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Challenges of digital technologies for Albanian manufacturers (Case studies)

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Abstract: This paper investigates how Albanian manufacturing companies use information systems in their managerial processes and ways to promote their innovative use. There are evidence Albanian manufacturing companies use advanced production technologies and are increasing application of information systems. Still, there is a lack of knowledge and literature about the magnitude of information systems used in Albanian small and medium enterprises (SMEs) and their integration into the company's activity. This study intends to reveal the usage of information systems in core activities of SMEs, the benefits these systems bring to the management and performance of companies, and the driving factors to deploy these systems. The study was conducted using mixed research methodology. It has combined secondary research to create the theoretical context of the observation with primary research in the form of case studies applied in some manufacturing companies. The paper brings findings on the extent of information systems used in SMEs and impact on companies' management and performance. The conclusions point out the barriers and challenges companies face in applying systems and emphasize some ways to overcome them. The practical implications of this work are that these findings and recommendations apply to the cases observed and many other SMEs in the manufacturing industry. The dissemination of such knowledge would encourage Albanian businesses to promote innovation and digitization.

Keywords: *Human resource development, Information systems, Innovation, Learning in organizations, Manufacturing industry, Small and medium enterprises.*

1. Introduction

In recent years, digitization and innovation at the global level have significantly impacted enterprises' capabilities to compete in a rapidly developing business environment. The development of information technology and its role in businesses of various sectors has attracted the attention of researchers worldwide. Several research papers and publications from other local and international institutions [1], [2] prove an increase in the use of digital instruments, a general evolution of indicators of digitization and innovation, and an increase in information systems in Albanian enterprises. At the national level, developing and improving information systems for public services offered by the government through the e-Albania system and digitalizing the tax system (fiscalization process) are important and impactful achievements [3].

Despite progress, the use of digital technologies and systems in Albania is relatively low compared to other countries, especially in small and medium enterprises (SMEs). These companies play an essential role in the country's economy and have made evident improvements in recent years, still lacking information and communication technology [1].

On the other hand, enterprise managers have increased awareness and interest in taking advantage of technology and information systems (IS) opportunities. This is evidenced by the increased Internet use and platforms, social media, and online sales [1]. The commitment of scientific and academic

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institutions to research, support, and finance developments in innovation and digitalization proves the same interest [4].

This general overview confirms the need for Albanian businesses to set up, update, and improve their information systems to enable effective management and decision-making. The establishment and "smart" use of information systems can bring multi-faceted benefits to businesses. Meanwhile, the factors that restrain investments of material and non-material nature in information technology (IT) and systems are of different types, including deficiencies in the IT and managerial training of managers, the lack of capacity to evaluate (or distrust in) the effectiveness of systems, financial factors, lack of institutional support, etc.

From this perspective, SMEs should be helped to improve their decision-making policies and practices through better and broader use of their information systems. This can be achieved through the education of human resources and the improvement of the processes that are part of the information systems in the enterprise. If the information systems are missing, support for installing and using such systems will help the companies to be more competitive in the domestic and foreign markets. Otherwise, market mechanisms will place them in vulnerable and low-performing positions if they apply intuitive management and out-of-date techniques.

This paper investigates how information systems are used in Albanian manufacturing SMEs and the challenges they face. Investigating some cases allows us to highlight the good practices and difficulties companies should overcome in using information systems. The study scope is extended to analyze the impact of these systems on core business functions. The observation findings can be generalized at the industry and company size levels. The recommendations for the companies included in the study are applicable and can help SMEs increase their effectiveness.

2. Theoretical Framework

2.1. Role of Information Technology in Enterprises

The use of IT in the activities of enterprises has been extensively examined in the literature of the last decades, especially in pointing out the encouraging and inhibiting factors. From the beginning of years 2000,' the analysis [5] emphasizes that "Chief executives now routinely talk about the strategic value of information technology, about how they can use IT to gain a competitive edge, and about the "digitization" of their business models." Since then, many Information and Communication Technology (ICT) studies have focused on large and multinational firms [6]. Small- and medium-sized enterprises (SMEs) are getting more attention. Nevertheless, the existing body of evidence regarding the factors that promote or impede the adoption of information and communication technology by small and medium enterprises, particularly in developing countries, remains scarce, according to the most recent systematic literature review [6].

