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DIGITAL MATURITY OF THE COMPANIES IN SMART INDUSTRY ERA

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Abstract

The advent of Industry 4.0, marked by the integration of cyber-physical systems, the Internet of Things (IoT), and advanced data analytics, is revolutionizing the logistics industry. The paper proposes to use a survey developed and provided by the Research group Logistics and Alliances of the HAN University of Applied Sciences (the Netherlands). The survey was edited in March and April of 2023 and used from April 2023 to February 2024. Participants were from six partners in Europe (Finland, Spain, Ireland, Croatia, Romania, Austria) and one in Argentina. Students from all partnering universities interviewed their chosen case companies. The questions were categorized in the next sections: Background questions; Organization questions; Competencies; Tools and applications; Ranking; Company's performance compared to others. Results shows that the digitalization process in companies has started, with significant improvements in companies profit and customer satisfaction. From an organizational point of view, about 10% of companies consider themselves "Analytics as a business vision" and 20-25% are in the "data-driven organization" phase. Excel remains the most used tool for data processing, but there are preparations for integrated ERP applications in the digital management of companies. The results of the study are also confirmed by other analyses carried out by other institutions such as the Digital Maturity Assessment (DMA) tool of the European Digital Innovation Hubs Network, KPMG or BDC, and underlines the opportunity and importance of integrated digitization efforts of companies, as well as the need for standardized applications both in the field of local data processing and in international logistics chains.

Key words**:** *Digital maturity assessment, smart industry*

INTRODUCTION

In today's digital age, companies face the challenge of adapting to constantly evolving technologies and effectively integrating them into their business strategies [4, 8].

Climate change, rising production costs, and shifting consumer demands are just a few of the difficulties they have been dealing with recently. These industries may be able to overcome these obstacles, introduce innovation, and produce gains for everyone involved in the value chain thanks to the digital economy.

The use of digital technologies to modify business models and offer new chances for revenue generation and value creation is known as the "digital economy," or more accurately "digitalization." It seems that digitalization and the rapid development of numerous new technologies will cause disruptions. Technologies that fundamentally change how companies or entire industry's function are known as disruptive technologies. These technologies frequently compel businesses to adapt their methods of doing business, or else they run the risk of losing customers or going out of style. Additionally, the development of smarter industry is made possible by digital technologies, which also give consumers a lot more power.

The next stage of digitization, known as Industry 4.0, is being driven by four disruptive forces [15, 23, 28, 29]:

(i)An increase in **connectivity**, processing power, and data volumes, particularly in new low-power wide-area networks;

(ii)The development of **artificial intelligence**-based analytics and business-intelligence capabilities;

(iii)Novel avenues for **human-machine communication**, like Internet of Things and augmented reality systems;

(iv)Advanced robotics is one example of how digital instructions are better transferred to the real world.

Information and communication technology, or ICT, is now regarded as a commodity technology that facilitates the development and/or adoption of more sophisticated technologies, including smart phones, satellites, cloud computing, and remote sensing.

E-business platforms are software technology solutions that serve as the foundation for additional processes, applications, or technologies, primarily related to digital commerce.

The advent of Industry 4.0, marked by the integration of cyber-physical systems, the Internet of Things (IoT), and advanced data analytics, is revolutionizing the **logistics industry** [7, 17].

Smart logistic chains are emerging as a pivotal component in this new industrial era, offering unprecedented efficiency, transparency, and adaptability.

The key elements, benefits, and challenges associated with smart logistic chains in the context of Industry 4.0 are:

(a)Internet of Things (IoT): IoT technology enables real-time tracking and monitoring of goods throughout the supply chain. Sensors and connected devices collect and transmit data on location, temperature, humidity, and other critical parameters. This data allows for immediate adjustments and proactive management of logistics operations.

(b)Big Data and Analytics: The vast amounts of data generated by IoT devices are analyzed using advanced analytics. Machine learning algorithms and predictive analytics can forecast demand, optimize routes, and improve inventory management. This data-driven approach ensures more accurate decision-making and resource allocation.

(3)Automation and Robotics: Automated systems and robotics are increasingly used in warehouses and distribution centers. Automated guided vehicles (AGVs) and robotic arms enhance the speed and precision of sorting, packing, and shipping processes. This reduces labor costs and minimizes human error.

(4)Blockchain Technology: Blockchain provides a secure and transparent method for recording transactions and tracking goods across the supply chain. It enhances trust among stakeholders by ensuring the immutability and traceability of records, thus reducing fraud and discrepancies.

(5)Artificial Intelligence (AI): AI enhances logistics by providing smart planning and optimization solutions. AI-driven systems can adapt to changing conditions, such as traffic patterns and weather, to optimize delivery schedules and routes. Additionally, AI can manage dynamic pricing and supply chain risks.

The main **benefits** of Smart Logistic Chains are:

(6)Enhanced Efficiency: Smart logistic chains streamline operations through automation and real-time data analytics. This leads to faster processing times, reduced downtime, and optimized resource use. The result is a significant boost in overall efficiency.

(7)Cost Reduction: Automation and predictive analytics help reduce operational costs. By optimizing routes and inventory levels, companies can lower transportation expenses and minimize holding costs. The reduction in manual labor further decreases operational expenditures.

(8)Improved Customer Satisfaction: Real-time tracking and transparency allow customers to monitor their orders and receive timely updates. This visibility enhances trust and satisfaction, as customers are better informed about their deliveries.

(9)Flexibility and Adaptability: Smart logistics systems can quickly adapt to changes in demand, supply disruptions, and other unforeseen events. This flexibility ensures continuity and reliability in the supply chain, even under challenging conditions.

(10)Sustainability: Optimized routes and efficient resource use contribute to reduced carbon emissions and environmental impact. Sustainable practices in logistics are increasingly important for meeting regulatory requirements and fulfilling corporate social responsibility goals.

Smart logistic chains are at the forefront of the Industry 4.0 revolution, transforming the way goods are transported and managed. By leveraging IoT, big data, automation, blockchain, and AI, these systems offer enhanced efficiency, cost savings, improved customer satisfaction, and greater adaptability. However, the transition to smart logistics is not without **challenges**, like:

(1)Integration Complexity: Implementing smart logistic systems requires significant investment in technology and infrastructure. Integrating various IoT devices, data analytics platforms, and automated systems can be complex and time-consuming.

