


The hidden potential of advantages offered by a wooden pallet in a heterogeneous pallet pool – theoretical and analytical view

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Keywords: logistics infrastructure, wood pallets pool, hidden value, supply chain, logistics process

JEL Classification: A10, B40, O03, R41

Abstract

A flat wooden pallet, being a simple logistics carrier in terms of its structure, can nonetheless be treated as a highly specialized logistical and marketing object applied in complex supply chains. Rigorous measures taken to standardize pallets are predominantly aimed at ensuring the highest possible safety level for the transported products and people handling the freight units during the complex logistical processes that involve pallets along supply chains. The goal of this article was to increase understanding of the operating strategies employed by entities using pallet pools, as well as the organizational, operational, and market challenges faced by them. It was hoped to achieve this goal via both theoretical and empirical studies. To this end, the research study applied theoretical synthesis and empirical evidence derived from primary research based on the industrial, transport, forwarding, and logistics markets. At the same time, the theoretical context was based on the literature on the subject, related to wooden pallet issues and their special role in logistical processes. Challenges connected with decisions made to enable effective and efficient management of pallet pools were addressed at legal and regulatory, as well as organizational and operational, levels. Diverse courses of action identified in several stakeholder groups were reflected in the adopted philosophy of managing the main feeding streams of pallet pools. Though limited to just the Polish market, the research study was sufficiently representative due to the strategic share of the European and global market of standard flat wooden pallets. The author proposes taking a perspective of value-added synergy as an alternative (to be understood as different and complementary rather than excluding possibilities) to other ways of approaching the value of supply chains. The undertaken considerations may contribute to increasing the awareness of the importance of taking a pallet, so common from the technical and technological point of view, as a value-added carrier in scientific considerations, due to its paradoxically low individual economic vulnerability.

Introduction

“A wooden pallet does not have to be an attractive object for logistics considerations, but it must be solid and effective in the operational dimension of supply chains functioning...”

Mariusz Jedliński

To function correctly, contemporary supply chains require adequate technical and technological

support, which may be assured only by a logistics infrastructure being a key element of the logistical support system dedicated to the supply chain. Undoubtedly, a flat wooden multiple-use pallet is a key element of the thus understood logistics infrastructure, even though at the same time it is often ignored in scientific deliberations pertaining to the functional characteristics of supply chains, due to its design, which has remained practically unchanged over a long period of time, and its low economic

value. This was noticed by T. Vanderbilt in his popular science publication, in which he stated that: "...pallets rest outside of our imagination, regarded as scrap wood sitting outside grocery stores..." (Vanderbilt, 2012). Only a few authors have recognized their useful functions (e.g., Bengtsson & Logi, 2015), confirming that the use of pallets streamlines service processes and reduces warehousing costs throughout the supply chain, and multiple-use exchangeable pallets are more durable, thus leading to smaller losses and reduced material consumption (which is beneficial in environmental terms). This paradox of perception of the wooden pallet is because even though, on the one hand, pallets are characterized by a relatively low unit costs of purchase, on the other hand even the smallest damage to a pallet requires repair in compliance with high (and thus costly) standards or else it must be totally eliminated from circulation. Nevertheless, in business trading pallets are not treated as fixed assets, but as consumables that constitute a one-off cost incurred at the moment of purchase. Moreover, it is increasingly common to use third-party (leased) pallet pools or single-use pallets (which often are not included in the purchase price of goods). Nevertheless, it is pallets that constitute the key interface between the packaging and unit transport equipment (Hamner, 2007), being the portable platforms that facilitate the movement and storage of unit goods (Kator, 2008).

