

Advantages and disadvantages of developing an enterprise resource planning to manage quality in an accredited reality. COSMOB S.p.A case study

Enterprise
resource
planning

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Abstract

Purpose – This study aims to analyze the innovations introduced, with reference to enterprise resource planning, in the Italian wood–furniture sector, focusing attention on the COSMOB S.p.A. case study, identifying how this small company tried to exploit the advantages offered by the introduction of new digital technologies to remain competitive in the context of the accredited Test Laboratories in the furniture industry.

Design/methodology/approach – The research has been developed with a qualitative approach. The study is a conceptual development and it uses exploratory interviews to create a single case study of COSMOB. The case study was developed with the realization by the researcher of a long period of support to the company's Quality Manager, and periodic bi-monthly interviews for an update of their perceptions on the development of the activity.

Findings – The need for rapid decision-making processes, the management of high volumes of data and the need for inter- and intra-organizational connection had a critical relief in company's decision to adopt the integrated software. As for the main problems related to its adoption, these were the duration of the implementation of the operation, the complexity of the system and its limited adaptability.

Originality/value – The value of the paper relies on the development of an in-depth company case study, where the researcher supported the implementation of the system for the entire activity, obtaining therefore, a qualitative base of information that cannot be obtained through limited interviews.

Keywords Information systems, Accreditation, Enterprise resource planning systems, Quality management

Paper type Research paper

1. Introduction

The evolution of information systems has followed that of information technology (IT). But it was not until the 1990s that enterprise resource planning (ERP) systems also became widespread in small- and medium-sized businesses as tools to manage business processes in an integrated manner (Seethamraju, 2015). The collection and processing of information has become, in recent decades, a fundamental competitive factor. Information plays a crucial role



within the business system, providing an important contribution to all the processes that support corporate governance. Some studies have shown that corporate performance and competitive advantage are increasingly linked to intangible elements such as information assets and knowledge development and sharing (Morabito, 2013). In this context, political initiatives have begun to support companies in the transition to the so-called “Industry 4.0” (Weyer *et al.*, 2015). This term refers to the digitalization of production processes and the diffusion of artificial intelligence embedded in objects. The technological elements that are currently transforming the industrial world are represented by the Internet of Things, artificial intelligence, robotics, cloud computing (Lee *et al.*, 2015; Bravi *et al.*, 2018; Basl, 2017).

This work aims to analyze the innovations introduced, with reference to ERPs, in the Italian wood–furniture sector, focusing attention on the Cosmob S.p.A. case study, trying to identify how this small company tried to exploit the advantages offered by the introduction of new digital technologies to remain competitive in its reference context, namely, that of the accredited Test Laboratories for the verification of conformity of products in the furniture industry.

2. Literature review

2.1 Drivers of enterprise resource planning adoption

The collection and processing of information has become, in recent decades, a fundamental competitive factor; they provide an important contribution to all processes that support corporate governance (Murmura, 2009).

To be competitive, companies must be able to respond promptly to external requests and to rely on efficient integration with all the relevant players in the supply chain (Altamony *et al.*, 2016). One of the ways to respond to these needs is the adoption of integrated information systems, among which the ERP management applications are distinguished. ERPs are considered a form of adaptation (proactive) to a market that is moving faster and faster, as these are solutions that integrate the operational and administrative processes that regulate business activities (Fui-Hoon and Delgado, 2016).

The factors influencing the decision to adopt an ERP system are numerous. Global competition, the need for rapid decision-making processes, the management of high volumes of data, the incompatibility between information systems, the need for inter- and intra-organizational connections (Ehie and Madsen, 2005; Finney and Corbett, 2007; Hwang and Min, 2015; Kharuddin *et al.*, 2015) are particularly important. The interest aroused in economic operators by ERPs and business intelligence (BI) systems is linked to the benefits brought by their introduction into the company, both from a strategic and operational point of view.

Their correct implementation determines, in fact, a reduction in costs (due to an integration of processes) and an increase in revenues (following an improvement in the service provided to customers), also facilitating opportunities for expansion and development. It can therefore be said that organizations that invest heavily in IT and, more specifically, in ERP and BI applications tend to obtain higher financial performances and market assessments than those that do not adopt these management solutions (Paolone, 2012).

