, location is one key feature for an efficient goods distribution network (Dablanc et al., 2012). Location aspects have been described in the literature, citing, for example, the availability of transport services and infrastructure in the surroundings, such as motorways, railway stations, ports or airports, and a facility's location in a logistics centre or freight village (Lipińska-Słota et al, 2018). In this case, the location can increase the value of a logistics building if it supports or facilitates logistics activities (Woudsma, 2008). For instance, a warehouse near a motorway can help deliver goods faster than a farer facility. However, the value given to the location depends on the function played by the building. Indeed, central warehouses or last mile cross-docking facilities have different location needs (Mattarocci et al., 2017).
Other significant aspects, such as technical and construction characteristics, internal and external spaces, utilities and "green" systems, have been pointed out. Technical and construction characteristics refer to the building features, such as structural mesh, pavement, and roof structure (Ciaramella, 2010). Internal and external spaces

refer to areas (e.g. truck parking lots, offices, recharge areas for material handling equipment, technical rooms, and restrooms) or devices and facilities (e.g. docks, refrigeration rooms, safety systems). Utilities and "green" systems refer to those appliances such as systems for fire-detection, fire-extinguishing, lighting, electricity, heating/air-conditioning, and photovoltaic energy.

All the above-mentioned aspects can be evaluated differently, depending on the purpose of usage (i.e. "functionality") of a logistic building (Mattarocci et al., 2017). However, this concept has been underestimated by scholars, since the value of a facility is usually not assessed in terms of its functionality (Baglio et al., 2018). In literature, logistics buildings have been recognised to play different roles. The most common one is inventory holding, i.e. conventional stock warehouses where goods are stored in racks for a long period, depending on the timing of inbound and outbound flows, and customer orders are consolidated before delivery. A second role is cross-docking, i.e. warehouses where goods are moved directly from the receiving to the shipping area, rapidly sorted and loaded to their final destinations (Higgins et al., 2012). Cross-docking facilities are commonly used as transit points by transportation companies to optimize long line haul with last mile delivery. According to Baker et al. (2009), other roles for logistics facilities may include value added services (e.g. secondary packaging activities), or production postponement, returned good (for reverse logistics) and other activities, such as service and repair.

OBJECTIVE AND RESEARCH QUESTIONS

The literature review has identified a gap in terms of evaluation models specifically developed for logistics buildings focusing on their quality and functionality (Baglio et al., 2018). Quality has to be intended as a set of elements (e.g. site location, external spaces, building technical characteristics, internal areas, utilities and "green systems") affecting the overall building evaluation, and not only as a combination of architectural characteristics and equipment features. Functionality refers to the level of compliance of a logistics building to host a certain type of logistics activity (e.g. storage, picking and sorting). To fill this gap, the objective of the present paper is to describe the state of the art of contract logistics warehousing in Italy by applying an original model developed by the authors and presented in Baglio et al. (2018) to assess the quality and functionality of logistics buildings. Such original model allows a user to identify, structure and rate the most relevant features of a warehouse, considering, too, the purpose of usage, in line with Mattarocci et al. (2017). Specifically, the model is applied to evaluate 65 contract logistics facilities located in Italy. The aim is twofold: to enrich the factors that supply chain and logistics managers use in their location decision, and to help policy makers identify factors that may be critical to promote local and industrial development.

According to the intended objective of the research, the following research questions have been identified:

RQ1: Based on the application of the model developed (Baglio et al., 2018), what is the state of the art in terms of quality among contract logistics facilities in Italy, and what are the main features?

RQ2: How do these main features contribute to the quality and functionality evaluation of the logistics facilities?

METHODOLOGY

The research methodology consisted of different phases. First, a literature review was performed in order to identify the main types of logistics buildings, the significant features to be considered to assess a warehouse or a cross-docking facility, and the rating systems available and adopted in the logistics real estate industry. The literature review results allowed for collecting a first set of information to develop the model. Second, six semi-structured interviews with experts in the logistics real estate industry (e.g. logistics real estate managers, structural engineers, and facilities managers) were developed to define the types of logistics buildings (i.e. confirmed as stock warehouses vs cross-docking facilities) and the list of features characterising them. These figures were selected since they operate in the logistics real estate market and have a deep understanding of the industry.

