DIGITAL TRANSFORMATION AS A COMPETITIVE FACTOR IN SUPPLY CHAIN MANAGEMENT: PROOF OF CONCEPT IN ONE OF THE LARGEST EDITORIAL GROUPS IN PORTUGAL

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Abstract

Research purpose. Through the adoption of the concept of the Proof of Concept, the main objective of this work is to highlight the approach that allows the framework and study of the viability of investments in the digital transformation of companies. The research focuses on the publishing sector and, mainly, on one of the largest publishing groups in Portugal and focuses on the strategic decision, due to the covid-19 pandemic situation, to adopt a Warehouse Management System to increase productivity, competitiveness, and sustainability of the company under study. Due to the need for confinement, publishers saw their sales drop drastically and the option of e-commerce implied the need for adjustments in the organizational dynamics associated with the distribution of products. The research/paper goal is to show the viability of investments in the digital transformation of companies in order to enlarge their efficiency and effectiveness.

Design / Methodology / Approach. As a methodology adopted in the first phase, the authors developed a framework of current challenges through the focus group technique. In the second phase, the authors conducted semi-structured interviews with the different managers of the group's various companies and their departments. These methodological options aim to obtain more specific information on facts, the degree of relevance, validity, and reliability that is analyzed from the perspective of collecting information. Both methods provide elasticity in the approach and depth of the intended analysis, favoring spontaneous responses and the creation of openness to the approach of more complex and delicate topics.

Findings. Information technology investments do not automatically bring competitive advantages. It is essential to carry out careful management of the project and carefully analyze the economic and financial viability of the investment. The disruptive changes do not allow errors in investment. So, adopting a methodology that integrates the strategic analysis of the challenges and technical analysis of the assets and respective viability seems critical for the success of digital transformation projects, namely in the publishing sector.

Originality / Value / Practical implications. The digital transformation of companies is a current reality. The pandemic has highlighted digital as a factor of sustainability. However, this finding requires the preparation of management and the adoption of appropriate models and instruments. The present work presents a model that organizations can adapt to in a changing context.

Keywords: digital transformation; warehouse management system; information systems; warehouse management; logistics.

JEL codes: M1; M15.

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Introduction

The digital transformation of companies is a current reality resulting from the pressures of technologies, markets, the economy, and society itself. Consumers' and citizens' adherence to information and communication technologies (ICT) puts pressure on economic organizations to adapt information systems (SI) and internal operations to the specific nature of the market and customers (Anunciação, 2008).

This fact is a reality across all economic sectors and is even a condition for economic sustainability (Anunciação, 2014). Therefore, it is natural that companies opt for a gradual and incremental transformation process as an evolutionary response to the challenges they face, seeking to minimize the risks inherent in a radical change. Within the supply chain, storage, as a critical area of economic support, has also been subject to technological restructuring. Andrade (2014) stated that the undeniable strategic relevance of the current technological reality and its impact on business conduct has resulted in the various organizational areas in which warehouses are included and have to adapt or even reinvent themselves.

Many companies, due to the pandemic, had to strengthen their presence in the market through Electronic Commerce. This change in commercial strategy direction, as a factor of sustainability, forced the reorganization and streamlining of several areas, such as logistics. An example of this is the book sector. Considering that the logistics mission is to deliver the right product, in the correct quantity, to the right customer, in the right place, and at the lowest possible cost (Moura, 2006), it is in this context that the warehouse plays a determining role for the perfect order.

The effectiveness of their management depends on the SI/ICT support. The warehouse is a buffer between production and the market. The implementation and operation of warehousing and distribution systems along the chain aim to reduce pressure on warehouses, seek the optimization of logistic performance, increase productivity, reduce logistical costs, and offer additional services and customer satisfaction (Hompel *et al.*, 2017). The warehouse constitutes a service unit, in a functional logic, with storage, conservation, and control objectives, but above all, making it possible to supply materials and products (Richards, 2011).

Pressure on distribution chains has led to a diversification of the function of warehouses (cross-docking, postponement, fulfilment, etc.), resulting from cost-effective requirements such as Just-in-Time or Efficient Consumer Response. The case of the cross-docking warehouse, for example, reflects the need to consolidate and as well reverse actions in loads with diversified destinations, allowing more considerable added value and a closer approach to the market. The logistics postponement warehouse looks for the best location to position the decoupling point, which can also be considered a buffer within the supply chain, as is the case of warehouses dedicated to co-packing operations.