Internal barriers to the utilization and adoption of information technology in SMEs exist within an organization and typically are made up of organizational culture, lack of resources, owner/managers' attitude toward ICT, the level of training of employees, etc. [7]. The external barriers that are out of the organization's direct influence generally include a lack of infrastructural facilities, limited financial resources, costly consultancy, or missing support from the ecosystem [8]. According to prior work [7], "one of the most surprising barriers to ICT adoption is the lack of knowledge of ICT solutions, how they work, their implementation and perceived benefit to the SME sector." These barriers deserve a deeper investigation, especially in the Albanian environment.

The role of information technology in Albanian businesses has been addressed in terms of its impact on the creation of premises for the Industry4.0 paradigm. The observation [9] has evidenced the connection between innovative technologies, the digitalization process, and the role of universities, which are applied mainly in large businesses. Because large enterprises have higher capacities and more driving factors towards the use of information systems and technology, [10] have evaluated digitalization attainments in large Albanian businesses located in the industrial area of Tirana. Similarly, [11] has researched the penetration of digital elements in the banking sector. The studies cited above have focused on macroeconomic phenomena and general indicators of technology and

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information systems in a specific industry or market segment. There is a lack of research on the use and role of information systems in Albanian SMEs.

2.2. Information Systems in Enterprises

An information system (IS) is technically defined as a set of interrelated components that collect, process, store, and distribute information to support decision-making and control in an organization [12]. Despite variations in IS definitions, the authors [12] and [13] focus on two ways of describing information systems: the *components* that make up an information system and the *role* those components play in an organization. Five significant components make the information systems: hardware, software, data, people, and processes. According to [12], the first three are technology and can easily associate with the meaning of information systems. The two other components, people and processes, relate the technical field (computer science) to the business one.

The recently increased integration of information systems with organizational processes is intended to boost productivity and improve control of those processes. The information systems are designed to turn data into information and, further on, transform that information into organizational knowledge. The design and operation of information systems enable companies to possess basic instruments in operational and strategic decision-making. Through them:

- The necessary indicators for identifying the current situation are provided to achieve the company's objectives and optimize the use of available resources.
- Data is provided to make decisions, implement necessary changes in real-time, and generate practical solutions regarding organizational and functional issues in the company.
- Forecasts are made for future business developments (demand, resources, risks), and regulatory actions are determined as basic management instruments.
- Optimizing the use of the company's resources for activity management is possible by integrating the information systems, maintaining, and updating them.

As technology has developed, the role of information systems has evolved into the whole organization, becoming an integral part of every business. According [14] in 2020 there were some big Albanian companies using information systems and accepting many advantages of these systems. The users of ERP / CRM point out these main benefits: enterprise growth, streamlined processes, flexibility in data entry, better organization of jobs within a department, and fuller control over the enterprise. Although the integration of information systems into organizations has progressed over the decades, the survey [15] in Albania still shows that only a small percentage of enterprises use management information systems. These authors mention two main reasons: the high initial cost, lack of information, and uncertainty in the functioning of the management information systems. Conversely, the Albanian SMEs lag compared to big companies. Experience and observations show that SMEs often do not produce data, and even when they do, they lack the necessary knowledge to use them in strategic and operational decision-making. During the decision-making process, the managers of many small businesses rely primarily on entrepreneurial intuition or copy of competitors' practices rather than on analyzing data generated from a dedicated and functional information system. Lack of digital knowledge, trust in traditional management methods, and resistance to change lead to limited and fragmented use of information systems, up to the extent they are forced by legal or fiscal requirements [16]. Small enterprises do not consider the implementation of ERP/ CRM as necessary [15], although such a situation might have somewhat changed after Covid-19. It aligns with the evidence from recent research in different countries [17], [8].

Under such conditions, the deficiency in "smart" use of information systems primarily affects enterprises' performance. Investment in advanced production technologies and digital tools becomes effective when integrated and involves synergy. Companies should realize that technology can't assist unless human resources have the knowledge to use it best.