(2)Data Security and Privacy: With the increased reliance on data, ensuring its security and privacy is paramount. Companies must invest in robust cyber security measures to protect sensitive information from breaches and cyber-attacks.

(3)Skill Requirements: The shift towards smart logistics necessitates a workforce skilled in handling advanced technologies. Companies must invest in training and development to equip their employees with the necessary skills to manage and operate these systems.

(4)Interoperability: Ensuring seamless communication and interoperability between different systems and technologies is a significant challenge. Standardization and collaboration among industry stakeholders are crucial for achieving effective integration.

(5)Regulatory Compliance: Companies must navigate a complex landscape of regulations related to data protection, safety, and environmental standards. Compliance with these regulations is essential to avoid legal penalties and maintain operational integrity.

Companies must address integration complexities, data security, skill gaps, interoperability issues, and regulatory compliance to fully realize the benefits. As technology continues to advance, the potential for smart logistic chains to further optimize and innovate the logistics industry is immense, promising a future of more intelligent and sustainable supply chains.

The digital maturity of companies refers to the level at which a company has embraced and effectively leveraged digital technologies to drive innovation, efficiency, and competitiveness [1, 11, 14, 16].

Digital maturity can be assessed based on a variety of factors, including the extent to which digital technologies are utilized throughout the organization, the level of digital skills among employees, and the overall digital

transformation strategy of the company [4, 19, 20, 26, 27]. Digital maturity is crucial for companies to stay relevant and thrive in the competitive landscape.

To understand the level of digitalization of an enterprise, the paper proposes to use a survey developed and provided by the Research group Logistics and Alliances of the HAN University of Applied Sciences (the Netherlands).The digitalization efforts of companies can vary greatly, with some companies being more advanced in their digital maturity than others.

According to a study on the digitalization efforts of leading manufacturing firms, many companies are still far from ready to fully benefit from digitalization [2, 18]. They may be focused on achieving greater efficiency through digitalization rather than pursuing a growth agenda. This imbalance is attributed to the difficulties related to identifying profitable configurations of competencies, assets, and data generated from digital technologies, orchestrating them, and exploiting them in an agile organization [4].

However, it is essential for companies to prioritize digital maturity and embrace a holistic approach to digital transformation [2]. This includes developing a clear digital strategy, investing in the necessary infrastructure and tools, fostering digital skills and capabilities among employees, and continuously monitoring and evaluating the progress and impact of digital initiatives. Companies that have a higher level of digital maturity are more likely to successfully adapt to changing market conditions, seize new opportunities, and deliver value to their customers in a digital-first world [6].

Additionally, digital maturity enables companies to gather and analyse large amounts of data, allowing for more informed decision-making and the ability to identify trends and patterns that can drive innovation, efficiency, and competitiveness. Overall, digital maturity of companies is crucial for their success in today's digital era [13, 24, 25, 33].

The level of digital maturity within a company can be determined by factors such as the utilization of digital technologies throughout the organization, the level of digital skills among employees, the integration of digital systems and processes, the data-driven decision-making culture, and the company's ability to adapt and innovate in response to technological advancements [4].To better understand the digital maturity of companies, various assessment models and tools can be used [2].

One such model is the "Industry 4.0" maturity index developed by the National Academy of Science and Technology of Germany [4]. This index measures the level of digitalization and integration of technologies such as automation, artificial intelligence, and Internet of Things in manufacturing processes. Another model is the Big Data Maturity Model which assesses an organization's maturity level in utilizing big data and analytics [2]. By evaluating different dimensions such as people, governance, technology, methodology, and strategy alignment, the Big Data Maturity Model can provide deep insights into an organization [21, 31].

The goal of this research is to find out the current level of data maturity of companies, taking into consideration different aspects regarding:

-Organizational aspects of data maturity (Digital literacy, Leadership and support, Measuring);

-Competences (Decision making for clear connections between data analysis and decisions; Specialists for deployment of specialised data analysts; Software and methods);

-Infrastructure (Quality of data; Access to data; Management of data processes);

-Tools and applications;

-Ranking;

-Companies’ performance to others.

MATERIALS AND METHODS

The data maturity scan in brief

The data maturity scan was developed and provided by the Research group Logistics and Alliances of the HAN University of Applied Sciences (the Netherlands) and was used for research purposes in Erasmus + project SMARTER. The survey for SMARTER project was edited in March and April of 2023 and used from April 2023 to February 2024.

The data gathered was analyzed in March 2024.

The survey is a data maturity scan. The higher the organization scores on the survey, the more analytically mature they are in their business. Organizations that are analytically mature are likely to have processes for building and deploying analytical models that are robust and built according to schedule.

As such the scan provides a valuable framework for companies to understand their current level, and where they still need to go to achieve their future desired level in analytics and data science (Halper, 2014), particularly when used as a tool for a dialog on this subject. The results from the scan can then be discussed together. And solutions on how to grow in maturity can be tailored for the organization.

The current scan was developed based on a diverse set of scientific and practical data science maturity models, such as The TDWI Analytics Maturity Model [10], Informs.org Analytics Maturity Model [12], and [3, 5, 9, 22, 30, 32, 34, 35, 36].

Participants (Sample):

In total 187 answers to the survey of which 70 number was scientifically reliable. From the 187 answers, the partially finished ones were eliminated. Participants were for six partners in Europe (Finland, Spain, Ireland, Croatia, Romania, Austria) and one in Argentina.

Data Collection:

The students from all partnering universities interviewed their chosen case companies.

The questions were categorized in the next sections:

(a)Background questions

This section includes the following questions:

-I work as ... (name of position): Please choose the one which is the most suitable for you or use the option other and describe your job position.

-I work for ... (company name): As mentioned above the company name will not be used for research nor will it be published. It is recorded in case the data needs to be adjusted or other clarification is needed afterwards; we can then identify your response among the others.

-In which country is your organization located? The options are in English to ensure the reliability of the answer and to ease the analysis phase after all the surveys have been completed. The final analysis is conducted by the SMARTER research team, meaning that that is not included in teaching.

-How many people are employed in your organization (approximately)? This question is asked for comparison reasons.

-In which sector is your organization active? This question is asked for comparison reasons.