Warehousing is becoming a critical activity in the supply chain to outperform competitors on customer service, lead times, and costs (Nynke, de Koster & Van de Velde, 2002). In this sense, the Warehouse Management System (WMS) is an opportunity to streamline operations management, allowing to simplify processes and monetize resources because of the company's competitiveness (Mulcahy & Sydow, 2008). The WMS is an IS management tool that controls the warehouse's physical and informative flows, involving both inbound and outbound processes (Shiau & Lee, 2010; Baruffaldi *et al.*, 2019).

WMS facilitates shorter lead times, access to more diverse distribution channels, and improved responses to a more global market. As an integral part of the supply chain, the warehouses directly support the market trends, increase the product range, reduce delivery times, optimize the most critical variable of the market, the time-to-market, or the time-to-respond. In this way, warehouses must be designed and managed according to the specificity of the chain they belong to since their nature may vary enormously. Still, the objective is not to obtain the lowest possible cost and the highest possible level of service.

However, it is not enough to acquire software associated with storage management to expect the automatic acquisition of competitive benefits (Westerman, 2018). A strategy is before technology

(Schwertner, 2017) (Westerman, 2017), and the technology must match strategical plans. The decision relating to the computerization of warehouses must follow the economic principles of assessing investments and economic viability. Oliveira (2004) stated that the economic and social climate has been favorable. The power of suppliers has been powerfully motivating such acquisitions and consumptions, inducing new concepts, processes, and values in the field of modernity, competitiveness, prestige, and the result of ease. Moreover, this author adds that some believe that IS/ICT always gives good outcomes, and it is not necessary to study, a priori, the feasibility (technical and economic) of the acquisition or use.

However, as decisions about investments in IS/IT are increasingly complex, many managers, in an attempt to simplify them, reduce the evaluation to an investment costs approach. They ignore that IS/IT investments' success or failure depends on how they are defined, architected, measured, and implemented.

The digital transformation processes of enterprises and the specificity of IS/ICT should oblige top management to think about and envisage the acquisition and their use as «investment projects». Some of the critical steps in the analysis are as follows (Oliveira, 2004):

- General and global awareness of the problem manifested in management or business;
- Research and in-depth study of the issues raised and the naturally related adjacent issues;
- Critical analysis of the existing situation as part of the solutions provided by the systems and technologies in use;
- Presentation of proposals for solutions to the diagnosed problems because of the deficiencies presented by the systems in existing information technologies and, also, due to the new information needs identified by the business and management;
- Evaluation of proposals using weights and criteria according to management policy, the desired organizational model, business needs, and the level of competitiveness to be achieved through investment;
- Formal approval and decision by the top management body;
- Implementation of the preferred solution according to defined priorities and a schedule of activities to be developed;
- Control of the investment to achieve the chosen objectives for the assets and the calculation, analysis, and justification of possible deviations from the expected, with the attribution of the inherent responsibilities.

Bounfour (2016) refers to it as a challenge of digital transformation that no one can ignore, which requires appropriate management methods and tools.

Supply Chain Management and Warehousing

Supply chain management (SCM) seems critical in supporting economic activities (Tejero, 2011) (Vieira & Roux, 2011). SCM is part of a set of undertakings acting in an economic sequence, upstream, to make products or services available to customers. It presupposes a collaboration and integration of processes, information, and systems, which condition the strategic positioning, aiming high efficiency and operational effectiveness (Carvalho, 2020) and developing an urban perspective on the global organization (Anunciação & Zorrinho, 2006).

Supply chains are growing more complex and challenging (CSCMP, 2021), and this involves planning and managing all sourcing and procurement activities and converting all logistical activities. Thus, it is clear that there is a need for collaboration and coordination between partners, whether suppliers, intermediaries, logistics service providers, or customers (Novaes, 2007). This collaboration presupposes an organizational arrangement appropriate to each organization's functional areas, processes, and channels connected with suppliers, partners, and customers across organizational boundaries (Bowersox et al., 2013). To achieve it, the diversity of systems' flows

and operations have to be designed and developed, ensuring the coherence of upstream objectives downstream of the chain (Anunciação & Zorrinho, 2006).

Putting the right product at the right time in the right place at the lowest possible cost is a management challenge. Bowersox et al. (2016) stated that this management must have at least three perspectives of value: economic value, market value, and value. Economic value refers to the efficiency of the Economy of scale, leading to lower total cost and the creation of goods and services. The market value corresponds to product diversification at the right time and place to optimize costs. Finally, the value of relevance corresponds to the customization, diversity of segment, and positioning of goods and services.