A five-star rating system was then developed to assess the quality of logistics buildings. The five-star rating assessment system was selected since it is easily identified and understood, thanks to its widespread use in different fields, such as finance, hotels, online customer reviews, safety systems, and sustainability performance in real estate (Berardi, 2012; Sparling et al., 2011). The model was validated by pilot tests on 15 existing warehouses. This phase allowed for a fine-tuning of the model, adjusting wording, weights and scores.

To test the model on different types of facilities, either stock warehouses or cross-docking facilities - both having different features and quality levels - the authors decided to implement the model on contract logistics buildings. To understand the quality of the contract logistics facilities located in Italy (RQ1) and the main contributing

features (RQ2), intended focus was placed on LSP facilities. Therefore, the buildings assessed were stand-alone facilities, while factory warehouses (e.g. logistics buildings with direct access to the manufactory plant) were excluded from the analysis.
To identify the most relevant companies in the industry, authors used the database of the Contract Logistics Observatory (as per Marchet et al., 2018). Started in 2011 and dedicated to topics regarding logistics outsourcing, it is a permanent research initiative launched by Politecnico di Milano School of Management. Thanks to the contact database of the Observatory, it was possible to survey up to 150 LSPs with the questions related to the model.
Starting from the database obtained from the survey response, a subset of 65 warehouse was formed. From the initial database, information was used to eliminate warehouses having inappropriate characteristics, such as being more than 30 years old and/or smaller than 2,000 m^2. This was done because buildings older than 30 usually prove to be obsolete facilities, as they typically do not meet safety standards. Furthermore, not including small buildings allows for paying attention to large facilities where LSPs concentrate the goods of more clients (multi-client warehouses).

MODEL DEVELOPMENT

The detailed development of the rating model has already been discussed by Baglio et al. (2018). In this paragraph, we present the main issues of the model we developed. In particular, the model is structured into four sections. Each section is divided into sub-sections:

- Section 1: "Location and relationship with the context" divided into two sub-sections: "1.1 Context" and "1.2 Proximity to transport infrastructure";
- Section 2: "External spaces" divided into two sub-sections: "2.1 External yard" and "2.2 Loading/unloading bays";
- Section 3: "Building technical characteristics" divided into three sub-sections: "3.1 Warehouse size", "3.2 Structure" and "3.3 Flooring";
- Section 4: "Internal area, utilities and green systems" divided into two sub-sections: "4.1 Offices and other spaces", and "4.2 Utilities and green systems".

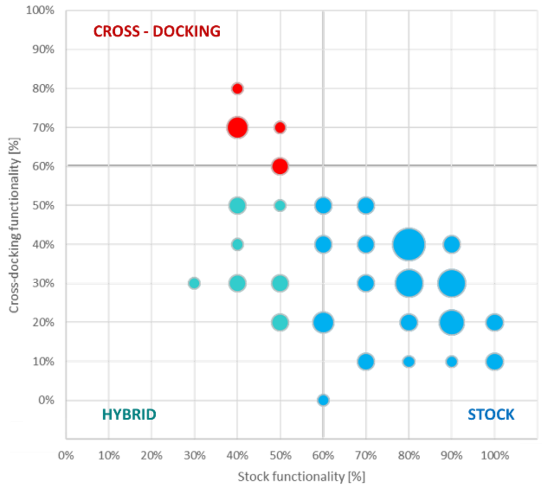
Each subsection includes single-response questions (i.e. items). To evaluate quality and functionality, as highlighted in the methodology section, a pool of experts was involved to define the features to be included in the model and their importance. The weight of each section and sub-section for the quality evaluation was discussed with the pool of experts, while for the items the weights were validated and discussed with practitioners of the field, in order to give higher weight to the most important questions. During the phase of weight allocation, the experts also gave their opinion, paying attention to building functionality. As a result, two patterns of weights emerged: one for the stock warehouses and one for cross-docking facilities. Thus, quality score is computed as the sum of all the scores obtained for each question of the model. The percentage rate of quality is then converted into a score using a five-star rating system. Indeed, five different ranges were set, using intervals of different sizes, in line with the Green Star certification for sustainability (Mattoni et al., 2018).
Regarding functionality, structured interviews were used to define which features were fundamental to being able to distinguish between stock warehouses and cross-docking facilities. A score was assigned to each feature, and the sum provides the final functionality rate. When the functionality rate, expressed as a percentage from 0 to 100%, is equal to or higher than 60%, the warehouse belongs to the stock or cross-docking facilities type. If the rate is below the set level, the warehouse assessed is considered "hybrid", since it has some features of both stock and cross-docking facilities.