(b)Organization questions

The section on **Organization** involves three blocks that deal with **organizational** aspects of data maturity. The extent to which the organizations strategy and culture fosters an analytics program. The interviewee is asked which of the five maturity phases (1. Learning and discussion phase; 2. Novice user; 3. Not yet data-driven, 4. Data-driven organization; 5. Analytics as a business vision) resembles his or her company the best on these specific maturity aspects.

The three blocks are:

(1)***Digital literacy:*** this aspect refers to the general digital/data literacy of the workforce.

(2)***Leadership and support:*** this aspect refers to the extent there is support from the (top) management for working smart with data

(3)***Measuring:*** this aspect refers to the extent there is emphasis on data and data analysis when making decisions.

(c)Competencies *–involves three blocks dealing with the following aspects:*

-Decision making for: Clear connections between data, analysis and decisions

--Specialists for: Deployment of specialized data analysts

--Software & Methods

(d)Questions about Infrastructure

The section on Infrastructure involves three blocks that deal with the data management aspects of data maturityresembles his or her company the best on these specific maturity aspects. The three blocks are:

-Quality of data: this aspect refers to interviewee's judgement on the quality of data, and of data analysis

-Access to data: this aspect refers to the ease with which data can be accessed and analyzed

-Management of data processes: this aspect refers to interviewee's judgement of the

control of the data process, from the source of the data to data-driven decision-making

(e)Tools and Applications

This section of the survey deals with the data-related applications and tools used in the case company. The interviewee is asked to check the apps and tools used in his or her company for data gathering, -usage and -storage.

(f)Ranking

In this section the interviewee is asked on which of the three blocks (Organization, Competencies, and Infrastructure) his or her company experienced the most challenges. The interviewee is asked to rank these blocks from most challenging to least challenging.

(g)Company's performance compared to others

In this section the interviewee is asked to indicate how well his or her company performs, compared to similar companies or competitors.

(h)Open-ended Questions

After the interviewee has answered the above questions, it will initiate a more in-depth conversation on specific responses. Supplementary answers can and should be recorded in this section, with concrete examples.

Data Preparation and Demographics

The first step in data preparation was to extract the data in Excel format from Qualtrics. The valid data and the invalid responses were then separated. The survey received 187 responses in total. The previews and incomplete answers were also included in this figure. Prior to sorting the data, the preview responses were removed. Responses that lacked a company name or had an invalid name were removed. Finally, the incomplete responses were removed, leaving 70 valid responses at the end of this procedure.

Finland accounted for 28% of the respondents (19), with Argentina making up the second-largest group (14 respondents) (21%). Spain, Austria, and Romania also contributed significantly to the valid responses (9).

There were also few responses from the United States, United Kingdom, the Netherlands, Ireland, and Croatia. Twenty-five percent of organizations regularly employ more than 500 people. The second-largest group, comprising 22%, employs between 50 and 250 people. There were four companies with a single employee.

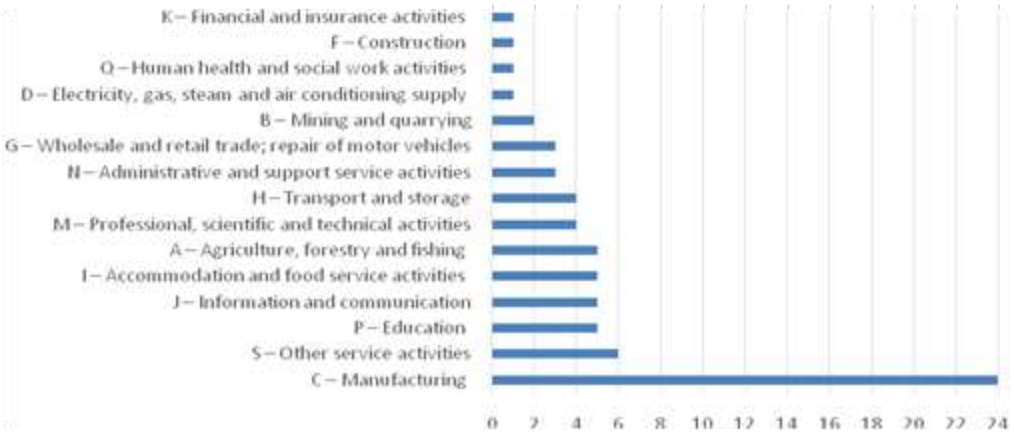

Fig. 1. Business sector of the respondent organizations
Source: Results of the survey.

The business sector of the respondent organizations is shown in Figure 1. Every respondent company selected the industry that most accurately reflects their line of work. The majority of the organizations that responded work in the manufacturing sector.

RESULTS AND DISCUSSIONS

The results of the study were processed using the Excel application and are briefly presented below in graphic form, being organized similar to the categories of questions included in the online questionnaire.

(1)Organization

Regarding the organizational aspects, from Figure 2 it can be seen that about 58% of the companies are still in the "learning and discussion phase - 23.88%" or "novice user - 34.33%" phase. Only 10.45% consider themselves "Analytics as a business vision" and 22.39% are in the "data-driven organization" phase.

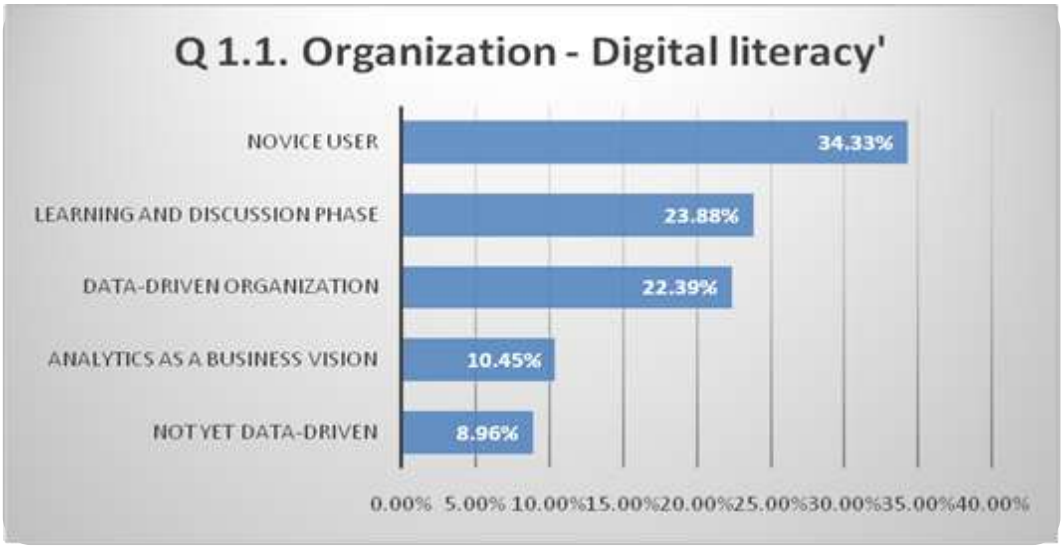

Fig. 2. Organization - Digital literacy
Source: Original results of the survey.