In this regard, the central role of the information systems should consider four levels:

- Strategic planning, through the formulation of strategic alliances, customer service analysis, and the development and improvement of skills and opportunities;
- Decision analysis, through route programming, stock management, and vertical integration versus outsourcing;
- Administrative control, through financial monitoring of costs and assets, customer service mediation, and measurement of productivity and quality;
- Transactions through order management, order sorting and dispatch, customer information, billing, and stocks.

Information Systems include information and communication technologies in their genesis, and both form the link between economic and logistical activities. It is in this context that the term «intelligent logistics» is considered to be a result of a growing connection of machines, people, transport, among other «Things» through the IoT (Internet of Things). This digital interconnection of several «Things» provides, through the disposal of sensors, gains of some intelligence and communication capacity (Porter & Heppelmann, 2015). A warehouse that uses RFID tags, for example, to identify articles, does not need close contact with the optical reader to read the label, as, with its radio frequency technology, it communicates directly with the WMS. In this new reality, the supply chain is the network where the chain elements converge, in a programmed and organized way, constituting an ecosystem (Ross, 2011).

Warehouse Management System

The opportunity to adopt a WMS (Mulcahy, 2013) is associated with difficulties related to the differences between actual balances of inventory and physical stocks, partial satisfaction of customer requests due to stock shortages or inventory shortfalls, cancellation of customer orders due to lack of supply or increased customer complaints. A WMS is a warehouse management module. It is responsible for product control, identifying the best storage area, obeying restrictions imposed, controlling information such as expiration date, batch (traceability), and quick location of any stored item (CSCMP, 2020; Fleury, Wanke e Figueiredo, 2000; Hompel, 2007). It also facilitates planning, organization, management, and optimization activities in using resources in the movement and storage of materials, inside and outside the warehouse, and provides information necessary for the correct execution of activities. Through WMS, it is possible to visualize inventory levels in real-time and know the exact location of the products, making more efficient the daily operation of the put-away and the picking (Hill, 2003).

A WMS integrates the traditional functionalities of a warehouse, such as scheduling and order entry, planning and resource allocation, reception of materials and products, storage, transfers, product separation, shipment, inventories, checks on containers and reports (Banzato, 1998), however at a more demanding level of economic response. Richards (2011) points out the following benefits of a WMS: visibility and traceability of stock in real-time; improved productivity; reduction of wrong choices; automatic restock; reductions in reverse logistics; accurate reporting; improved responsiveness; remote data visibility; better customer service; and minimizing print processes.

Nevertheless, implementing a WMS solution requires prior preparation of the company. Laurent Cochet (2020) states that the answer will entail disruptive challenges for logistics agents by optimizing resources and logistics processes in the warehouse, requiring a preliminary analysis as a success factor for the project, starting with their respective attributes their framework in business strategy. According to Ruriani (2003), WMS must integrate with other systems, interface with internal and external networks, act as a technology integrator (Voice Picking, RFID, etc.), easy-to-use, among other things. However, in the field of management, prior verification of investment and operating costs is advisable. The solution should match its needs, avoiding unnecessary costs for features that one will not need. The ideal will be to opt for modular solutions adjustable to future needs, allowing a gradual development and evolution.

The system must comply with best practices recommended for storage management, that is, according to BASDA (2020), be able to optimize movements within the warehouse (task merge, automated receiving, targeted sequences, storage, optimized refueling tasks, document management, and warehouse mapping). Ideally, the system will monitor the speed of items within the warehouse and locate them (Slotting) or provide the data in a format that can be transferred to programs with slotting functionality.

Methodology

By adopting the “Proof of Concept” concept, the main objective is to highlight an approach that allows the framework and study of investments' viability in the digital transformation of companies. The Proof of Concept's adoption aimed to present a practical model that could be adopted and used in the present case to validate its usefulness and practical application (Kendig, 2016). The need for the digital transformation of companies, particularly in the book sector, is a must nowadays. The authors sought the possible strategic decision to adopt a WMS by the top management of this case study was to highlight the usefulness of the proposed methodology as a tool to ensure the coherence of future decisions to be taken in this field.