3. Methodology

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This paper is part of a broader study on information systems in Albanian manufacturing SMEs, which has observed the use of these systems in the activities of participant companies in the project [4]. Our empirical study aims to incite the use of information systems to increase the performance of managerial activities in our SMEs. The following work includes the analysis of the information systems that companies use in their value chain activities and processes. The study has combined empirical and applied work in both critical fields of management and IT.

The research question is formulated: how can manufacturing SMEs be encouraged to use information systems effectively?

The following steps are considered to answer the research question and provide a deeper understanding of the companies' concerns:

- First, assess to what degree information systems are used to support managerial processes in SMEs,
- Then, identify alternatives for the integrated use of information technology tools in the enterprises, considering their existing and potentially new systems,
- Finally, explore the challenges SMEs face in applying systems and how to overcome them.

3.1. Methods

The study's methodology combines primary and secondary research. The literature review and secondary research in the databases have brought together the findings identified by researchers in the managerial field and information systems and their research techniques. The theoretical framework has enabled the design of the study model, which is implemented through primary research.

The primary research is based on multiple case study methodology [18], [19] to conduct an exploratory analysis of information systems SMEs use in manufacturing industries. According to [20], the case study approach permits examining the details and causes of decisions made and provides a comprehensive landscape of the issues in discussion.

In this study, qualitative analysis is based on the concept of "information systems coverage" [21] and it considers the activities held with information systems support for each area of application in the company. Following research by [22], areas of application are identified based on the classification of activities and functions that are part of a company's value chain, according to Porter [23]. Innovation and information technology advancement significantly impact primary and support activities in the value chain. Consequently, all these activities can be investigated separately to highlight the intensity of information systems usage in each. They can also be jointly observed because of their strong integration into the company's activity, performance, and competitiveness. As to the technical quality (intensity) of systems in each area of application (sales, marketing, production, logistics, management, finance, and other applications of IT), it can be assessed along a diapason going from the use of spreadsheets to fully integrated ERP systems for each area of application [8].

3.2. Instruments

The primary data about the areas of application/ functions involved and the intensity of information systems are collected through extensive semi-structured interviews during face-to-face meetings with top company managers. The multidimensionality of information systems and technology used in companies requires consideration of the opinions expressed by several executives despite their professional backgrounds. The semi-structured interviews permit both a structured approach in all interviews and more space for interviewees to share their experiences and opinions freely, according to the theory of Yin [24]. The interviews were conducted on the premises of each SME, and one or more top managers were involved. The interviewees' opinions on the intensity of systems usage in each application area were recorded on the spot in a questionnaire for easy conversion into digits (quantitative expression) that enable comparability in dealing with qualitative data.

The main areas of application and managerial activities considered in the interviews and reflected in the questionnaire consist of:

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- Support decision-making activities and their review by analyzing the actual data and indicators generated by the systems. This makes it possible to trace any inaccuracy in decision-making, errors in production processes, or the causes of productivity decline, among other things.
- Coordinated use of machines and other inputs according to the production plan of different products within the sector or between sectors, in a centralized or non-centralized way, with the support of the company's information systems.
- Logistics and inventory management involve functional decision-making integrated with production planning and scheduling through information systems (MRP, ERP, etc.). They also include supplier relations in light of medium—and long-term company objectives.
- Sales management is closely related to marketing management, considering the broad range of indicators the information systems can provide, and the top management can deploy to improve their production and market performance.
- The capabilities provided by the information system to evaluate the performance of employees, using the data for their reward and compensation. This approach makes employees more responsible and motivated to achieve the company's objectives over a certain period. When complementing this assessment with evaluating employee satisfaction in the workplace, the company possesses more instruments to promote increased work productivity.
- Appreciating continuous learning and stimulating a culture of improvement. The information system can provide data that allows the analysis and understanding of the causes that have resulted in accordance (or not) with the expected ones. Thus, experience is gathered, indicators are fixed, and appropriate procedures are established to improve company management.
- The interconnection of accounting and finance functions with other functions in the enterprise and the role of fiscalization enforcement in using information systems.

3.3. Participants

There were twelve companies participating in this study, all of them fulfilling the following criteria and agreeing to collaborate with the research team on the project.