Ehie and Madsen (2005) identify eight factors that influence the process of adoption and implementation of the ERP: project management principles, feasibility/evaluation of ERP project, human resource development, process re-engineering, top management support, cost/budget, IT infrastructure, consulting services. They also observe how, once the decision

to acquire an ERP system has been made, the adoption project that usually is complex starts and therefore requires considerable efforts in both organizational and technical terms.

2.2 Enterprise resource planning critical success factors and barriers of adoption

ERP systems allow management to make decisions that can increase the long-term value of the company, thanks to the possibility of having complete, univocal and coordinated information (Jayawickrama *et al.*, 2012).

The implementation of ERP systems makes it possible to make value-based decisions, that is, based on the knowledge of all the critical factors (current indices, previous performances, performance of the reference competitors). Another feature of ERP system is that of providing business performance indices not related to an area, but to all processes considered as strategic for the pursuit of corporate objectives, monitoring simultaneously financial, economic and qualitative indices, evaluating the effects of management decisions (Holsapple *et al.*, 2019).

Fui-Hoon and Delgado (2016) analyzed the critical success factors for the implementation of an ERP system. They observe how implementing an ERP involves a series of significant changes that need to be carefully managed. The critical areas of success are identified in seven macro categories: business plan and vision, change management, communication, team composition and skills, project management, top management support, system analysis, selection and technical implementation. Firstly, it must be considered that an ERP package is a complex system that requires a lot of time and a significant economic investment to be introduced into the company. Furthermore, implementing an integrated ERP solution is an “organizational revolution” which presupposes a specific business plan and vision.

In turn, Momoh *et al.* (2010) identified nine factors that are critical in the failure of ERP implementations: excessive customization, dilemma of internal integration, poor understanding of business implications and requirements, lack of change management, poor data quality, misalignment of IT with business, hidden costs, limited training and lack of top management support.

Despite this, the implementation of an ERP system is a very delicate problem, as the phases of this operation must be carefully planned and controlled. If their introduction presents critical elements, in fact, the benefits that these systems release can be minimized or even cancelled by significant losses. The analysis of case studies show that ERP projects have not always contributed to improving the productivity and efficiency of the company. Furthermore, implementation times often expand far beyond the initial forecasts, occupying the organization in costly adjustment processes (Lechesa, 2012; Seethamraju, 2015).

The critical points that must be considered to ensure that the implementation is successful include, among others, the commitment by top management, the re-engineering of existing processes, the integration of ERP with other corporate information systems, the selection and management of consultants and employees, and finally the training of employees in the use of the new system (Tome *et al.*, 2014).

Considering the re-engineering of existing business processes according to standards of excellence, provided by the best practices followed in the sector to which they belong, both benefits and costs deriving from the alignment with the system can be very high. In particular, the larger the size of the company and the extension of the system to many processes and organizational units, the more difficult it becomes to standardize the processes following the standards (Finney and Corbett, 2007; Lechesa *et al.*, 2012; Tome *et al.*, 2014).

Moreover, IT literature has long insisted on the criticality of top management support for the success of IT projects. This is especially true for ERP, which do not involve so much a change in system software, but rather an internal repositioning of the company and a transformation of business practices (Altamony *et al.*, 2016).

A study by Barth and Koch (2019) analyzes the role of management and chief information officers in the process of implementing ERP systems. The latter have a huge impact on the company's competitive advantage; in fact, the management needs to evaluate the strategic implications of implementing an ERP solution, evaluating the real chances of strengthening the competitive position and reflections on the structure and organizational culture.

Companies must also decide whether to adopt the ERP software as proposed by the vendor and acquire the predefined procedures from the system, or to "customize" the product, modifying it according to their specific needs. It is a complex choice because each of the possible alternatives has risks. If the software cannot adapt to the organization, the opposite must occur and modify all its processes; instead, if the organization customizes the software according to its needs, the total cost of implementing the system increases significantly (Olson and Zhao, 2007; Tome *et al.*, 2014; Seethamraju, 2015). Furthermore, following the impressive and rapid growth of the ERP market, and due to the complexity of the ERP system, in the early years, there was a shortage of competent consultants, since the necessary skills are such that they cannot be acquired extremely quickly. The ability to find valid consultants who can support the implementation phase is an important success factor. The skills required are both technical and interpersonal. It is important, however, that consultants have specific experience in the sector in which the implementation is carried out (Finney and Corbett, 2007; Tome *et al.*, 2014).