Fig. 3. Organization - Leadership and support
Source: Original results of the survey.

Regarding "Leadership and support" (Fig. 3), the situation is somewhat better, about 30% of companies are in the "data driven organization" phase and about 12% in the
"Analytics as a business vision" phase. About 24% of the companies are in the "Learning and discussion" phase, respectively "Novice user".

Figure 4 shows results related to "Measuring and data analysis when making decisions". 28.36% of the companies are of the "Data driven organization" type, about 9% are in the "Mature/Visionary" stage, about 33% are "Novice user" and 19.4% are in the "Learning and discussion phase".

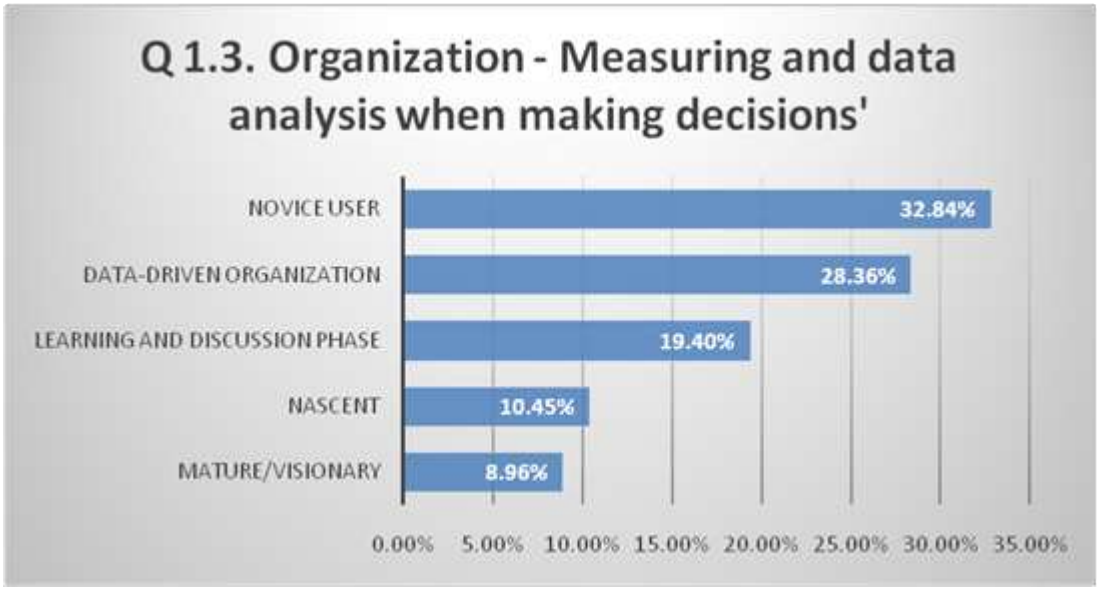

Fig. 4. Organization - Measuring and data analysis when making decisions
Source: Original results of the survey.

(2)Competencies

Figures 5...7 show aspects related to the degree of maturity in matters related to digital skills. Thus, in making decisions, about 30% of companies rely on digital data analysis, while 50% of them are in the beginning phase of the digitalization of the decision-making process (Fig. 5).

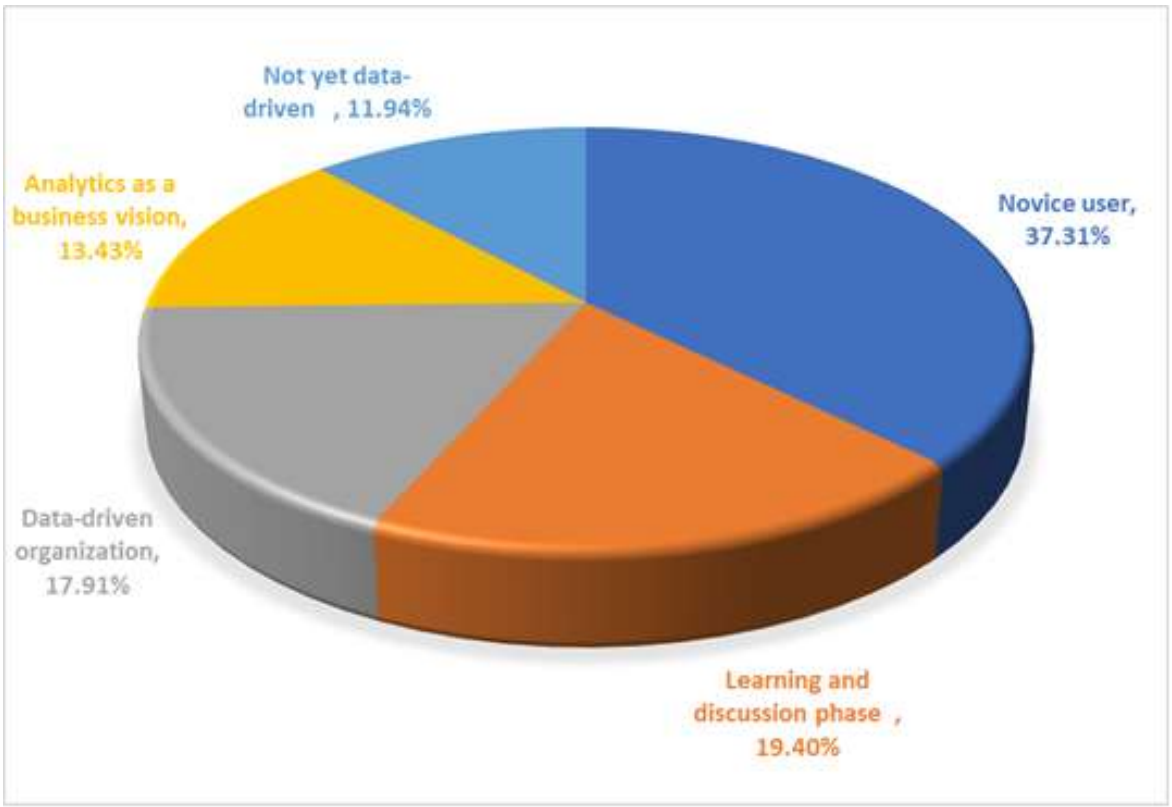

Fig. 5. Competencies - Decision making
Source: Original results of the survey.