Unfortunately, due to its common use in logistics chains combined with its changelessness over many years, a pallet is not prone to innovation, neither as defined by C. Freeman as "the first commercial introduction of a new product, process, system, or device" (Freeman, 1983), nor in terms of the diverse perception of innovations by P. Kotler as "everything perceived as a novelty" (Kotler, 1994). Therefore, it is not a new product for any logistics chain in view of the changelessness of its form. However, quoting J. Fiksel, it is characterized by a *Physical Life Cycle* that distinguishes it from others and is based on the transformation of materials and energy, in the form of a sequence of activities such as the sourcing and purchase of raw materials, the processing of materials, the manufacture and assembly of products, distribution, use, recovery, and disposal (Fiksel, 2009, p. 79). This means that, in the material (physical) life cycle, a pallet as a product starts to "live" at the moment of sourcing the raw materials necessary for its production. This life cycle is also connected with energy consumption, as raw materials and energy are processed in the subsequent processes of material storage, manufacturing, drying and fumigation,

distribution, use (operation), repair, and recycling or disposal. At the same time, the market aspect of a pallet is outside the canon of principle marketing goals, i.e., product creation, making people aware of the product's existence, making them want to try the product and buy it, and obtaining acceptance on the market. Nevertheless, users are well aware of its existence, as it is a well-recognized product necessary for the efficient functioning of supply chains, being well tested and proven frequently on the market under various operating conditions.

However, it is worth noting numerous GCI Capgemini reports indicating the key role of pallets in "last mile" logistics with regard to city hubs and regional consolidation centers. Such distribution centers located on the outskirts of cities operate on the cross-docking principle, and distribution within the cities may be completed using smaller (more ecological) vehicles, as well as using the public transport infrastructure (Report GCI, Capgemini, 2008, 2010, 2012). It was also indicated that it was possible to obtain the following benefits in this case: a nearly 40% reduction in the transport cost of one pallet, a 20% reduction in the handling cost of one pallet, a 25% reduction in the total number of kilometers traveled, a 25% reduction in CO₂ emissions per pallet per vehicle, and a 40% reduction in the distribution time (GCI, Capgemini, 2008).

Pallet pools have been researched since 1960s (Wu et al., 2016), but they still lack an overall definition, and therefore it is advisable to raise the issue of the very idea of a "pallet pool." Most often it is treated as an effect of the market trend consisting in paying for using things rather than buying or owning them. Consequently, the totality of logistics connected with pallet circulation is outsourced to specialized companies. Nevertheless, in the business environment, the term "*pallet pool*" is understood ambiguously, even though most often it is defined as: "a system for pallet leasing/renting (circulation) managed by a specialized operator" (Słownik terminologii logistycznej, 2016), which implies a "shared use of the devices by a certain number of people who invested in them." A standard pallet is then made available by the supplier (operator) to the customer, which most often takes place within the framework of a so-called "color pool" (i.e., CHEP, PLR, IPPLogipal) (Raport Palety 2018, 2018). However, according to the author, "a pallet pool" (regardless of whether this would be the aforementioned "color pool" or "white pool") should be approached not only in terms of *owning*, but also *using*, which means that it constitutes "an integrated operation system

for circulation of standard pallets, which consists in co-sharing them by entities being part of a supply chain (shippers, recipients, and logistic operators) in a closed-loop, regardless of the distribution channel complexity level.” Importantly, a dominating entity (leader) within the whole chain “co-ordinates the management of the pallet pool, which due to the ownership form of the pallets themselves may be an own, mixed or entrusted (rented) pallet pool” (cf. Jedliński & Sowa, 2021). Hence, they create “a value chain which refers to the full life cycle of a product or process, including material sourcing, manufacturing, consumption, and disposal/recycling processes” (WBCSD, 2011).

The so-called “white” wooden pallet market within the European Pallet Pool (EPP) includes predominantly EPAL-branded pallets treated as a set of pallets with standardized dimensions, exchanged in European cargo transport. Back in 2006 their share of the Polish market amounted to ca. 40%, whereas in 2021 it was already nearly 100%. Wooden pallets are not only flat: there can also be box pallets, post pallets, or specialized pallets. Since in the case of the EPP pool the principle of identification (as per license number) but not identifiability is in place (a RFID chip might be a solution), the pallets in circulation are “of the same kind, but not the same” (Wiak, 2018). This means that the pallet manufacturer and the brand owner bear time-limited liability which ends at the moment of sale (date of releasing the pallet from the warehouse in order to put it in operation), and the liability is transferred onto the user when the pallet is put into circulation (i.e., the pallet has been loaded for the first time). If during the operation some non-standard features are found (e.g., inappropriate board thickness, wrong way of assembly, improper kind of nails, unacceptable rounding, etc.), such a pallet is no longer considered an original pallet and will be treated as non-standard single-use packaging.