2.3 Use of enterprise resource plannings in small- and medium-sized enterprises

The phenomenon of small- and medium-sized enterprises (SMEs) is typical of the Italian economic structure. This particular market structure has a significant impact from an organizational and economic/financial point of view. While larger companies are more structured and have long faced the need to have an information system that supports them in internal processes and in the analysis of the large amounts of data they produce, for SMEs, this computerization process started later and is often not yet fully accomplished (Seethamraju, 2015).

The organizational models of the SMEs are usually much more flexible and less structured than those of the large company: staff often cover multiple tasks and follow multiple different processes; the company itself is required to have a high degree of adaptability to deal dynamically with the market. Information systems designed for large companies are poorly adapted to SMEs, which require leaner and more configurable solutions. Today, however, the major international players in the panorama of integrated information systems have specific solutions for SMEs. For example, System Application and Product offers S/4HANA for large enterprises and Business One for SMEs, Microsoft offers Dynamics-AX to one and Dynamics-Navision to the other.

The general concepts and basic principles are similar in the two product lines, but the actual implementation and structuring are very different (Ogunyomi and Bruning, 2016). Chatzoglou *et al.* (2016) identified seven success factors that allow a SME to effectively implement an ERP system: committed management support and sponsorship, clear vision and well established business case, business-centric championship and balanced team composition, business-driven and iterative development approach, user-oriented change management, scalable and flexible technical framework, sustainable data quality and integrity.

Chatzoglou *et al.* (2016) note that the duration of the operation and the costs connected to it are among the most critical elements. As for the temporal aspect, the first factor to consider is that the modular nature of ERP systems means that they are not all implemented at once. Many SME follow a phased approach where each module is installed at different times. To make a precise estimate of the time required to complete the system, it is necessary to keep in mind the number of modules to be installed, the range of action of the system, the degree of customization required by the company. Each of these variables affects the installation time and the adoption and use costs. In fact, the main critical issues related to the implementation of an ERP system include complexity, limited adaptability and costliness. The three categories of costs emerging from the adoption are acquisition/adoption costs, maintenance/adaptation costs and transaction/switching costs.

With respect to the first category, the SME management must evaluate the costs related to the investigation for the choice of the software, the costs deriving from the parameterization and customization of the system, the costs for the adaptation of the IT infrastructure and any costs generated by the initial inexperience in the use which may lead to an inefficiency of the system. The second cost class concerns the system's own characteristics. Finally, the switching costs are linked to the possible decision, by the SME that had originally planned the introduction of the system, to discontinue it, migrating to other management solutions (Haddara, 2012).

3. Methodology

The research has been developed with a qualitative approach. The study is a conceptual development and it uses exploratory interviews to create a single case study of COSMOB S.p.A. The case study allowed for examining in depth the implementation of an ERP system in a small business reality of an Italian Accredited Laboratory according to the ISO/IEC 17025:2017 that performs quality tests for the verification of conformity of products in the furniture industry (Yin, 1994).

The case study was developed with the realization by the researcher of a long period of support (from October 2016 to June 2018) to the company's Quality Manager, who had internal responsibility for the implementation of the ERP software and periodic bi-monthly interviews with both the Quality Manager and the General Director, for a periodic update of the development of the activity in the company.

It has been decided to focus the attention on the Quality Manager of the company, and on the General Manager, as they were the figures responsible for the realization and introduction into the company of the ERP system in connection with the Quality Management System (QMS) of the company. The periodic interviews were developed with the help of a check list. During the first initial interview managed in October 2016, when the objectives of the project were defined and just before its startup phase, questions focused on more general issues such as the management of quality in COSMOB and the role of the ERP system in managing the QMS standard and the management of customers in COSMOB.