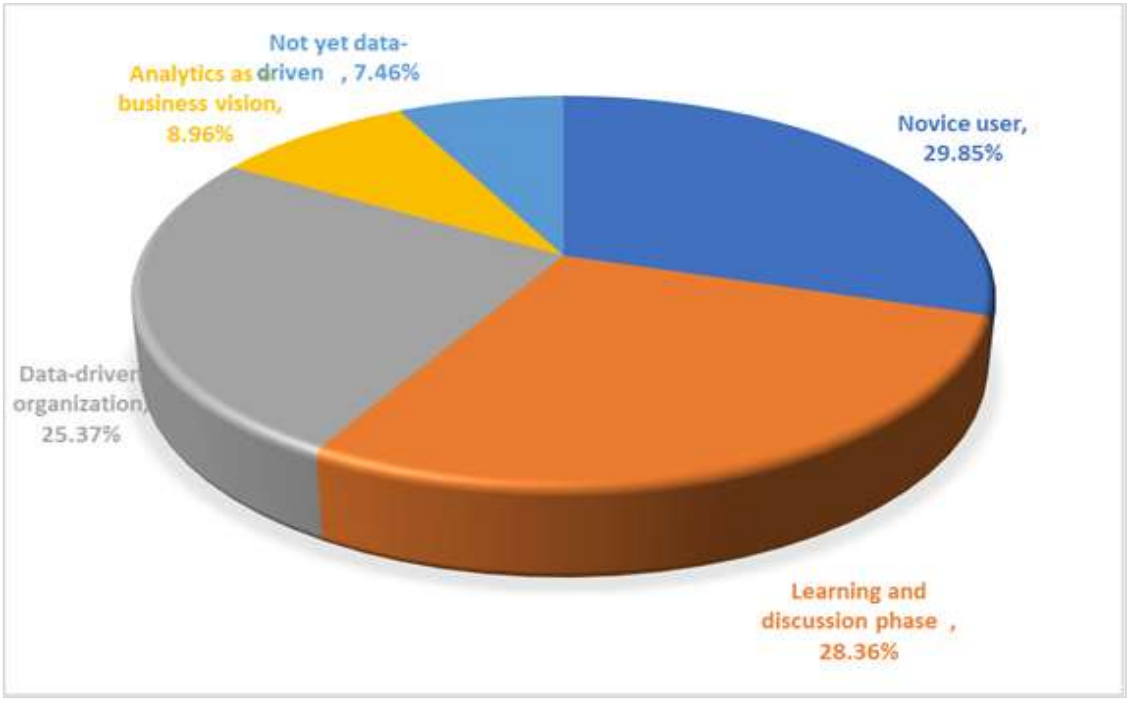

Fig. 6. Competencies - Deployment of specialized data analysts
Source: Original results of the survey.

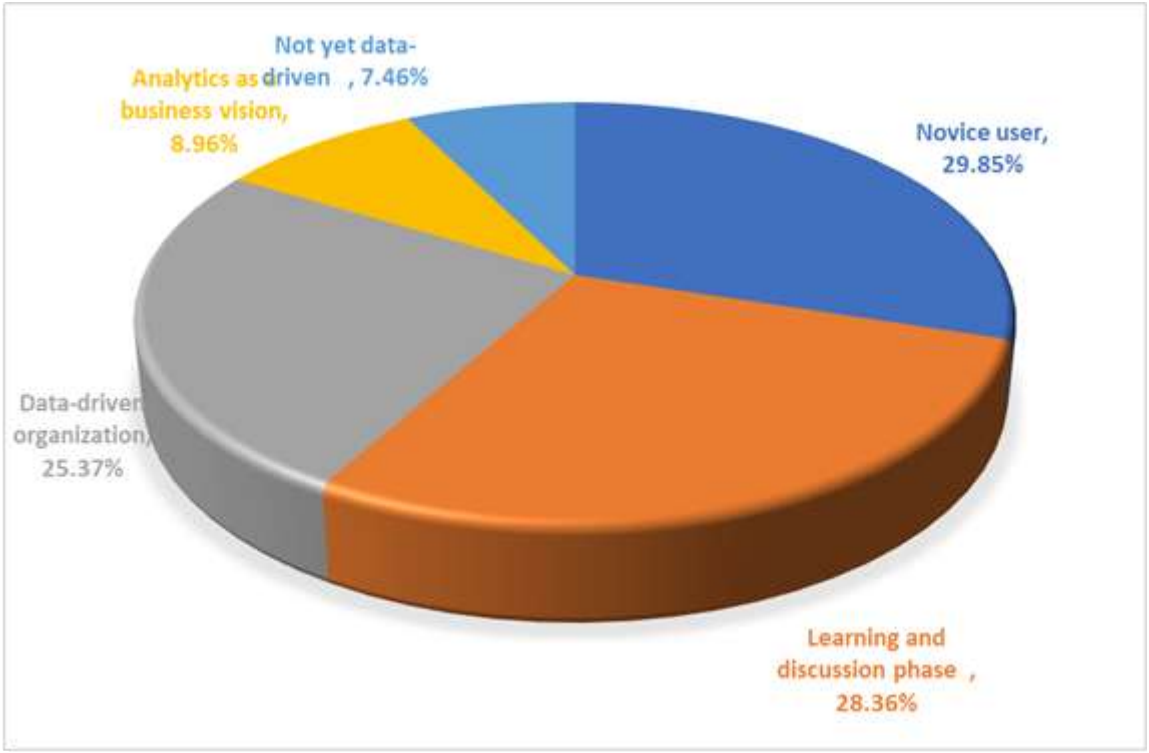

Fig. 7. Competencies - Software & Methods
Source: Original results of the survey.