MODEL RESULTS

This section reports the model application on 65 warehouses located in Italy and used by LSPs. For each logistics facility under assessment, Figure 1 reports the relationship between stock functionality and cross-docking functionality rates. The graph pinpoints three groups of facilities: the one on the top left (red points) includes the cross-docking facilities, the one on the bottom right identifies the stocking warehouses (blue points), while the green group identifies the "hybrid" buildings. These latter facilities do not have the typical characteristics of "stock" and "cross-docking" warehouses (i.e. with both functionality rates under the thresholds of 60%), and are reported in the bottom left quadrant. Finally, no warehouse has been found with a functionality greater than

60% for both "stock" and "cross-docking" types. This is the reason why the area on the top right is empty, since there are no warehouses with high functionality rates for both stock and cross-docking facilities.

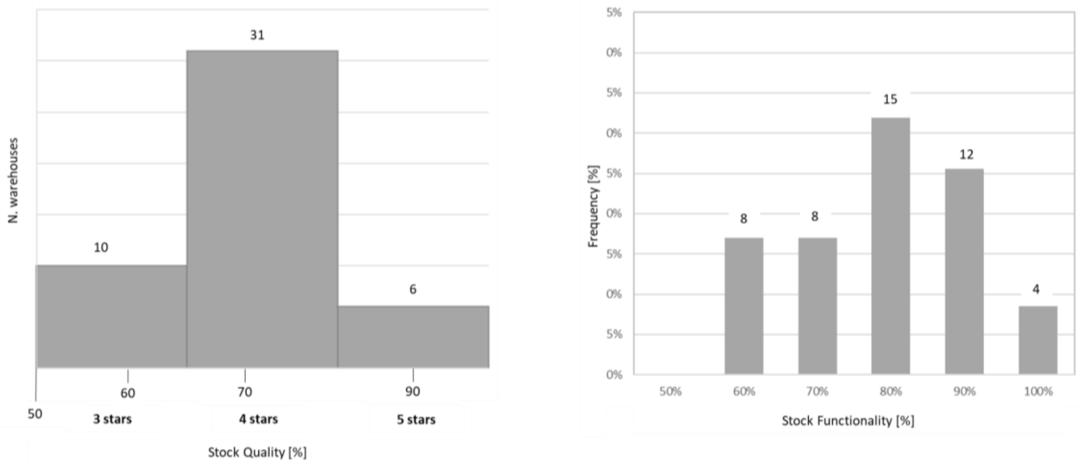
Figure 1: Comparison between functionality rates (stock warehouses vs. cross-docking facilities)



The majority of the observations are reported in the "stock" quadrant (i.e. 47 facilities with stock functionality rate equal to or greater than 60%), since most of the logistics service providers interviewed mainly used such facilities to stock, pick and sort the goods of their clients. For this reason, in order to allow for homogeneous comparisons in the further analysis, we decided to focus on the subset of stock warehouses only (i.e. warehouses with a stock functionality equal to or greater than 60%).

Looking to the subset of stock warehouses, quality and functionality rates are reported in Figure 2. The overall quality mean is equal to 70%, which corresponds to 4 stars in the five-star rating system. Overall, it emerges that the examined warehouses in the Italian contract logistics industry have high a standard of quality. Regarding functionality, 62% of the observations have rates greater than 80%, meaning that contract logistics warehouses are strongly related to storage activities. The graph reports the number of warehouses above each column.

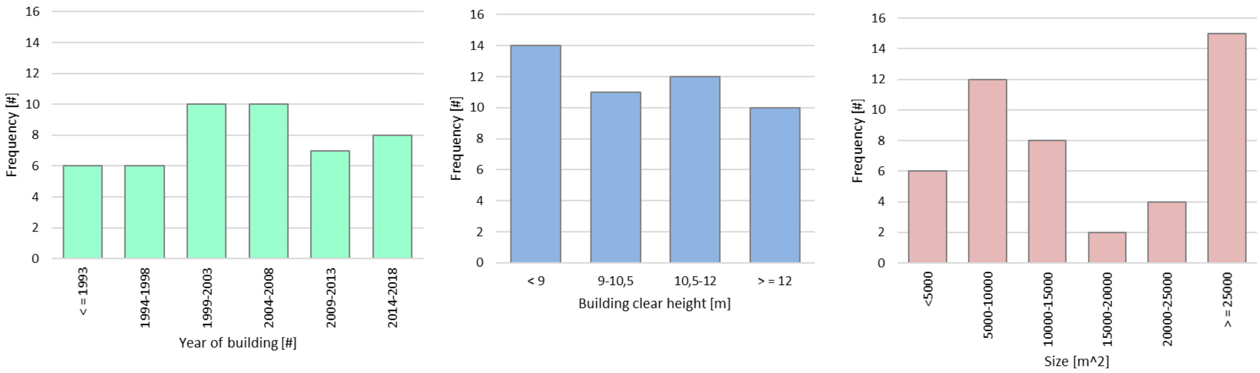
Figure 2: Stock quality and functionality for the examined subset (47 warehouses)