Subsequent bi-monthly interviews were based primarily on the following topics: the changing in customer management in COSMOB, the challenge that the development of integrated software was introducing; the main challenges faced during each implementation phase and the main benefits they were encountering from its introduction. Table 1 shows in detail the number of meetings and interviews carried out during all the period considered. As for the participant observation, the researcher was directly involved in the ERP implementation activities, collaborating with the working group, and facing directly obstacles and problems that emerged during these stages. Interviews, meetings and participant observation activity were useful to triangulate secondary data, such as company

Table 1.
Meetings and
interviews carried
out during all the
period considered

Time/ Figure involved	Quality Manager	General Director	Employees involved
September 30, 2016	Initial meeting/ Interview	x	x
November 25, 2016	Meeting	x	
January 26, 2017	Interview	x	
March 30, 2017	Meeting/Interview	x	
June 5, 2017	Interview	x	
August 29, 2017	Meeting	x	
October 24, 2017	Annual Meeting/Interview	x	x
January 8, 2018	Interview	x	
March 21, 2018	Interview	x	
May 25, 2018	Interview	x	
June 29, 2018	Meeting/Interview	x	x
October 22, 2018	Annual Meeting	x	x
January 18, 2019	Meeting/Interview	x	
March 29, 2019	Interview	x	
June 2019	Interview	x	

reports and the website, collected during the period of support in the company. Secondary data have been used mostly to describe COSMOB history, structure and the services it offers to customers.

4. COSMOB case study

4.1 Wood–furniture sector and its informatization

The wood–furniture sector represents a production chain which is divided into two macro-segments: that of woodworking and that of making furniture products.

In Italy, the wood–furniture sector has developed through local systems, characterized by the presence of a network of independent SMEs, specialized in different phases of the production process. At the end of 2017, the wood–furniture sector had 73,098 companies, for a total of 239,270 employees. This is a production area with a high artisan vocation, attested by the fact that the average number of employees is 3.2.

This characteristic is also confirmed by the fact that 67.7% of the wood-furniture companies, are characterized as artisan enterprises. The main geographical feature of the sector is its division into districts (mainly located in the Center-North, in particular in Lombardy, Veneto and Friuli Venezia Giulia, but with significant realities also in the Center-South of Italy); more than half of the production units operate in the wood sector, 30.7% are active in the furniture supply chain and the remaining 17.8% in the upholstery. In particular, as highlighted by the report of the Institute for Social Research ([Istituto per la Ricerca Sociale \(IRS\), 2016](#)), the furniture system is divided into eight production segments (see Productive segments of wood–furniture industry) ([Mariani, 2012](#))

Productive segments of wood–furniture industry:

- Bedroom
- Living
- Seats
- Upholstered
- Kitchens
- Mattresses

- Furnishing accessories
- Commercial furniture and furnishings

Over time, the development of technologies has favored the adoption of new information systems by wood-furniture companies. Among the various systems adopted to collect, organize and manage the high volume of data created by management processes and those external to the company, the class of IT systems generically referred to as BI plays a fundamental role (Melchiorri, 2012).

A BI management system aims to reorganize the large amount of data collected by transforming it into usable information. These data derive from three sources of information:

- (1) that created by the tracking of market transactions, which is a kind of register of company movements (incoming and outgoing);
- (2) that originating from accounting tracking; and
- (3) in larger wood furniture companies, also that created by tracking the interactions between the company and business partners.

This source monitors activities for the acquisition of new customers, those for managing existing customers and those for pre/post sales assistance and support. This register provides very useful information to understand some marketing phenomena regarding the propensity to buy back, loyalty, etc.

4.2 Company profile

COSMOB S.p.A. is a technological center for quality, which offers wood-furniture companies a set of services and products capable of promoting the adaptation of companies to the technical-regulatory framework. COSMOB's activity, as it has been possible to see from the consultation of the annual reports on the laboratory activities, started in 1983, as part of an initiative promoted by the companies and institutions of the wood-furniture district of Pesaro.

As the General Director wanted to emphasize, COSMOB contributed, in the second half of the 1980s and the beginning of the 1990s, to promoting product and process innovation in the Pesaro area, contributing to the commercial success of the district. The area in which COSMOB was most decisive was that of strategic-organizational consultancy, innovation and product quality.

The company's international presence began in 2000, with the opening of offices in Mexico, Brazil, Russia and China, which are also involved in the implementation of training, research and development projects.

In the last decade, COSMOB's business has taken on a clearer technology-oriented configuration. In 2006, the Research and Development Center was opened, committed to promoting and assisting innovation and the development of national and international research projects. The expansion and enhancement of the Quality Testing Laboratory in 2008 was followed the year after by the development of new technologies, becoming the first Italian structure equipped with a chamber designed for the detection of harmful emissions (formaldehyde and volatile organic compounds). This investment was defined by the director and the quality manager as an investment that looked to the future, giving the laboratory a competitive advantage over its competitors and attracting customers of international interest.