Hidden potential of the advantages of wooden pallets

“If a pallet manufacturer is the only person satisfied with their products, this is the shortest way to failure. The success is determined not by the pallet manufacturer’s complacency and self-love, but by the users’ satisfaction with the pallets...”

Mariusz Jedliński

In accordance with the recognized definition formulated by the Global Supply Chain Forum,

Supply Chain Management may be understood as “integration of key processes from end users, via initial suppliers who provide products, services, and information and add value for customers and other stakeholders of the supply chain” (Lambert, Garcia-Dastugue & Croxton, 2005, p. 28). This distinctive “bottom-up” perspective underlines the full customer-orientation of the supply chain and the need to integrate its resources to satisfy the end customer. What is remarkable, though, is that most definitions encountered in the literature on the subject ignore financial flows (treating them as elements of business processes connected with payment and title transfer). This can be exemplified by the definition formulated by R. Handfield and E. Nichols who described it as “all organizations and activities that accompany product flow and transformation from extraction of raw materials to the end user, as well as the accompanying information flows” (Handfield & Nichols, 2002, p. 8).

In each of the raised aspects of a supply chain, the logistics chain (being an inherent part) has key importance. It covers warehousing and transport, and it constitutes a technological combination of transport routes, warehouses, and transshipment points. The task of logistics chain management is first and foremost the effective and efficient completion of a logistics process whose main goal is providing the end customer with time and place utility (on time and to the right place), which is also economically satisfying. The concept of logistics chain management also covers value creation, the integration of key logistical processes, and collaboration (Green, Whitten & Imman, 2008, p. 318). However, the said value may be perceived by the organization in a different way, e.g., as a total cost of operations, total savings, or the synergism of the provided products and services with the processes and practices of the organization and other suppliers (Poon & Lau, 2000, p. 151). It is worth noting that in supply chains (and thus also in logistics chains) value is created on two levels, i.e., in relationships between the links (participation in achieving mutual profits) and in the organizations themselves (obtaining a specific profit on an individual basis) (cf. Hammervoll, 2009, p. 633). For this reason, the term “Logistics Chain Performance” is gaining importance. It should be understood as the achievements of the chain considered at the strategic, tactical, or operational level (Gunasekaran, Patel & McGaughey, 2004). Therefore, according to G.T.M. Hult et al. (Hult et al., 2006), supply chain functioning is closely related to four equivalent elements, i.e., *speed* (deliveries

made on time, according to the schedule), *flexibility* (agility, adaptivity, and quick response to customers' needs), *quality* (reliability of products/services and striving to satisfy the customers), and *costs* (cost reduction or increasing the benefits for customers, according to the principle that the value for the customer is benefits/costs). These factors mean that the expected benefit from the point of view of the end customer is obtained by receiving the highest possible surplus of benefits over costs incurred. This consideration leads to the need to refer to the concept of "embedding" the logistical resources and capacities in the structure of the potentials and determinants of success of each enterprise, as presented by J.T. Mentzer, S. Min, and L.M. Bobbitt (Mentzer, Min & Bobbitt, 2004). Based on their research, they indicated that effective utilization of logistical resources and capacities may lead to achieving expected changes in a business management system and its individual subsystems. Therefore, if the prerequisite for achieving multidimensional market and economic effects by an enterprise is effective engagement and utilization of logistical resources and capacities in striving for success, the key role of infrastructure engaged in logistics process implementation should be emphasized.