In the "deployment of specialized data analyst" process, about 1/3 really perform, while over 50% are in the beginning stage or the discussion/learning phase (Fig. 6).
The situation is similar in the case of the software applications used (Fig. 7).

(3) Infrastructure

Regarding the digital infrastructure of the companies, the analysis of the answers provided the results presented in Figures 8, 9 and 10, from which it can be seen that data quality is an important problem for 60% of the

companies, only about 30% having notable performances (Fig. 8).

Figure 9 also shows that about 37% of the answers indicated a very easy access to the data, 62% being still in the beginning or training phase, and 10.45% in an intermediate phase.

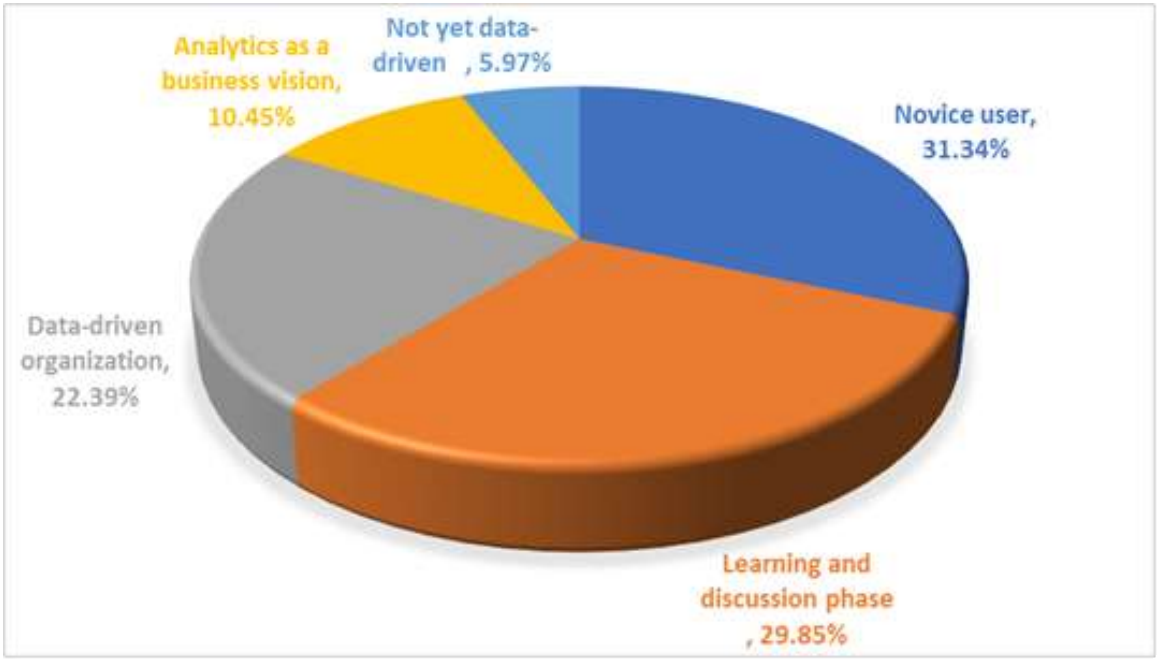

Fig. 8. Infrastructure - Quality of Data
Source: Original results of the survey.

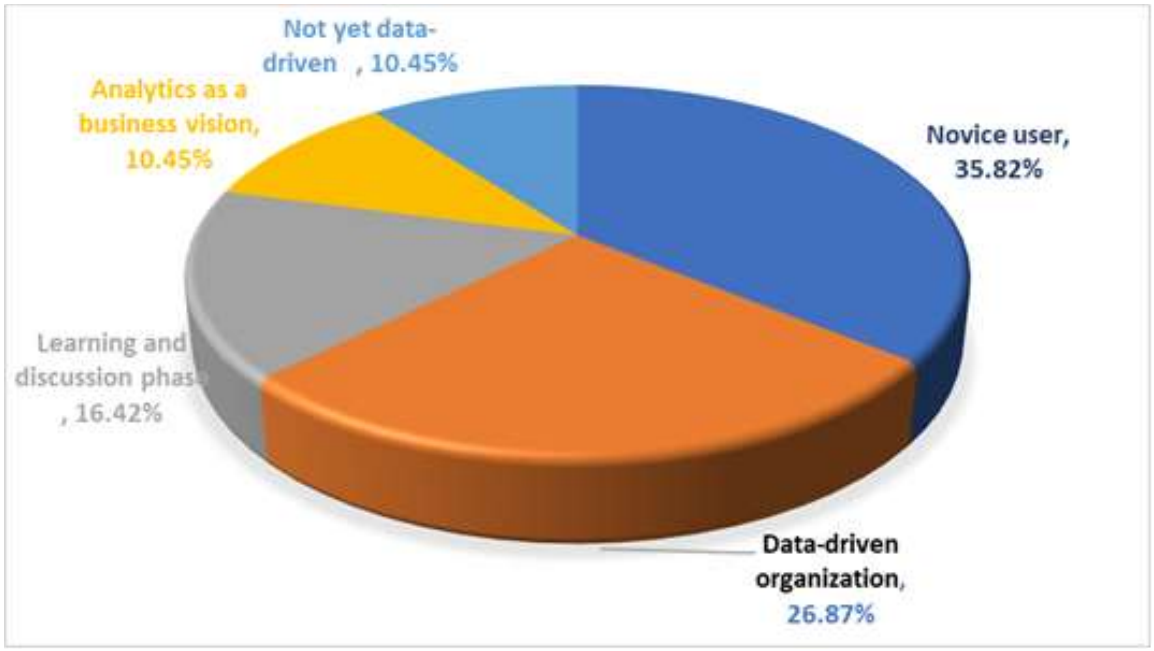

Fig. 9. Infrastructure - Access to Data
Source: Original results of the survey.

Similar results were recorded in the analysis related to data control, where only 8.96% of companies are in the "Analytics as a business vision" phase, 25.37% in the "Data driven organization" phase and about 55% in the " Learning and discussion" or "Novice user" (Fig. 10).