More recently, to update its structure to the evolution of production technology COSMOB has created the FabLab Pesaro Laboratory, specialized in prototyping and digital manufacturing. At the same time, the company took further steps towards certification. In 2017, in order to strengthen the competitiveness of Italian furniture in the world, the Made in Italy brand was created for the certification of the controlled origin of wood-furniture products. Furthermore, in 2019 COSMOB became a Product Certification Body, accredited by Accredia according to the UNI CEI EN ISO/IEC 17065: 2012 standard.

COSMOB currently has 17 employees, including 13 internal employees, a PhD student, a research fellow and two interns.

4.3 Management of quality in COSMOB

On the certification side, it must be remembered that the “quality system” implies the implementation in companies of a series of activities, programs and actions aimed at ensuring that a product, process or service complies with the set objectives and purposes for which it must be used (ISO 9001:2015). In the furniture sector, the approach to quality assurance has evolved through various methodologies. In fact, four fundamental stages can be identified which tend to coexist in the most advanced current systems. The four systems that have followed over time are: the Product Verification System; the Quality Control System; the QMS; the Integrated Management System.

As underlined by the General Director, over the years, in particular, market competition has forced furniture companies to improve their ability to interpret customer expectations (or requirements) and manage the production process to obtain the desired quality with maximum reliability and efficiency. The QMS is based on the certification process. This is the tool through which COSMOB (as a third and independent body) certifies that a specific product, process or service complies with the chosen reference standards. COSMOB, in particular, is a center accredited for certification by Accredia, the national accreditation body, as it can be seen from the accreditation certificates on their website and how strongly the Quality Manager wishes to emphasize.

Consulting the quality documents of the company QMS, it can be seen as the COSMOB test laboratory performs tests aimed at ascertaining the conformity of the products with the technical regulations relating to seven different areas: finished products; finishing surfaces; materials and accessories; tests relating to the presence of formaldehyde and volatile organic compounds; chemical analyzes; reaction to fire; sound absorption tests.

COSMOB also provides a continuous certification service, thanks to the “Cosmob Qualitas Praemium” (CQP) brand, which has the aim of increasing product performance, certifying its quality, as well as protecting the manufacturer and enhancing the entire production phase of sale. The company’s price list shows the wide range of CQPs on activities such as controlling the panel painting and edging process, limiting levels of formaldehyde emissions from panels for exports to American markets as indicated by the American Environmental Protection Agency and the Californian California Air Resources Board regulation; the issue of Volatile Organic Compounds; the evaluation of circularity of products; technical support for Leadership in Energy and Environmental Design (LEED) and for the acquisition of the Made in Italy brand; rather than the control of minimum environmental criteria on school and office furniture. Achieving the CQP mark is a guarantee of product compliance with specific technical requirements, monitored periodically for the duration of the certification (3 years plus possible renewal), ensuring to consumers and the company a verified and constant quality that lasts over time, as stated by the Quality Manager.

The main advantages linked to CQP, that have been detected during the participant observation period and that have been stressed by the Quality Manager are: certified products; both the manufacturer and the transformer are protected; verifies of the sustainability of the product; easy product communication; enhancement of production in the sales phase (see [Table 2](#); source: company reports, service leaflets and price lists).

4.4 Adoption of the enterprise resource plannings system in COSMOB

As extrapolated from the meetings and interviews carried out during the research period, the current information system of COSMOB has been adopted since 2013. It is the result of the experience gained by the company with the systems previously in use and is constantly evolving, with new configurations and customizations. The structural and functional increase is made necessary, in fact, by the need to ensure a constant review of company flows and to support the growing complexity of the products and services provided. COSMOB has an ERP that includes three business areas: administrative, commercial and related to quality management for laboratory tests ([Figure 1](#)).

As for the administrative software, COSMOB purchased the version of the Gamma administrative software from Team System at the end of 2013, which replaced a previous obsolete administrative management software. This new version was implemented at the beginning of 2014. In fact, the part of the information system dedicated to the administrative area registered an increasing articulation according to the expansion of the operating areas, as underlined by the General Manager. The administrative sector was the first to be computerized in COSMOB: accounting procedures, often repetitive, adapt well to automated processes, having a high IT attractiveness. The main objectives of the administrative ERP adopted by the Pesaro company are: compliance with tax and civil regulations; the final evaluation of the company trends, and the presumptive evaluation of the company trends (budget policies).