- Size and structure of the company: small or medium enterprise having more than ten employees, carrying out activity for some years under consolidated structures;
- Type of activity: manufacturing industry (non-ferrous metal, paper, plastic recycling and production, furniture production, food processing, etc.) trading B2B. 7.4% of all Albanian enterprises are in industry [2], [25]. The choice of SMEs from varied manufacturing sectors gives us a comprehensive view of the current situation while considering different sectors from the perspective of information systems usage.
- Location: factories are located in the Tirana – Durres region, where 57.1% of all Albanian companies are located, and almost half of the manufacturing companies (49.2%) carry out their activity [2], [25]. The concentration of companies in this region makes it suitable for investigation.

The study devoted a thorough and careful investigation of every case to obtain insights into the perceived and actual usage of information systems in operational and strategic management in the company. The findings and recommendations were provided to each company participating in the study. Then, the cases were compared to analyze similarities and differences and provide general recommendations applicable to various SMEs in resembling conditions.

4. Results and Discussion

The first step of the study, assessing the degree of information systems use in managerial processes in SMEs, was made possible by interviews and questionnaires completed during visits to participant companies. The research group's visit to the production facilities was part of the observation. It allowed us to understand the way the business operates, the extent of digital technology use in general, and that of information systems in particular. In the second step, this comprehensive approach enabled the

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detection of challenges, obstacles, and intelligent improvement alternatives in all areas included in the study.

It should be emphasized that the top managers were also owners in all companies, which is common in small and even medium companies in Albania, as recent publications have demonstrated [26]. This fact has practical implications in decision-making and affects the speed and magnitude of digital technology deployment in their companies.

The qualitative data collected during the interviews were converted into a point assessment on a scale from 0 (lowest) to 4 (highest) to describe the intensity of systems usage in each application area. Using the same questions and the same evaluation scale enabled the presentation of the results in graphic form. This helps the presentation of findings and allows comparability at the level of application fields between companies and the company level between fields or functions. The summarized scores are presented in figure 1 and figure 2. We avoided mentioning the company's names in this publication because of confidentiality concerns some participants expressed. They are named "Company," followed by a number, enabling reference and comparison during the discussion.