It seems then that the key to an enterprise's success is obtaining logistical sensitivity via stimulating all the people who manage logistics processes in the enterprise (who, after all, are owners of the individual processes) as well as the enterprise as a whole (first and foremost its human and tangible resources), so that they adopt such a way of thinking and acting that allows integration of the logistics chain's capabilities and economies of operation (Bowersox & Closs, 1996). Unfortunately, in the case of operational activities it is possible to observe some inconsistency, as the role of logistics carriers – such as flat wooden multiple-use pallets – is too often ignored or marginalized. This is mainly because a logistics carrier is characterized by considerable *prevalence* (which makes it practically invisible in terms of costs), relative *cheapness* (low cost of acquisition), and apparent lack of interest in *high quality* (relying on licensed pallets only to a certain extent). For this reason, taking up any optimizing activities in the area of pallet pool management provides a prospective economic basis for obtaining expected savings in a stable manner, which will ultimately translate into benefits for end customers, because a wooden pallet is a logistics carrier for goods/cargoes, providing added value to logistics processes while being a significant part thereof.

Methodology

"No matter how sure you are of your exceptional performance excellence, this needs to be confirmed by others..."

Mariusz Jedliński

In the empirical studies pertaining to the Polish pallet market (the production volume is estimated at ca. 70 million pallets per year) (Forrester, 2021), a demoscopic method was applied, using a survey that made it possible to gather data regarding the actual conditions of cargo pallet use, i.e., the course of the procedures in specific supply chains, or the expectations regarding pallet use in a pallet pool. The surveys were based on an indirect measurement methodology with quasi-representative characteristics, and they were carried out using an anonymous questionnaire. The respondents taking part in the empirical study were selected on a targeted basis, considering criteria such as:

- business operations where wooden pallets are used,
- size of enterprise,
- business line focused on consumer goods (especially FMCG).

The purpose of the survey was to find out about the scope, tasks, and specificity of pallet management regarding multiple-use flat wooden pallets, and to specify its impact on creating a logistical value potential.

In the European countries associated in the UIC (Union Internationale des Chemins), Poland features as the second biggest manufacturer of standard flat wooden Euro pallets. Pallet production licenses are currently held by 102 companies, and 100 companies are licensed to repair them (Forestry, 2021). Using basic analytical tools in the form of graphical (most often pie charts) and numerical data presentation, the analysis of the results made it possible to arrive at certain generalizations, insights, and conclusions. The questions included in the general profile were standard questions about demographic data, applied in similar studies, e.g., those by A.L. Hammett, K. Naka, and B. Parsons (Hammett, Naka & Parsons, 2009), or P.A. Araman and R.J. Bush (Araman & Bush, 2009; Araman, Bush & Hager, 2010). The prepared survey questionnaire was addressed at manufacturing, trading, and service enterprises. A non-probabilistic sample selection was made from the set of the surveyed population, being as complete as possible (business entities trading with pallet pools). The technique of "selecting typical units"

was followed. The entities invited to participate in the survey represented a total pallet pool of ca. 3.5 million (3,305,599 pcs), while the biggest of them handled a pool of 465,600 pallets. They included leading Polish manufacturing and trading companies as well as logistics operators, but also smaller enterprises handling pallet pools of merely 100 pcs. The surveyed entities altogether accounted for ca. 15% of the annual domestic production volume of standard flat wooden multiple-use pallets in Poland.

Results and discussion

The survey involved enterprises representing the following business sectors (industries): food, automotive, wholesale and retail trade, services, and, in the dominating part, transport and materials management (according to sections and subsections of the Polish Classification of Activity). The breakdown by sector is shown in Figure 1.