Shifting the focus on the commercial sector, the Tustena software relating to Customer Relationship Management was developed by Team System and was implemented in COSMOB in January 2017. The participant observation permitted to see that it took five months to collect, clean up and combine all information from COSMOB customers. Prior to the software, an Excel file was present in the company in which the contacts of both consolidated COSMOB customers and potential customers, who had never had relationships and contacts with the company, were inserted. The Excel file had dirty data, sometimes repeated and sometimes incomplete.

1. Application phase	• The application verification process is started
2. Business Audit	• Training in the company through the transfer of knowledge and skills • Document verification includes: support in completing the documentation, verification of compliance with the reference standard • Sampling of the product subject to verification for the execution of tests
3. Cosmob Laboratory Tests	• Tests relating to the product (s) • Tests relating to the materials composing the product (s) • Issue of test reports
4. Granting of the CQP brand	• Issuance of CQP certificate
5. Monitoring	To maintain the brand, the following activities are carried out: • Six-monthly/annual maintenance check • Laboratory tests • Renewal of the CQP certificate

Table 2.
Acquisition and
maintenance process
of the CQP COSMOB
Brand

A work was carried out to evaluate each contact and also to classify it according to the type of production carried out (for example bathroom, school, community, kitchens, bedrooms, panels, accessories. . .). Subsequently, thanks to the adoption of the Tustena software, the contacts were divided into consolidated and lead companies (i.e. potential, but not yet effective contacts). The software communicates with Gamma, drawing from it the basic information on consolidated companies. The dialogue between the two software was made possible fairly quickly thanks to the fact that both software were made by the same parent company.

The basis of the CRM implemented in COSMOB was the awareness of the importance of creating and maintaining customer relationships. At the same time, the implementation of the CRM has allowed COSMOB to achieve a series of other benefits that have allowed, on the one hand, an increase in turnover and, on the other, a reduction in costs.

In particular, as it has been detected from the interviews and during the meetings, the increase in turnover was achieved through the acquisition of new customers due to the provision of services more in line with their expectations and needs; identification of the most profitable customers to whom dedicate targeted initiatives; the tendential increase in the customer retention rate. The second result is being achieved by reducing the time of customer interactions thanks to the information collected in the database; the increase in the effectiveness of marketing actions; the increase in job satisfaction by reducing the turn over.

A third element of the ERP implemented by COSMOB, always in 2017, is that relating to quality management and laboratory tests. COSMOB WebgestLab was already present in the company, for about ten years, in an earlier version. Over time the software, due to the obsolescence of some functions, had been gradually discontinued and was used only for small parts of the test management activity. In September 2017, it was therefore decided to update the software to make it conform to current business needs by integrating it with the administrative and commercial software purchased from Team System.

The software house chosen by COSMOB from November 2017 to April 2018, provided for the integration of the software with the two previously acquired by Team System. At the same time, COSMOB staff began to collect and arrange the data that needed to be entered into the software. The latter began to be operational, with reference to the creation of the first test reports relating to the mechanical tests of the laboratory (i.e. the certificates issued by COSMOB after carrying out the quality test on the product), in June 2018.

The reengineering and computerization project was aimed, as underline by the General Director during the initial meeting, at developing an *ad hoc* software, able to meet the specific needs of a laboratory accredited by Accredia (UNI CEI EN ISO/IEC 17025: 2018). The goal was to achieve more efficient integrated management of internal and external quality assurance. Until March 2019, chemical tests carried out in the laboratory were also included. In the meantime, from November 2018 to today, a software function has been developed that is able to translate the

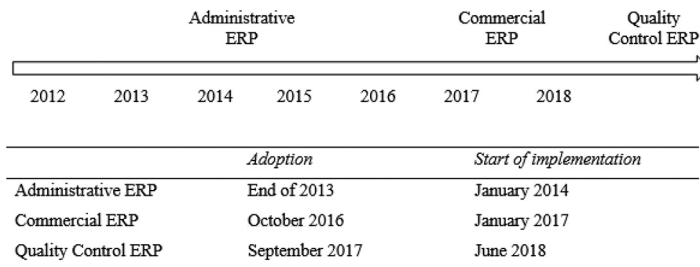


Figure 1.
Timeline ERP
adoption in COSMOB

test report into English in real time, for the benefit of customers requesting the certificate in a foreign language. In fact, while in the past about 3% of customers requested certificates in English, now this percentage is gradually increasing. The first reports translated into English have been produced since March 2019, although the work of inserting a large part of the standards into the software for simultaneous translation in English remains to be completed.