The quality related only to location features is always greater than 80% in the examined subset. Indeed, location is an important critical success factor for LSPs since all the warehouses are located near transport services and infrastructures (in particular motorways, ports or airports servicing the area), and in the surrounding area of cities or logistics centres. Regarding railway stations, since the transport is performed mainly by road vehicle in Italy, only 10 facilities have access to this service, because they are located in logistics centres. Looking at the other three subsections of the model, quality rate is critical for Section 4 ("Internal area, utilities and green systems"). In fact, there is a lack of investment in warehouse equipment for sustainability improvements because

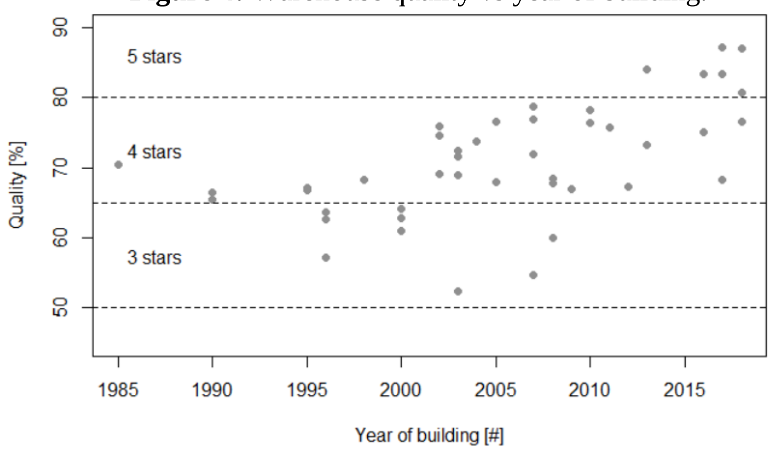
the attention is primarily given to CO_2 emissions in transport. A detailed description of the main features of these subsections is described hereafter.
The subset includes different types of warehouses, in terms of year of construction, size and building clear height (Figure 3). Size is defined as the floor space measured in square metres, while height is the building clear height measured in metres.
Most of the observed buildings are less than 10 years old, while only two facilities are more than 30. Indeed, most of the warehouses assessed are rented as stated by the facilities managers interviewed, making LSPs flexible to the demand and able to move to the newest and most suitable building when necessary. Figure 3 reports in the top-left graph the number of warehouse analysed in a range of five years.
Regarding the building clear height, the sample presents a very wide range of values: from 4.5 m to 14 m. In two cases the clear building height is equal to 29 m since those facilities have automated storage and retrieval systems (AS/RS) in place, which justifies such a high building clear height. However, these cases are not included in the current analysis, since we consider only the height of the concrete building. Excluding those two particular cases, in Figure 3 the top-right graph reports the number of warehouses within a specific range of height. The ranges are formed using 1.5 m as the standard height between two beams of a pallet rack.
Looking at the size, 60% of the logistics buildings examined have a floor space that is less than 20,000 m^2. The sample includes mostly small (less than a standard pattern of 5,000 m^2) or medium-sized warehouses, with an outlier having a size of approximately 140,000 m^2. These features are specific to the Italian context, since in other countries, size, year of buildings and building clear height for LSP facilities could yield different results.

Figure 3: Sample characteristics: year of building, building clear height and size.