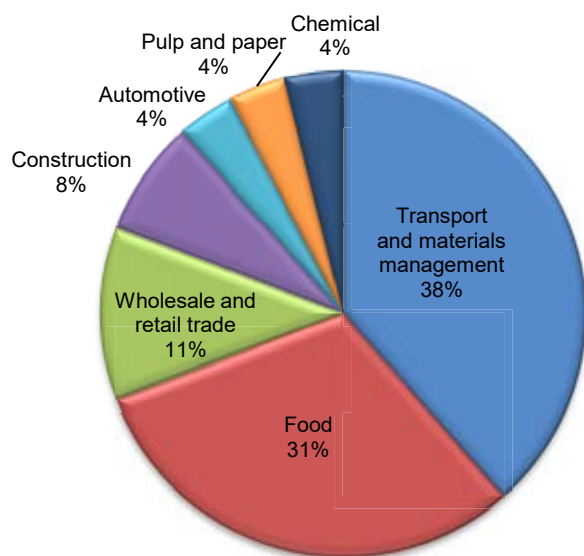


Figure 1. Business sector (industry) represented by the surveyed companies

With the total number of pallets in all the analyzed pallet pools amounting to 3,305.6 k, the breakdown of pallets used in goods circulation by the surveyed enterprises, categorized as EPAL (40%), UIC/rail pallets (26%), color pallets (3%), and other pallets (31%), is presented in Figure 2. Additionally, the pallets may be categorized as either so-called “white” or “color” ones, which respectively accounted for 91.50% and 5.51%, whereas the direct proportion of EPAL and UIC/rail pallets was respectively 75.96% and 15.54%, while the remaining 8.5% accounted for the so-called “color” pallets.

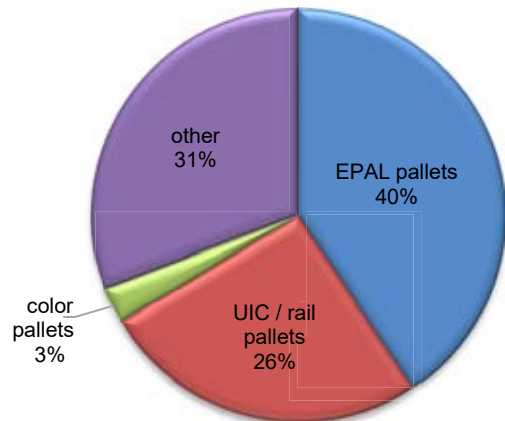


Figure 2. Quantitative structure of the pallet pool according to its complexity

Each year (Figure 3), the surveyed enterprises purchased a total of 1,662,199 pallets of different kinds (1,096,316 new pallets), including 107,800 new EPAL pallets and 344,780 used EPAL pallets, which meant that on average one in four EPAL pallets purchased in the group was new (23%). In the case of UIC pallets, virtually all of them were purchased second-hand (89%), as only one in ten was new (10%). Unfortunately, the yearly purchase of so-called “white” pallets accounted for merely 37% of all purchased pallets (the other ones constituted 63%). What is interesting, as regards the other pallets, two in three of the purchased pallets (62%) were new, while the used ones accounted for 37%.

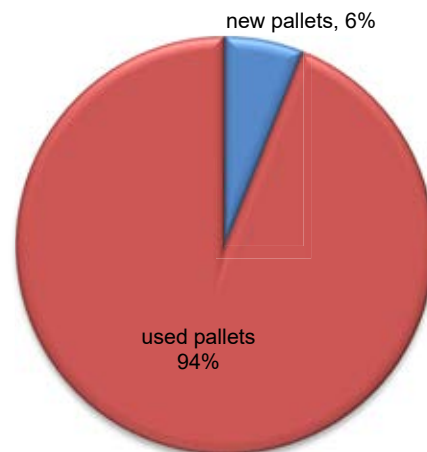


Figure 3. Structure of total pallet purchases by their condition (in a calendar year)

Taking into account the fact that in the case of EPAL pallets only one in four was new, those responsible for purchases in the surveyed enterprises replied that the main criteria followed by the enterprise in the process of pallet purchase were predominantly “purchase price” (50%), followed by “speed of delivery” (17%), and almost equally “pallet

legality” and “trust in the manufacturer/supplier” (14% and 13%, respectively). The survey allowed the selection of more than one criterion. Only 6% chose the criterion “guarantee of repair and service of pallets.” This result is directly attributable to the demonstrated purchase preference for new and used pallets observed among the surveyed enterprises. The distribution of pallet purchase preferences is shown in Figure 4.