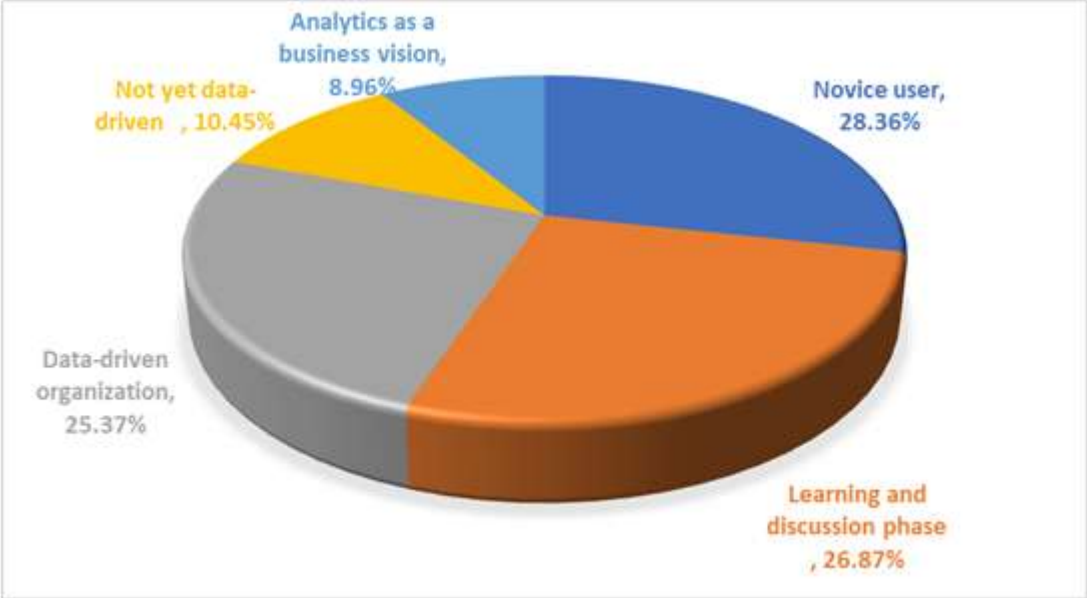

Fig. 10. Infrastructure - Management - Control of the data process
Source: Original results of the survey.

(4) Tools

The analysis related to the tools used in data processing provided interesting results. For the "Management reports" segment (Fig. 11), the Excel application is used uniquely in over 35% of cases. And in another 20% of cases, it is used in combination with applications such as Python or Tableau. 13.43% of companies use other types of software applications.

Fig. 11. Tools used for: Management reports
Source: Original results of the survey.

Related to the "Charts, and data visualization" chapter, it is noted that the Excel application also holds the first place in preferences, being used exclusively in over 40% of cases and in another 15% of situations together with Python, Tableau or others (Fig. 12).

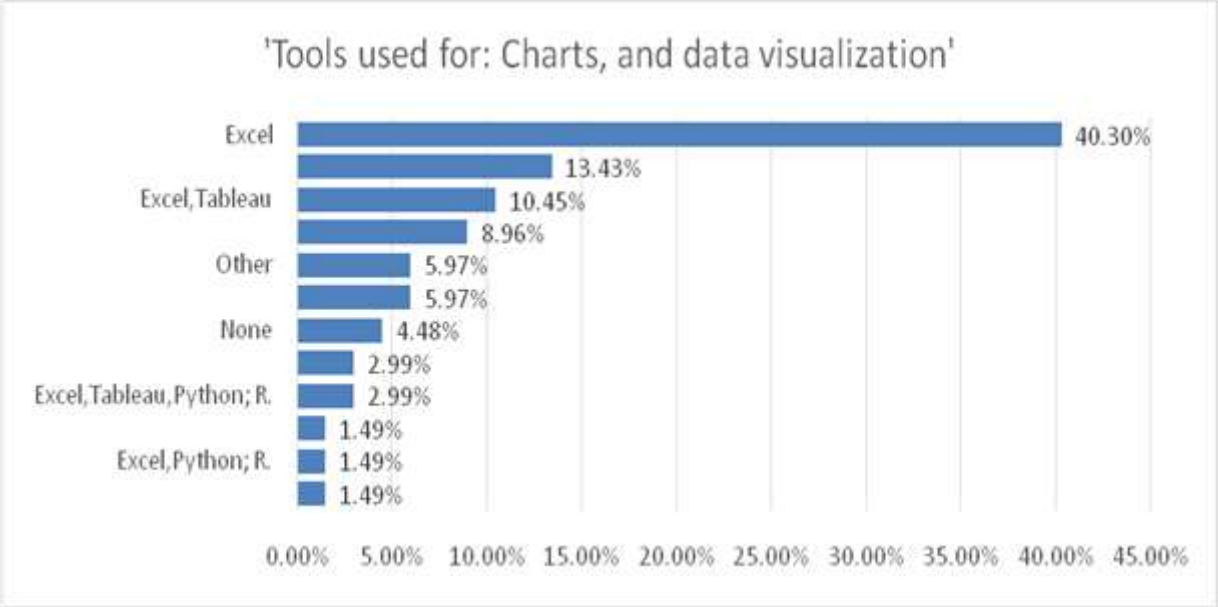

Fig. 12. Tools used for: Charts, and data visualization
Source: Original results of the survey.

Excel is also the application used in about 25% of cases for "Forecasting using time series" (Fig. 13) as well as for "Correlation" (Fig. 14). Instead, Python is used in most situations for "Machine learning" processes, over Excel, used in about 6-7% of cases (Fig. 15). The analyzes for the following cases show the preference for the Excel application (13.43%) in the "Process Mining" chapter (Fig. 16), but with regard to the processes of "Simulation"(Fig. 17), "Optimization"(Fig. 18), "Data Mining"(Fig. 19), or "EDI "(Fig. 20), it is out ranked by other applications, with percentages between 14 and 22.