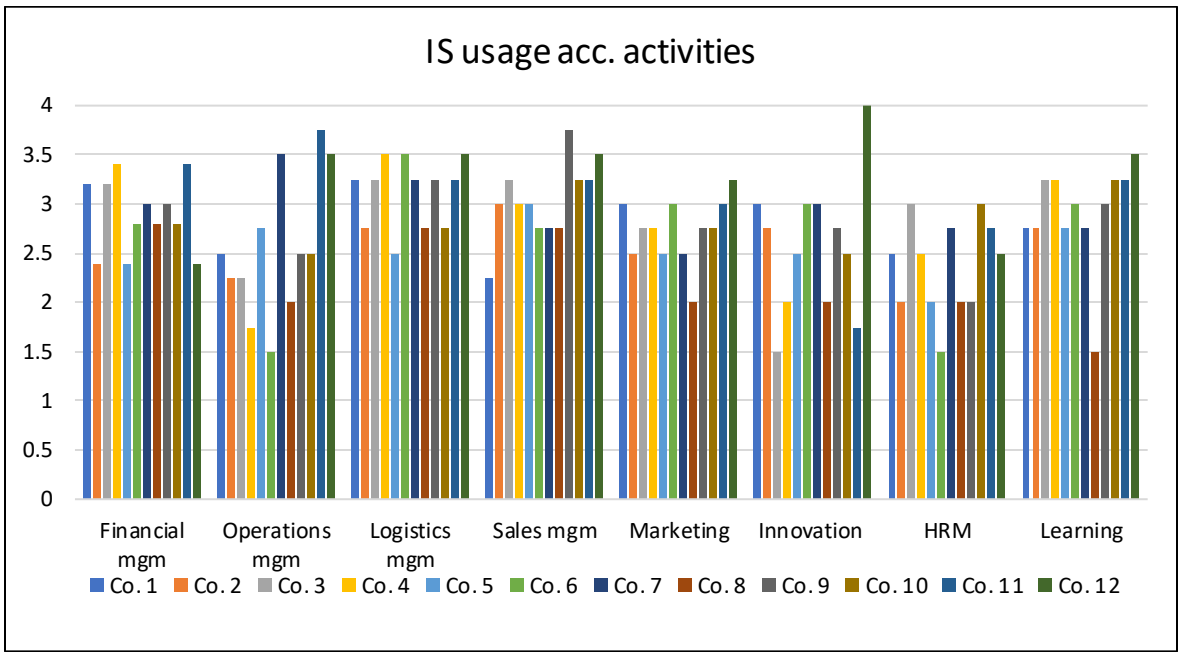

Figure 1.
General view of information systems usage according to fields of activities.

Many companies' experiences show that they start digitalizing their operations with minor changes and use information systems by impacting one or a few functions before jumping (or at least planning to) into fully integrated systems. Similar experiences are highlighted for Italian SMEs [23] regarding accepting digitalization processes.

All companies are convinced that technology affects every aspect of today's business operations. Simultaneously, they notice that the gap between innovation in respecting fields and its implementation in companies' activities is closely related to two main factors: the development of human resources and continuous learning and the effectiveness of investments in digital technologies.

The graphic presentation of the level of information systems use indicates a disparity between companies for the same core activities (Fig.1) and within a company among crucial business functions (Fig.2). Both figures have only illustrative value. The scores and their meaning are explained during the discussion, where necessary.

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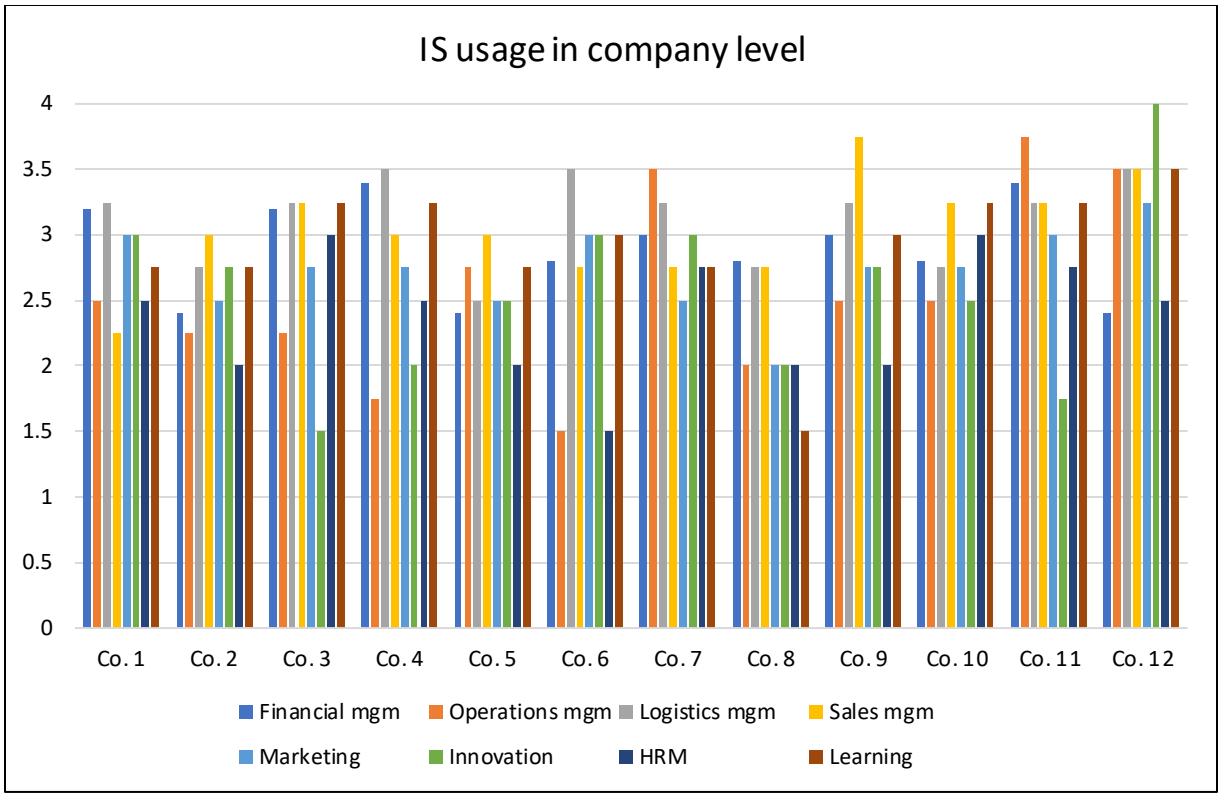

Figure 2.
General view of information systems usage at the company level.