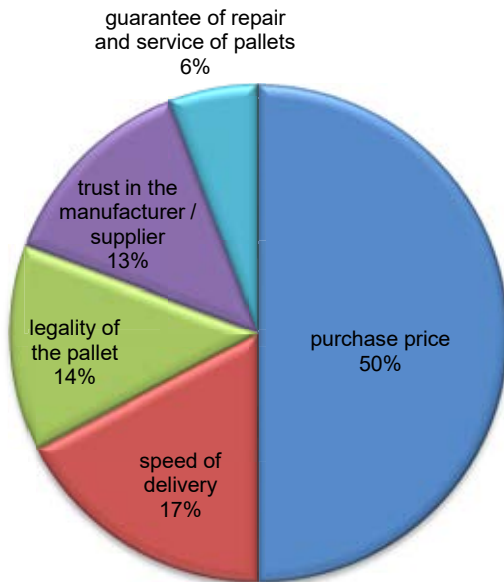


Figure 4. Distribution of pallet purchase preferences

Showing the preference for purchase price, the surveyed enterprises also confirmed that in everyday operations they used *Pallet Assessment Cards* (58%). Still, 27% of the respondents preferred not to use them, whereas one in six (15%) respondents found them irrelevant. The practice of applying *Pallet Assessment Cards* is shown in Figure 5.

In terms of assessing the differences in pallet durability (when comparing EPAL pallets to the UIC



Figure 5. Daily practice of using *Pallet Assessment Cards*

ones), it turned out that almost one in three enterprises (41%) did not see any difference, and more than half of them (54%) never compared them. Among the enterprises which did notice a difference in pallet durability, which accounted for merely 5% of all the respondents, EPAL pallets were assessed more favorably by 50% compared to UIC/rail pallets. For those respondents, pallet durability was intrinsic to a period of time over which a pallet maintained its original physical and mechanical properties and successfully resisted any factors that caused the biological corrosion of wood. In their opinion, proper selection of the raw materials and the production process regime, as well as taking protective measures, led to extending the useful lives of pallets. The breakdown of the provided responses is shown in Figure 6.

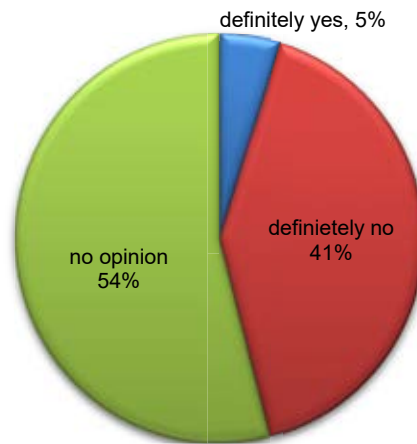


Figure 6. Recognition of differences in pallet durability

Finally, more than a half of the surveyed enterprises (46.46%) suggested that, if only it depended on them rather than the whole supply chain, all the pallets used by the enterprise would be EPAL pallets. But it should also be noted that as for other types of pallets, comparable preferences were shown for UIC/rail pallets (9.35%) and “color” wooden pallets (10.02%). However, a distinct preference for “other pallets” can also be noted (34.17%), which may be attributed to the specific nature of the served pallet pool (Figure 7). Nevertheless, when comparing the preference levels for EPAL and UIC/rail pallets only, the study has shown that four in five enterprises (81.82%) definitely stick to EPAL pallets.