The software adopted by COSMOB, thanks to the formalities and procedural requirements of the certification, is able to provide decisive help in archiving documents, in finding information and in advancing procedures. Table 3 shows the performance indicators that COSMOB monitors for the management of laboratory activities, both in the period prior to the complete adoption of the ERP system and subsequently thereafter (after March 2019). Table 3 shows that the results obtained from the complete implementation of the ERP, which developed in a time span from 2014 to March 2019, positively impact on the reduction of time and errors in work activities for around two thirds.

The ERP system implemented by COSMOB is characterized not only by its integration, but also by the fact that the company independently created the software that manages the accredited testing laboratory activities. This decision taken by the General Director, was motivated by two reasons. On the one hand, it is the result of a research done on the potential of open source tools for data management, which has allowed the company to ascertain that these platforms allow to have a certain reliability in relation to updating, development and potential; on the other hand, all the software offers evaluated by COSMOB made it possible to have links with software houses, but they could also have limited the company's operations from an economic point of view. The solutions had, in fact, very high entry costs and also risked having a costly management for their maintenance, development, deepening.

Performance indicator	Before ERP implementation (from 2014 to February 2019)	After ERP Implementation (from March 2019 until now)	Difference (Δ)
Time to generate offers to customers	60 min.	15 min.	45 min.
Distortion of information from customer to offer	35% of offers	5% of offers	30%
Presence of generic errors in test orders	35% of offers	5% of offers	30%
Time to collect sample information for testing	1 week	1 day	4 days (out of 5 working days per week)
Time to write a test report (TR) (for each single TR)	10 min.	3 min.	7 min.
Time to write a TR (for a standard order consisting of 10 TR)	100 min.	30 min.	70 min.
Time to translate a TR in English (for each single TR)	12 min.	1.5 min.	10.5 min.
Time to translate a TR in English (for a standard order consisting of 10 TR)	120 min.	15 min.	105 min.
TR approval time/sending results (for a standard order)	30 min.	10 min.	20 min.
Presence of errors in the TR	10% of annual TR	2% of annual TR	8%
Customer complaints	10%	5%	5%

Table 3.
COSMOB's Activities
performance annual
indicators: before and
after ERP
implementation

4.5 Reasons behind the adoption of the enterprise resource plannings and the barriers encountered

The adoption and subsequent updating of the ERP system in COSMOB were made necessary for various reasons, identified during the initial and subsequent meetings: the growth in the operations of the company, an increase in the complexity of the activities carried out, the need to manage an increasing number of services provided.

The five main exogenous and endogenous factors that, according to international literature, influence the decision to adopt an ERP system are shown in Table 4. The column on the right indicates those relevant for COSMOB’s adoption of ERPs, as indicated by the General Director and the Quality Manager.

In COSMOB, in particular, the software implementation had to face significant structural and organizational changes. The company had to redefine the impact of ERP on human resources, making all the data available in the software and imposing an approach of continuous recording. From an organizational point of view, this has changed the way of working of many employees, who previously used an approach based on obsolete and inefficient methods, imposing a change in daily operations and requiring them to carry out the activities in a different way than past. This process of change has proved very demanding due to the widespread resistance in adopting a new working method.

By shifting attention to the critical issues encountered by COSMOB, thanks to the participant observation it has been seen that the implementation times were long, as it was necessary to include these activities within the company’s ordinary operational management.

During the course of the work, it was also stressed by the General Director that one of the main reasons why the initial forecasts prove to be wrong is that there is currently no generally recognized methodology for planning and evaluating the commitment necessary to implement an ERP system. In the case of COSMOB, the introduction of both CRM and laboratory software required an organizational and management change of both customers and laboratory activities. Furthermore, in dealing with this change, there has often been a resistance to change by staff, who are used to managing much less standardized activities. Also, in the case of barriers to ERP adoption, a comparison was made between the indications provided by international literature and the concrete situation of COSMOB (Table 5), derived from the interviews to the Quality Manager and the General Director.