The study was based on a qualitative research approach to describe and interpret the actual situation under study (Fortin, 2009). This case study aimed to explicitly understand the presumed casual relationships that occur in the actual context. It is too complex to be explained by the research or experimental techniques, making it possible to explore situations where evaluated interventions have no clear consequences or outcomes (Yin, 2018; Stake, 2012; Thomas, 2011; Cavalcanti & Moreira, 2010; Fortin, 2009; Crewell, 2007; Yin, 2005; Yin, 1999).

The case study focuses on one of the largest editorial groups in Portugal, composed of three publishers working in two business areas: school editions and general editions. For each of the business areas, the company has a distributor. In each company, publisher, and distributor, there is a warehouse. The publishing sector is a clear case of the relevance of WMS in supporting the reverse distribution and logistics activity. This becomes even more evident due to the consequences of COVID-19, the consequent low-touch Economy, and the assumption that e-commerce has become a vital commercial channel for the survival of companies.

The study will include the phases indicated by Oliveira (2004), namely general and global awareness of the problem/opportunity; research and review of the issues raised:

- critical analysis – General and global awareness of the problem manifested within the scope of management or business, research and in-depth study of the questions raised and the adjacent naturally linked ones, and critical analysis of the existing situation, within the scope of the solutions provided by the systems and technologies in use;
- proposals for solutions to the problems identified – presentation of proposed solutions to the diagnosed problems, given the deficiencies presented by the systems in existing information technologies and, also, given the new information needs inculcated by the business and management;
- the evaluation of proposals – evaluation of proposals using weights and criteria depending on the management policy, the desired organizational model, the business needs, and the level of competitiveness to be achieved with the investment;

- final approval – formal approval and decision by the top management body;
- implementation – implantation/implementation of the preferred solution according to the defined priorities and a schedule of activities to be developed; and,
- control of investment – investment control, with a view to the level of compliance with the objectives chosen for the investment and the determination, analysis, and justification of any deviations from what was foreseen, with the attribution of the inherent responsibilities.

By the nature of this exploratory analysis, shall not be examined the last three phases (the formal approval and decision by the top management body, the implementation of the preferred solution according to the defined priorities, and the control of the investment) under the Proof of Concept.

As a methodology adopted in a first phase, the authors developed a framework of current challenges through the Focus group technique (Queirós & Lacerda, 2013) (Berg, 2001) (Morgan, 1996), and in a second phase, through semi-structured interviews with the various managers of the different companies of the group and their respective departments, more specific analyses associated with organizational impacts, namely related to automation of warehouse management (Ghiglione & Matalon, 1997). These methodological options aim to obtain more detailed information on facts, the degree of relevance, validity, and reliability in which is analyzed from the perspective of the objectives of collecting data (Boni & Quaresma, 2005; Ketele & Roegiers, 1998; Hanguette, 1997). Both methods present as an advantage the elasticity of the approach and depth of the intended analysis, favoring spontaneous responses and the creation of openness in the direction of more complex and delicate topics (Selltiz, 1987).

Results: analysis of the case study

Firstly, it is crucial to justify the choice of the study case—the justification for choosing a publisher's case study results from several reasons. The first is that there are many academic publications about WMS, around 5500 on the web of science, but they do not study with this economic sector. The second, because it is a confirmed case of one of the largest companies in the sector in Portugal. The third, due to the complexity of the bookstore activity that works with thousands of product references. Moreover, the last one, because this change was accelerated with the Covid-19 pandemic.

Following the steps proposed by Oliveira (2004), the evidence obtained was as follows:

- General and global awareness of the problem/opportunity

Trade is about information, not about goods. Goods sit in the warehouse until information moves them (Cherryh, 1992). Adopting technological tools that ensure more advantageous proximity to customers and more explicit support in decision-making is a source of competitive advantage. According to logistics challenges, the adequacy of warehouse layout, inventory management, product traceability, and the dematerialization of documents and processes are critical success factors. Technologies can improve the company's productivity and consequently the competitive advantage if they increase productivity, increase customer satisfaction levels, reduce costs, and facilitate the logistic mission. There are several technologies with potential impact on organizational functioning, namely, ERP (Enterprise Resource Planning), EDI (Electronic Data Interchange), CRP (Continuous Replenishment Program), ECR (Efficient Consumer Response), WMS, DMS (Distribution Manager System), automatic identification systems for the identification, capture and sharing of data on products, goods, and persons, among others. Each of the technologies mentioned above brings benefits to the organization that must be identified and quantified.

- Investigation and study of the issues raised.