The completed study (in the part presented in this paper) has indisputably shown that in the surveyed enterprises, representing both the manufacturing industry and logistics services, EPAL and UIC pallets dominate, even though the companies are involved in various pallet pools featuring diverse wooden pallets. Unfortunately, the key feature of

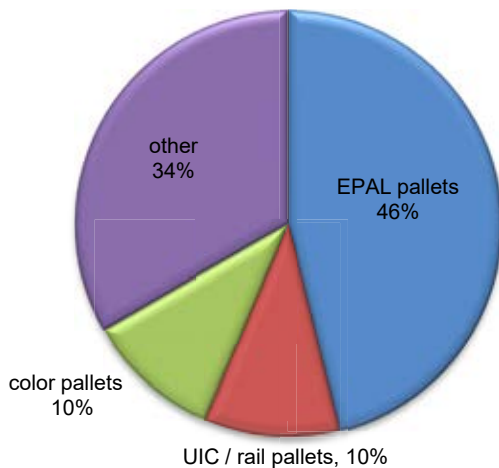


Figure 7. Structure of preferences regarding the choice of a pallet pool

a pallet, i.e., its durability, is assessed only with regard to its compliance with the Pallet Assessment Card. The criterion commonly considered in pallet management is predominantly its unit price of acquisition (when expanding the pallet pool or restoring its quantity in case any damaged pallets have to be replaced). Nevertheless, the assessed operational features of the pallets used so far indicate that the users have shown greater trust in EPAL pallets, which nonetheless, to a greater extent, may be due to their prevalence on the market or the encapsulation of pallet pools (no possibility of exchange between UIC and EPAL pallets).

Conclusions

“Wood is a wonderful raw material. It grows beautifully, is easy to model, and brings benefits even when disposed of... Therefore, let us not cut down trees too hastily, but let us use the raw material sparingly in production, create a product of exceptional durability, reuse post-waste materials, plant new trees...”
Mariusz Jedliński

The conducted research has confirmed that for a pallet to be safe and suitable for long-term use, it should be made in accordance with a standard (this is what characterizes the EPAL and UIC pallets, which dominate the market). This expectation is addressed only to (new or used) pallet suppliers; nonetheless, in four out of five cases the main criterion in the purchasing process is the unit price of a pallet. This is the case for both EPAL (one in four purchases pertains to new pallets) and UIC pallets – in this case only one in ten purchased pallets is new, which is due to the characteristics of the market. As for the pallet

pool denoted as “other pallets”, one in two purchased pallets is new. In the survey, those responsible for pallet management confirmed that they used Pallet Assessment Cards, which was mainly due to the need for preventive phasing out of pallets showing disqualifying physical dysfunctions that could lead to compromising the safety of logistical operations along the whole supply chain. Moreover, they confirmed that they were aware of the fact the wooden pallets should not be subject to unnecessary “*exposure to sunlight*,” any dangerous handling operations (such as dropping the pallets from a height) should be avoided, and due care should be taken to optimize the loads on a pallet (e.g., goods should be deployed on pallets in a reasonable manner).

Even though, in the sustainability context that is of key importance for the pallet segment, 1 m³ of raw material is necessary to manufacture 22 Euro pallets, only one in five of the respondents was interested in a guarantee of repair for purchased pallets (and it usually pertained to pallets leased from the so-called “color pool” rather than the “white pool”). The average life cycle of a wooden pallet on the Polish market is assumed to be ca. 8 circulations (aleo, 2016), though according to another research study completed by M. Jedliński and M. Sowa, the average useful life of a pallet is 12 months, which corresponds to 60 circulation cycles. Therefore, each new action that contributes to extending the life cycle beyond 12 months is undoubtedly advisable, as it will lead to an aggregate reduction in logistical cost. It is also worth referring to the abovementioned study completed by M. Jedliński and M. Sowa with regard to wooden pallets, which comprises a Total Cost of Ownership (TCO) analysis (Jedliński & Sowa, 2021). Although TCO is a purely economic concept, as it applies the cost category, it also implicates many other effects unrelated to the area of finance, by using the monetary dimension for both financial and non-financial attributes (Morssinkhof, Wouters & Warlop, 2011). The study confirms that pallet purchasing cost in fact constitutes a half of all costs incurred by the pallet pool owner/operator, which is shown in Table 1.