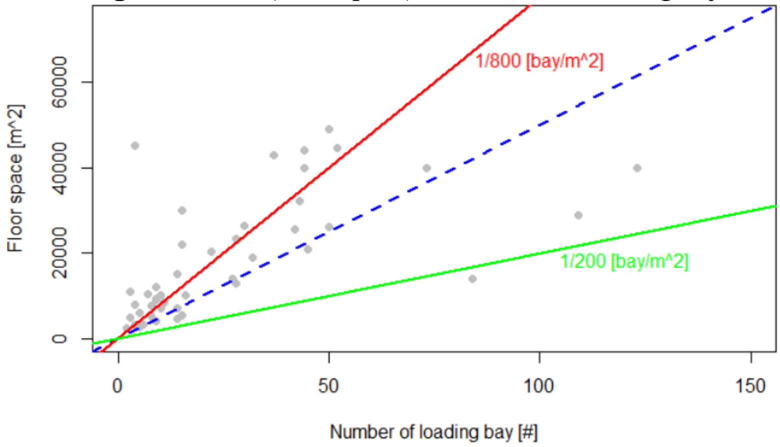
Year of building and quality rate are two variables that are related to one another: it emerged that new warehouses have a higher quality score. This is due to the use of innovative building techniques that are compliant with the new requirements of the logistics industry. Warehouses built after 2008 have a quality equal to or over 4 stars (more than 65% quality rate), while facilities built before 2000 have a lower value of quality and belong mainly to the 3-star class.

Figure 4: Warehouse quality vs year of building.



Looking at other variables, such as the number of loading bays, it is possible to identify other relationships. Specifically, the relation between size (floor space) and the number of loading bays is one of the key elements used by logistics real estate actors to distinguish a stock warehouse from a cross-docking facility. By extrapolating the data regarding the relationship between warehouse size and the number of loading bays located within, as a general rule, there is one loading bay per 500 m2 of floor space (dashed blue line). This rule is followed by the majority of the warehouses analysed. A ratio lower than 1/800 is for buildings completely dedicated to storage activities, such as document storage and management. Conversely, it emerges that logistics buildings with less than one loading bay per 200 m^2 floor space show the typical characteristics of a cross-docking facility.

Figure 5: Size (floor space) vs number of loading bays.



CONCLUSIONS

The objective of the present paper is to describe the state of the art of contract logistics warehousing in Italy by applying an original model developed by the authors and presented in Baglio et al. (2018) to assess the quality and functionality of logistics buildings. Specifically, the model is applied to 65 contract logistics warehouses located in Italy to determine the characteristics of these specific facilities.

The present work has both practical and academic implications. From an academic perspective, the model addresses an identified gap in the existing warehousing literature, which merely focuses on facility location and site selection problems, and sustainability topics. Moreover, the implementation of the model on contract logistics buildings gives new insights into the contract logistics industry in Italy.

From a practical viewpoint, it offers significant implications for the real estate industry. Indeed, the proposed tool can be used by all the actors of the real estate value chain to identify the right purpose of usage and, therefore, to better qualify the logistics building under assessment. It may also be useful to improve the quality of an existing logistics building by identifying its weakest elements and evaluating potential technical improvements. Ultimately, the model can also be used, as shown in the present work, to map warehouses in a specific industry or within specific geographical areas, with the aim of creating a database of logistics buildings classified by the level of functionality and quality. From this viewpoint, the availability of data for a large number of warehouses would also make it possible to update the distinguishing features of the logistics building types identified in the model, as well as the related weights and scores.

The implementation of the model presents some limitations due to the characteristics of the database analysed and the model used. The database should be enriched to increase the number of observations in order to also provide a complete analysis of cross-docking and hybrid facilities, thus extending the insights on the contract logistics industry. Even this first version of the model presents some limitations, which are highlighted by the findings of the present work. First, response items and weights have essentially been defined by referring to the Italian context. Therefore, a comparison between facilities in different countries/contexts in order to extend the knowledge in contract logistics warehousing requires some adjustments to the model. Second, functionality has been restricted to two types of logistics buildings only (i.e. stock warehouses and cross-docking facilities). No other differential characteristics, such as product categories, have been considered so far. Third, from a methodological perspective, a higher number of pilot tests is recommended to improve the fine-tuning of the model.

However, this research offers interesting streams for future investigation. Further study could: (1) enlarge the data on the contract logistics industry in order to complete the analysis on cross-docking and hybrid facilities, (2) improve the model by including the tenants' perspective, e.g. by looking at the characteristics of the products to be stored in the logistics building in order to analyse the characteristics of warehouses in other industries; (2) extend the model to the greater European context, assessing the difference between the Italian and other European logistics real estate industries.

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