Inventory is one of the most valuable assets of companies. The stock represents an investment in articles for future use, expected to exist in the correct quantity, at the right time, at the right place with the lowest possible cost. Efficient inventory management gives the company a competitive advantage over its competitors. Its management provides a balance of costs (product financial

costs and storage costs) and stock ownership (avoiding overstock levels and break situations). With the adoption of technologies to support storage management, the solution goes through an approximation to the production Just-in-Time, where the stock corresponds to the real needs and the storage, when it exists, even in cross-docking.

WMS also allows one to move forward with other strategic initiatives. The omnichannel experience, in which one will seek to satisfy customers as an increasingly demanding, facilitating its movement in different channels (physical store, virtual store, or APP), presupposes a technological integration of the order to the storage ending in the distribution. The Last Mile can even be considered the most demanding moment of the logistics operation, acting as a barometer of the whole process. If the customer is not satisfied may occur risks and high extra costs.

- Critical analysis of the existing situation

The focus of the improvements targeted by the company's management aims to optimize inventory management, seeking to avoid situations of overstock or article breakdowns and the implementation of a correct layout and simplification of processes. The explicit recognition of the need for technologies to speed up the processes of continuous improvement and re-balancing the business to meet the challenges given to the continually changing market, not only through customer purchasing habits but mainly for the omnichannel experience, is a must.

Also significant is adopting a WMS that ensures customer service excellence and greater agility and accuracy of storage operations. Improving the warehouse location of products, providing greater efficiency and effectiveness in the shipment process, and product traceability are essential on the external level to monitor the product's path along the chain to the final destination, significant in customer loyalty.

The option of investing in a WMS will be a relevant factor for business continuity where the online channel is increasingly preferred. There is a need to shorten the average time of the order cycle, sharing information along the chain and integration with the current ERP. The possibility of optimized flight routes constitutes a fundamental point for decreasing the order Cycle time and the Perfect order. The warehouse area that will be more beneficial is the picking, followed by the reception and conference of goods. This Logistics Center, which houses three publishers and two distributors with more than six thousand SKU's, makes kiting of school and promotional products, intra-group purchases, among others, so that a WMS solution would transversally benefit the entire activity.

- Proposals for solutions to the identified problems

for better warehouse productivity and internal communication with other departments, the technological focus involves adopting an integrated WMS with an ERP and is supported by automation technologies, RFID, or voice recognition. The company's strategy must be understood so that its current and future needs meet with the appropriate choice of a WMS solution.

It is expected with the acquisition and implementation in the Company of a WMS to achieve the following benefits: reduction of the average time of preparation of orders, simplification in the process of locating goods, optimization of storage space, permanent and real-time inventory, traceability of items from reception to the end of the Sumer, reduction of flight and dispatch errors, reduction of time in internal logistical flows, reduction of logistical costs, increased productivity, real-time decision-support information, adaptation to e-commerce needs, and omnichannel operations management.

- Evaluation of proposals using weights and criteria according to management policy

The expected gains comprise, in the view of the various managers, a predictable reduction of 50% in the time associated with the reception and checking and storage of merchandise, a predictable decrease of 50% in the time related to the delivery routes.

Also is predictable an increase of about 30% in shipping speed, a 30% reduction in shipping errors, and a 20% increase in the quantity of orders/day shipped.

Significant gains are also expected in the consumption of paper and other consumables associated with the daily activity of the warehouse using PDAs, not needing printing orders to get a projected reduction of about 35% in consumables and a considerable gain in sustainability.

The gains associated with merchandise receipt are related to the fact that there is a possibility of a location suggested by the WMS and the respective printing of labels with the SSCC barcode (the logistic unit serial code).

Therefore, this will profoundly change the current process of predominantly manual nature and using Excel.

Will be reduced sorting orders time because the system indicates the operator the optimal route of delivery, which will minimize the total distance traveled and increase the speed of dispatching orders. The percentage of Perfect Order and OTIF - On time in full will increase significantly, and there will be a decrease in OCT - Order cycle time.

The investment will be around 50.000,00 €, wishing a Payback less than three years. Table 1 summarizes the expected benefits of the investment.

Table 1. Expected Benefits

Item	Earnings			
	Year 2020	Forecast	Valuation	% of estimated earnings
Staff reduction	6	4	31.244,00€	30%
OCT – Order Cycle time	1h	0,45h		25%
Nº daily expeditions (Jan-Nov)	37	46	17.021,73€	25%
Inventory counting / settlement time (# days)	8	4	1.792,00€	50%
Elimination of printed orders	8136	0	780,38€	

The main objectives to be achieved are the following: customer service excellence, increased delivery efficiency, storage space optimization, reduced shipping time, increased productivity, simplification of the process, and reduction of time in annual inventory counts. This decrease will have a massive impact since they require a stop in daily shipping activity.