Summing up the research results regarding the four sets of pallets in circulation, including a pallet pool distinguished in terms of ownership form, i.e., the “white pool” and the “color pool,” and a pallet pool distinguished by standardization features, i.e., pallets manufactured under the EPAL/UIC licenses, or non-standard (i.e., so-called industrial) ones, it is possible to sum up as follows:

- there is a rather small difference in quality between EPAL and UIC/rail pallets, and the former are

Table 1. Cost item structure in Total Cost of Ownership of a wooden pallet (Jedliński & Sowa, 2021)

Cost items	Percentage (%)
cost (price) of pallet purchasing:	
– pallet manufacturing cost (by manufacturer)	50
– average sales margin	
– output VAT	
operation cost:	
– cost of physical and moral depreciation	36
– cost of shelter (shed/place on a storage yard)	
– cost of loss in value at resale	
cost of repair	4
cost of pallet phasing out	
– liquidation	10
– disposal	
Total	100

considered to be better; nonetheless, the supply of new UIC/rail pallets is definitely lower than in the case of EPAL pallets;

- enterprises that have an automatic warehouse (or are going to invest in one) definitely require pallets of good quality. The observed trend of the dynamic development of implemented technical and technological methods in the automation of production and warehousing processes will enhance these requirements;
- enterprises which use pallets as returnable packaging pay attention predominantly to the cost of acquisition and operation, but also to their legality;
- it is possible to note that the logistics sector is convinced about the definitely better durability of EPAL pallets, especially with regard to those older than one year. However, the logistics sector has also noted an improvement in the quality of UIC/rail pallets;
- there exists a considerable “capital of trust” demonstrated by pallet users, who believe that certified pallets guarantee all the features stipulated in the legal regulations (standards) and described in the Pallet Assessment Card, and therefore they are characterized by uniform consistency and reliability (within their life-cycle limits);
- all pallet users believe and expect that pallet durability should last at least one year. For this to be true, pallet manufacturers have to strictly follow EPAL construction standards (meeting the stipulated static/dynamic load requirements, without exceeding the permissible differences between the two diagonals of the pallet or the tolerances for length and width);
- the vast majority of pallet users make use of Pallet Assessment Cards daily, and for this reason they

pay close attention to the legibility and durability of pallet labelling.

It is possible to assume that understanding the hidden potential of pallet value has an impact on the possibilities of supply chain balancing in both operational (via striving to increase the operational durability to increase the number of cycles in business trading) and strategic terms (co-using a pallet pool). Moreover, it is necessary to realize that the relatively low economic vulnerability of flat wooden multiple-use pallets is only apparent, as due to the increased mechanization and automation of industrial and logistical processes their share and utilization along the supply chain is increasing, and the potential for benefits in the form of “economies of scale” is additionally enhanced by the fact that the purchase cost constitutes only half of all the costs of a pallet incurred throughout its operation cycle (up to and including the cost of disposal).

This comparative study regarding pallet pool typology may help the understanding of any possible challenges and sources of conflicts in pallet management practice, treated as an important element of any logistical structure. Decision-makers responsible for pallet management (both in the analyzed industry and other sectors) could apply the presented perspective for the purposes of sustainable management of pallet pools. In a situation when logistics (supply chains) is expected to increase added value, it is most rational to point to the hidden potential of the pallets themselves. The deliberations taken up in this paper lead to an obvious conclusion that an attempt to understand the role of pallets as a value driver, rather than just a marginal cost item, leads to a significant potential for cost reduction throughout a sustainable supply chain being obtained. Hence, it is advisable to show the potential benefits that may be found in flat wooden multiple-use pallets perceived as a basic element of a logistics infrastructure.

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Cite as: Jedliński, M. (2022) The hidden potential of advantages offered by a wooden pallet in a heterogeneous pallet pool – theoretical and analytical view. *Scientific Journals of the Maritime University of Szczecin, Zeszyty Naukowe Akademii Morskiej w Szczecinie* 71 (143), 111–119.