The fact that the companies belong to different manufacturing sectors hampers the comparison between their technologies regarding effectiveness and innovativeness. However, the analysis of production management in terms of product and process design, layout, capacity and automation, scheduling, and how these activities or sub-activities are interconnected permits some findings at the company level.

Investments in production technology in general (except Co.11) were made at different times, in partial form, adding machines and equipment of other generations. This makes it challenging to integrate the machines or separate links of the production line into a single chain, which can be monitored and commanded from a single center. Similarly, companies have expanded production in the exact location by adding parcels and sectors over the years, making it difficult to connect them in an integrated system. In these conditions, regardless of company managers' knowledge and desire to use robot equipment, the production layout makes their use difficult. According to the interviewees, robots can be programmed to perform various tasks by orienting themselves in the surrounding environment thanks to sensors and video cameras when the layout is adapted to the technical requirements.

Technically, in many of these companies, production line management can be improved through the interconnection of machines supported by sophisticated software, even when these machines are installed at different times. However, while mentioning this alternative and the suggestion for action, the research group was faced with the assertion from most SMEs that they cannot expand their information technology resources due to limited access to capital. The same concern was highlighted by studies in other countries [7], [8], confirming it as one of SMEs' critical challenges toward intensive use of advanced production and information technology.

Another reason companies delay digitalization is resistance to change, as evidenced during the interviews. Some authors [27] call these "cultural barriers" and have shown that entrepreneurs are unwilling to innovate, even in Italian SMEs. They are becoming familiar (and successful) with the

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traditional manufacturing system and are somewhat concerned about the transformation of their businesses into "smart factories" [23].

To a certain extent, this is explained by the fact that some owners and managers of these firms lack the proficiency to select an information system or ICT solution that would be appropriate for a given type of organizational problem. Hence, it is necessary to provide updated knowledge and proper training to the owner/managers and the employees to identify the optimum solution for their company. It was seen during the interviews that the age and digital literacy of SME owners/ managers are important drivers (or barriers) toward digitalization in their companies. We faced the same situation as [7] in 2015, as revealed in their surveys, mentioning that "younger owners/ managers tend to be fascinated by unique and fresh initiatives and are more willing to take risks than older ones. An older owner/manager may be reluctant to take risks to try out a new technology".

The consequences of these deficiencies are evident in quality management. Integrated production and information systems provide opportunities for continuous quality control in the links of the production process [28], [29]. They also enable real-time intervention, minimizing defective products and unnecessary waste and reducing costs. The SMEs observed were generally unaware of these opportunities and far from their application.

Logistics displays a uniform usage of digital instruments in all SMEs surveyed (scores from 2,5 to 3,5). Still, the mechanization or automatization of processes was far from what the recent technology enables in the respective industries. Again, due to the expansion of the production line and storage units at different times, conveyor systems were complex to adapt to production and storage layout. This deficiency has led to using a larger workforce in the transport processes, affecting cost, production time, quality, and work safety. On the other hand, providing data for these processes requires the time and commitment of functional managers, impacting the area of logistics and operations [30].

Fragmentation in the supply chain activities also affects sales management and the fulfillment of customer orders. The connection between the supply of raw materials and placing orders in the production process can be significantly improved using new technologies that monitor the supply chain and the goods' required/ promised delivery time [28]. The sales management function also displays variability in terms of using digital tools. A few companies (Co.9 and Co.12) have installed dedicated systems or used all the functionalities the enterprise resource systems enable and use the generated data for improving decision-making and customer service. There is probably a correlation between the size of the company (small or medium), the organizational structure, and the intensity of using digital systems in the company's activities. However, this was out of our study scope and couldn't be analyzed.