The following table resumes the estimated costs associated with the investment.

Table 2. Expected Costs

Nature	Valuation
Investment	
Software	7.004,00 €
Implementation Project	6.368,00 €
Hardware	5.084,50 €
Annual Costs	
Annual License	3.151,80 €
Maintenance contract/year	2.500,00 €
Consumables / Year	500 €
Wi-Fi network in the Logistics Center / Year	3.750 €

As an essential factor associated with the management of change, resistance to change by logistics operators has been highlighted, as this solution will represent a disruptive change in processes and practices. The expected mitigation of the effects of the change will be supported by an appropriate training plan aiming for successful integration. However, as this plan is not defined, these costs were not considered.

Subsequently, with the specific participation of the SI/ICT Director, the most appropriate characteristics, and criteria for identifying and selecting the available Packages addressed to manufacturers, logistic operators, distributors, or retailers were identified across all of them and centralized in warehouse management. The main characteristics indicated and considered were as follows: multi-warehouse, independent database (vertical solution), real-time operating system, integration with ERP. The following general factors were highlighted: picking, inventory, graphical warehouse drawing, management of document types, physical definition and layout logic, products, traceability, customer and supplier management, order management, route management, radiofrequency terminals, operations management, and reverse logistics.

The criteria for evaluating the solutions identified by the focus group elements with responsibility for the storage, logistics, and information systems, were as follows: safety, functionalities, integration with ERP, ease of use, compatibility with other technologies used, or in the future necessary, maintenance. The analysis of existing solutions in the market identified Generix Group as a company specialized in Collaborative Supply chains. A Supply Chain Hub: a collaborative platform for manufacturers, distributors, 3PL/4PL retailers, where they present 150 processes, 19 applications on a single platform in SaaS.

Through the platform, it is possible to execute logistics flows, access solutions to digitize information flows, optimize process performance, visibility in real-time, and connect all players in the ecosystem. Mecalux is known as one of the leading companies in the world market for storage systems. The company sells Easy WMS, a powerful, robust, versatile, and flexible software capable of managing a manually operated warehouse (through paper or radiofrequency) with the same efficiency as an automatic warehouse. Eye Peak, which offers a WMS solution, promises centralized management of all processes and faster operations. This solution provides a service layer that ensures integration with automation and robotic systems, allowing one to obtain the outputs of these machines and integrate them automatically into the WMS. Moreover, finally, Tec nibite makes available the xlog, which is a WMS to respond to companies in the logistics sector and companies that need to manage their warehouses.

It allows warehouse management and supports the most modern identification and handling technologies, such as barcode, Datamatix, RFID, radiofrequency, and voice picking.

To select between the identified solutions, the scoring model's methodology was adopted. According to the focus group intervenient, it allows a weighting of the most relevant variables according to the client's criteria. The overall score obtained allows forming the basis for a later decision. The solutions found in the market and the requirements identified by the logistics and informatics were classified according to Table 3. The Eye Peak solution got the highest score.

Table 3. Scores of the solutions available according to the selection criteria

Solution	Eye Peak	xLog	Easy WMS	Generix
Safety	4	2	2	3
Functionality	4	4	3	2
ERP integration	5	3	2	1
Easy intuitive use	4	4	3	3
Compatibility	4	4	3	4
Maintenance	4	4	3	4
Cost	4	2	1	2
Classification	29	23	17	19

This analysis considered the criteria technical adequacy, management capacity, quality, guarantees, and price. Weights were assigned according to the indications mentioned by the Informatics Director. The results are shown in the table below.

Table 4. Score of solutions available with weights

Criteria	Weight	Eye Peak	xLog
Technical suitability	0,35	5	5
Management skills	0,15	4	3
Quality	0,20	4	3
Guarantees	0,10	4	4
Price	0,20	3	4
Classification	1,00	4,15	4,00

The last phase and the previous data permitted the analysis of the viability of the investment in the WMS, as shown in Table 5.