In the case of COSMOB, the main problems were the duration of the implementation of the operation, the complexity of the ERP system and its limited adaptability. In fact, the latter barrier led to the creation of a customized laboratory software. If the transition costs were also quite high, a lower criticality was encountered compared to the acquisition/adoption and the maintenance/adaptation costs.

On the economic side, the investment in integrated software has involved a huge effort for COSMOB. Although its implementation mainly involved internal resources, it was

Table 4.
Reasons behind the adoption of COSMOB ERP system

Reference literature	COSMOB
Global competition (Seethamraju, 2015)	No
The need for rapid decision-making processes (Fui-Hoon and Delgado, 2016)	Yes
The management of high volumes of data (Finney and Corbett, 2007; Kharuddin et al., 2015)	Yes
The incompatibility between information systems (Finney and Corbett, 2007; Kharuddin et al., 2015)	No
The need for inter- and intra-organizational connection (Ehie and Madsen, 2005; Fui-Hoon and Delgado, 2016)	Yes

necessary to involve a software house both in the investment assessment phase and in that of adapting the infrastructure to the organizational configuration of the company.

5. Conclusions

The analysis of the research results shows that the adoption of the ERP made it possible to achieve three specific advantages for COSMOB. First of all, the operating system allows today to implement faster decision-making processes, in response to an increasingly complex strategic context. Secondly, the ERP allows the management of large volumes of data in the administrative, commercial and product certification areas. These two advantages allow COSMOB management to make decisions that increase the long-term value of the company, thanks to the possibility of having more information at the right time. The updating of the administrative and product quality ERP, as well as the adoption of the commercial ERP, are based on the assumption that to increase the company's value, it is necessary to prioritize the various decisions, based on their ability to achieve corporate objectives. A third advantage, achieved thanks to the ERP update, concerns a greater inter and intra-organizational connection. The most significant challenge COSMOB will face in the coming years is that of the ability of the new software to cope with the changes that are taking place. The wood-furniture industry is in fact through a phase of rapid transformation, determined by the paradigm of Industry 4.0. On the one hand, COSMOB finds itself operating within a district reality that requires close commercial and institutional relationships; on the other, its operations in different locations and the expansion on foreign markets determines a flow of information and data that must be managed consistently. The introduction of an ERP in the company has made it possible to obtain performance indices referring to all processes considered as strategic for the pursuit of corporate objectives.

On the side of the main disadvantages perceived, the most critical moment was the implementation of the ERP, as it required a redefinition of corporate procedures. The adoption phase entailed technical difficulties and organizational changes, also requiring overcoming some internal resistance. These obstacles were overcome thanks to COSMOB's clear sponsorship of the project, the high professionalism of the internal figures and the contribution of external resources and skills. Therefore, the practical implications that can be drawn from this study are that ERP systems can be a very useful tool for small businesses, with a structure usually already characterized by flexibility, because they can streamline the planning and management of the corporate strategy, allowing entrepreneurs to make decisions faster, on time and safely. Moreover, thanks to ERPs, the communication of company information improves, the information flow becomes faster and reaches all corporate figures. Certainly, the implementation of an IT system allows a reduction of errors due to incorrect corporate communication and a greater intra-organizational connection.

The main limitation of this research is that, although the study analyzes the reality of a technology center and the small- and medium-sized companies in the sector that the center serves, the specific advantages that the implementation of an ERP could bring to its customer companies

Reference literature	COSMOB
Duration of the implementation operation (Lechesa <i>et al.</i> , 2012; Seethamraju, 2015)	Yes
Acquisition/adoption costs (Lechesa <i>et al.</i> , 2012; Tome <i>et al.</i> , 2014)	Average
Maintenance/adaptation costs (Finney and Corbett, 2007; Lechesa <i>et al.</i> , 2012)	Average
Transaction costs (Olson and Zhao, 2007; Seethamraju, 2015)	Fairly high
Complexity of the ERP system (Finney and Corbett, 2007; Tome <i>et al.</i> , 2014)	Yes
Limited adaptability of the ERP system (Tome <i>et al.</i> , 2014)	Yes

Table 5.
Barriers to the
adoption of COSMOB
ERP system

are not evaluated. This issue is of significant importance and deserves to be studied carefully; therefore, future research should be devoted on evaluating the level of customer satisfaction and the advantages that customer companies could have from the implementation of an ERP by service companies, by extrapolating data from other centers, and considering also different sectors.

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Further reading

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