Human resource management in our manufacturing SMEs does not seem to have benefited much from the use of digital technologies (Fig. 1). Literature [23] proves that this impact has been most pronounced in recruitment, as many companies now rely on this on Facebook, LinkedIn, Skype, videoconferencing, etc. However, our observation shows that SMEs use digital tools and data from information systems to manage their human resources. There are deficiencies in the definition and formalization of objectives and a lack of measurable indicators related to the workforce and procedures for their monitoring. These deficiencies hinder the objective and impartial measurement of work results and limit the action of incentive mechanisms that would make the employee more satisfied and productive. Using motivational reward schemes and encouraging the development of employees in the company is difficult to realize without a database that integrated information systems can provide.

There is a discrepancy between the human resources activities and the procedures through which the company can assess and encourage learning. Most companies (except Co.8) take care to provide data and monitor improvement in all processes (avoidance of errors, timely corrective measures, and preventive measures for the future). However, these are generally based on partial information systems and less on planning and control systems to encourage the spreading of a meritocratic culture within the company.

Financial management is one of the areas where the level of systems use is more uniform (Fig.1). One of the critical factors that has influenced the use of accounting programs in all companies is the legal obligation to digitalize the invoicing, accompanied by all the supporting elements of education and training of users provided by the tax administration. This means that when companies are pressured to

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increase the use of specific technologies and platforms, either by market demands or the legal and regulatory framework, they engage and successfully adopt these technologies.
The findings relate to some of each company's core activities; however, the analysis should not be considered exhaustive. Achieving the company's strategic objectives in digitalization would require a longitudinal study, which was beyond the scope of our observation.

5. Conclusions

This study investigates to what extent manufacturing companies use information systems and what prevents the more comprehensive, effective, and "smart" use of these systems. The study was carried out in the form of cases, analyzing the information systems used by Albanian manufacturing SMEs in terms of inclusion and integration of the central business functions to support their decision-making. Some of the main conclusions are:

- Companies are aware of the benefits of digital transformation and the need to use information systems to support operational and strategic decision-making. However, systems use remains limited or fragmented in some functions or fields of activity in manufacturing SMEs.
- The uneven use of information systems among a company's functions shows that experience and existing systems can encourage innovative use in other functions and promote systems integration.
- The scarcity of appropriately qualified human resources in both fields of management and IT is one of the main barriers to using systems.
- The high costs associated with digitalization and the installation of integrated information systems are another challenge for manufacturing SMEs.
- The main practical implication of this survey is the fact that it provided the twelve companies observed with the know-how and consultancy to increase the intensity of system use within existing capacities.
- Moreover, several recommendations are proposed for manufacturing SMEs to overcome the abovementioned challenges.
- Companies should invest in installation and use of integrated systems to support their strategic and operational decision-making. Enterprise resource planning systems are helpful in order to get the most benefits from integration of activities at the company' level.
- There are several ways to address the scarcity/ lack of qualified human resources, such as (a) the commitment on the part of the companies for regular updates and training to keep up with developments; (b) the support from the stakeholders (public institutions, academia, business associations, etc.) to offer fundamental and life-long modern education in the respective fields.
- Regarding the high initial and running costs, information technology offers many opportunities that reduce such costs, including affordable cloud-based solutions, the use of Artificial Intelligence, an increasing number of customized solutions by local providers, etc. Companies should make all efforts to use them and to take advantage of all the support from public (local or international) and private funding opportunities provided in the framework of the integration process of Albania in the EU.

This study has several limitations, which can become opportunities for future research. The case study method and the limited number of companies investigated make generalizing the results difficult. In the future, the scope of the observation in a larger sample and the expansion of the purpose of the research can be realized. Despite our efforts to include companies from different sectors in the analysis, the industry has many other subsectors left out of the observation. This prevents the specific characteristics of some of the branches from being considered.

However, additional knowledge and support provided to owners/managers and employees in surveyed companies during increased use of their information systems and raised awareness of the need to strengthen human capacities remain among the modest contributions of this study.

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