Table 5. Score of solutions available with weights

	0	1	2	3	4
Estimated income		50.838,11€	50.838,11€	50.838,11	50.838,11
Expected costs		9.901,80€	9.901,80€	9.901,80€	9.901,80€
Cash flow		40.936,31€	40.936,31€	40.936,31€	40.936,31€
Update Factor (i = 5%)		0,952381	0,907029	0,863838	0,822702
Updated cash flow		38.986,96€	37.130,44€	35.363,32	33.687,40
Investment	18.456,50€				
Net present value	126.711,62€				

It is possible to verify that the net present value provides a high return on investment representing a significant lever for competitiveness while delivering considerable efficiency gains by the optics of cost reduction. Analyzing the results, although the management's desire has evidenced a recovery period of the investment in 3 years, as previously mentioned, the investment will be recovered in the first year.

These results represent an opportunity to develop a more detailed study. They have not been considered other benefits, which, because they are intangible, are challenging to quantify, such as increasing the level of service, customer loyalty, and employee satisfaction.

The last phases of the proposed model, namely the formal approval and decision by the top management body; the implementation of the preferred solution according to the defined priorities; and the control of the investment, were not considered due to the exploratory nature adopted and limited to proof of concept.

Conclusions

The digital transformation of companies is a current reality resulting from the pressures of technologies, markets, the Economy, and society itself. The pandemic situation forced many enterprises to increase the technical support process and change from traditional physical to virtual channels. Companies feel the need to adapt to the new digital reality to maintain their competitive advantage. That is the case of study of present research work, that, due to the Covid-19 pandemic situation, had to strengthen their presence in the market through Electronic Commerce. A new storage automation strategy could get significant efficiency and efficiency results.

In this case study, it was possible to verify that warehousing has become a critical activity in the supply chain to outperform competitors on customer service, lead times, and costs. However, as

stated by Westerman (2018), it is not enough to acquire software associated with storage management to expect the automatic acquisition of competitive benefits. The use of a WMS does not automatically bring competitive advantages. It is essential to carefully manage the project and carefully analyze the economic and financial viability of the investment. In addition to this, the change, in this case study, is disruptive and transversal to the whole company. The relevance of this strategic option became evident through the interviews carried out, an awareness of the impacts of this digital transformation with the possible implementation of a WMS. It was also clear the importance of knowledge with greater detail of the needs and requirements of the warehouse and its integration with the company's objectives.

This study may be a first step towards automating this company's warehouses. An attempt was made to find a strategic, economic, and financial justification for this decision, taking into account the solution chosen by the management. After a survey of existing market solutions and identifying the requirements of the ICT officer in the enterprise, a management decision on this type of investment is now safer by analyzing economic and financial viability. So, we concluded that the adoption of proof of concept was a relevant tool in the analysis and proposal of a methodology to support the management in the digital transformation process.

References

- Andrade, A. M. V. (2014). *Information Technologies in Management*, Porto, Portuguese Catholic University (In Portuguese)
- Anunciação, P. F. & Zorrinho, C. (2006). *Organizational Urbanism - How Managing Technological Shock in Companies*, Lisbon, Sílabo Publishing (In Portuguese)
- Anunciação, P. F. (2008). *The challenges of the Information and Knowledge Society. New challenges of Information Management*, Sílabo Publishing (In Portuguese)
- Anunciação, P. F. (2014). *Ethics, Sustainability and the Information and Knowledge Society*, Chiado Publishing (In Portuguese)
- Baruffaldi, G., Accorsi, R. & Manzini, R. (2019). Warehouse management system customization and information availability in 3pl companies, *Industrial Management & Data Systems*, Wembley, 120 (2), 251-273. doi:10.1108/IMDS-01-2018-0033
- Berg, B. L. (2001). Focus group interviewing. In B. L. Berg (Ed.), *Qualitative research methods for the Social Sciences* (Vol. 4, pp. 111-132). Needham Heights: Pearson
- Bounfour, A. (2016). *Digital Futures, Digital Transformation – From Lean Production to Accelution*, Springer
- Bowersox D. J., Closs, D. J., Cooper, M. B. & Bowersox, J. C. (2013). *Supply Chain Logistics Management*. 4.^a Edição. New York: The McGraw-Hill Global Education Holdings, LLC.
- Carvalho, J. C. (2020). *Logistics and Supply Chain Management*. 3.^a Edition. Lisbon, Sílabo Publishing (In Portuguese).
- Cavalcanti, M. J. & Moreira, E. O. (2010). *Methodology for case study: didactic book*. Palhoça: UnisulVirtual (In Portuguese)
- Council of Supply Chain Management Professionals – CSCMP (2020). *Logistics 2030 Year Two: Navigating a Disruptive Decade*, CSCMP, Retrieved January 18, from: <https://education.cscmp.org/products/logistics-2030-year-two-navigating-a-disruptive-decade>
- Crewell, J. (2007). *Research project: qualitative, quantitative and mixed methods* (2^a ed.) Porto Alegre: Artmed (In Portuguese)
- Fortin, M. F. (2009). *O processo de investigação: da concepção à realização* (5^a ed.). Loures: Lusociência
- Ghiglione, R., & Matalon, B. (1997). *The Inquiry - Theory and Practice*. Oeiras: Celta Publisher (In Portuguese)
- Hompel, Michael ten., & Schmidt, Thorsten (2007). *Warehouse management – automation and organization of warehouse and order picking systems*. Berlin: Springer Berlin Heidelberg New York.

- Kendig, C.E. (2016). What is Proof of Concept Research and how does it Generate Epistemic and Ethical Categories for Future Scientific Practice?. *Sci Eng Ethics* 22, 735–753. <https://doi.org/10.1007/s11948-015-9654-0>
- Morgan, D. L. (1996). Focus Groups. *Annual Review of Sociology*, 22. Retrieved June 21, 2018, from <http://www.jstor.org/stable/2083427>
- Moura, B. C. (2006). *Logística: Conceitos e Tendências*. Vila Nova de Famalicão: Centro Atlântico, Lda.
- Mulcahy, David E., & Sydow, Joachim (2008). *A supply chain logistics program for warehouse management*. Boca Raton: CRC Press Taylor & Francis Group
- Novaes, António Galvão (2007). *Logística e gerenciamento da cadeia de distribuição*. 11.º Edição. Rio de Janeiro: Elsevier Editora Ltda
- Nynke, F.; de Koster, R. B. M. & van de Velde, S. L. (2002). Linking warehouse complexity to warehouse planning and control structure: An exploratory study of the use of warehouse management information systems. *International Journal of Physical Distribution & Logistics Management*, 32(5), 381-395
- Oliveira, A. (2004). *Análise do Investimento em Sistemas e Tecnologias da Informação e da Comunicação*, 2004, Edições Sílabo.
- Porter, M. E. & Heppelmann, J. E. (2015). How Smart, Connected Products are Transforming Competition. *Harvard Business Review*, 93(1-2).
- Queirós, P., & Lacerda, T. (2013). The importance of interview in qualitative research. In I. Mesquita & A. Graça (Eds.), *Qualitative research in sport* (Vol. 2). Porto: Center for Innovation and Intervention Training in Sport, Faculty of Sport. Porto University (In Portuguese)
- Ross, F. (2011). *Introduction to Supply Chain Management Technologies*. 2nd Edition, CRC Press.
- Richards, Gwynne (2011). *Warehouse Management – a complete guide to improving efficiency and minimizing costs in a modern warehouse*. Great Britain: KoganPage.
- Schwertner, K., (2017). Digital Transformation of Business. *Trakia Journal of Science*, 15(1), 388-393.
- Stake, E. Robert (2012). *A Arte da Investigação com Estudos de Casos*. 3.º Edição. Lisboa: Fundação Calouste Gulbenkian.
- Tejero, J. J. A. (2011). *Logística integral. La gestión operativa de la empresa*. 4.ª Edição. Madrid: ESIC Editorial.
- Thomas, G. (2011). *How to do your Case Study: A Guide for Students and Researchers*. Thousand Oaks: Sage Publications
- Vieira, Darli, & Roux, Michel (2011). *Projeto de Centros de Distribuição, fundamentos, metodologia e prática para a moderna cadeia de suprimentos*. Rio de Janeiro: Campus / Elsevier Editora Ltda.
- Westerman, G. (2017). Your company doesn't need a digital strategy, *MIT Sloan Management Review*, October, 25
- Westerman, G. (2018). Your company Doesn't Need a Digital Strategy, *MIT Sloan Management Review*, Cambridge, 59(3), Spring, 1-5
- Yin, R. K. (1999). *Case Study Research - Design and Methods*. Sage Publications.
- Yin, R. K. (2005). *Case Study: Planning and Methods* (3ª ed.). Porto Alegre: Bookman (In Portuguese)
- Yin, R. K. (2018). *Case Study Research, Design & Methods* (5ª ed.). Thousand Oaks: Sage Publications