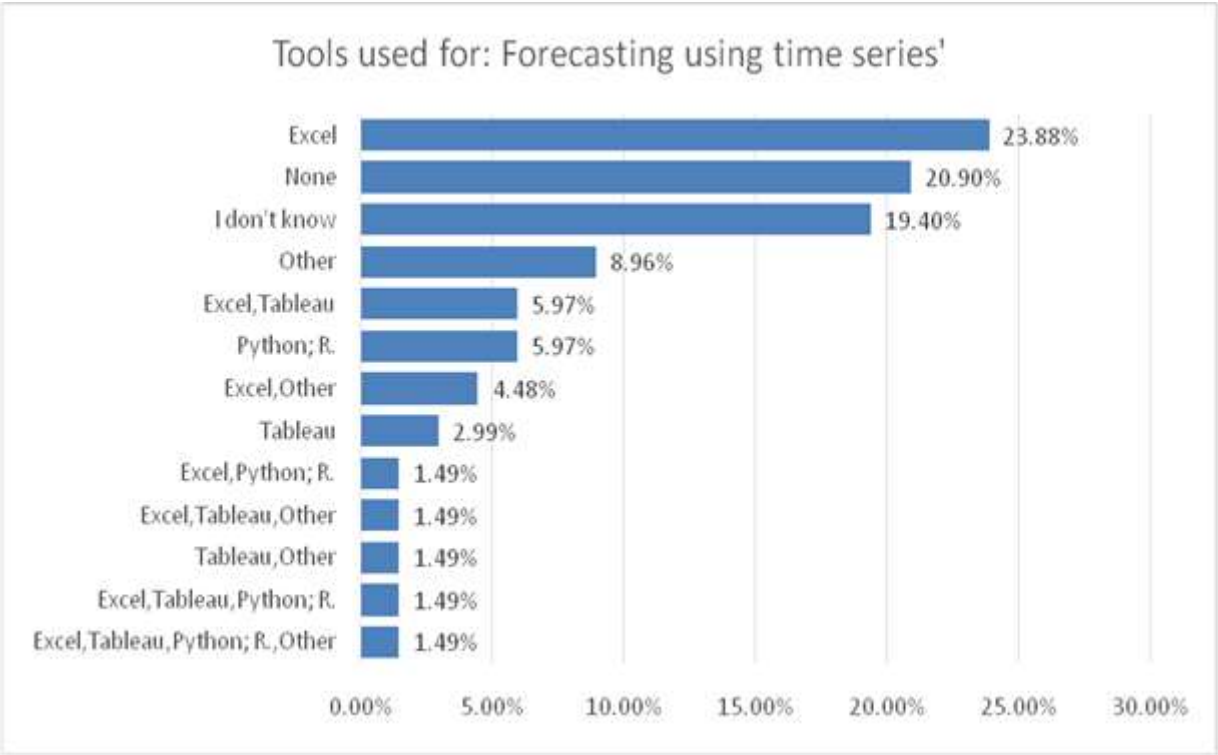

Fig. 13. Tools used for: Forecasting using time series
Source: Original results of the survey.

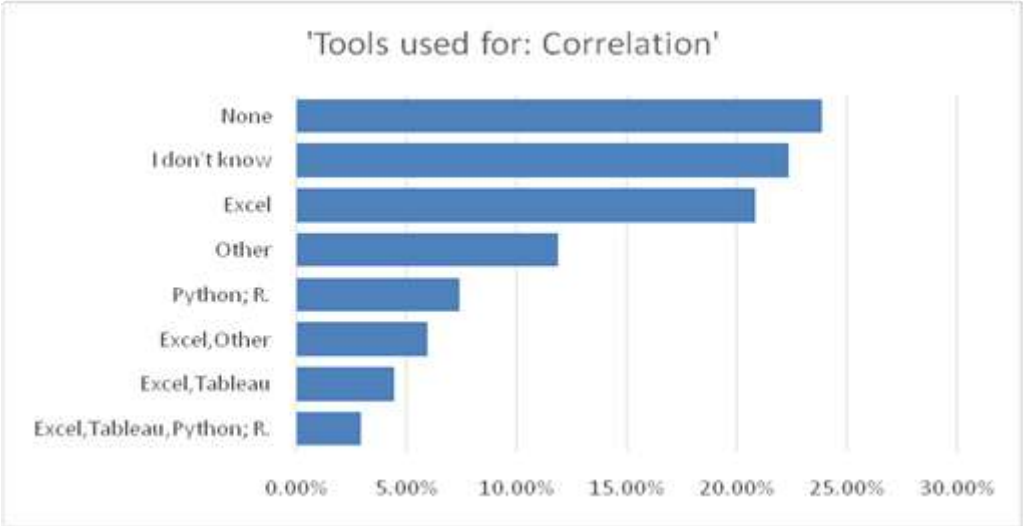

Fig. 14. Tools used for: Correlation
Source: Original results of the survey.

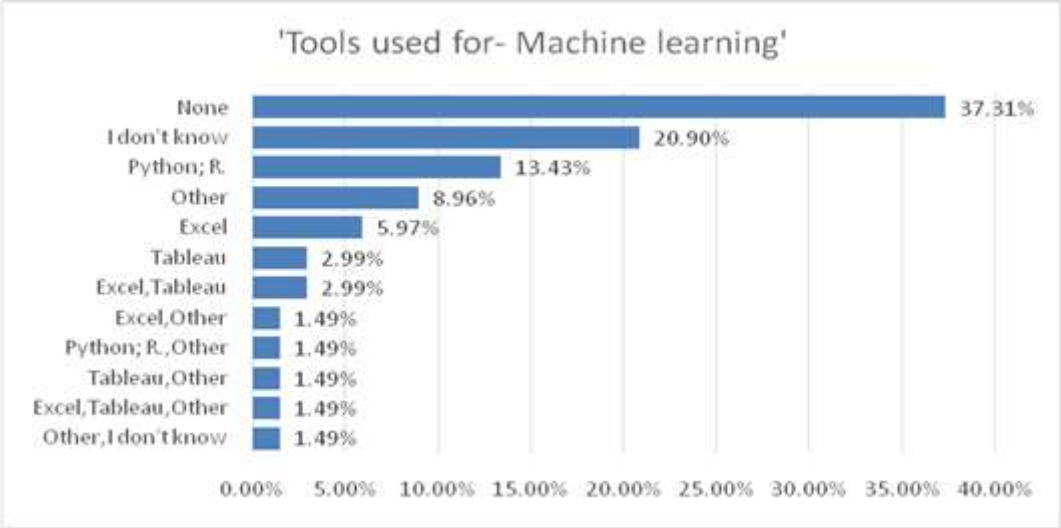

Fig. 15. Tools used for: Machine learning
Source: Original results of the survey.

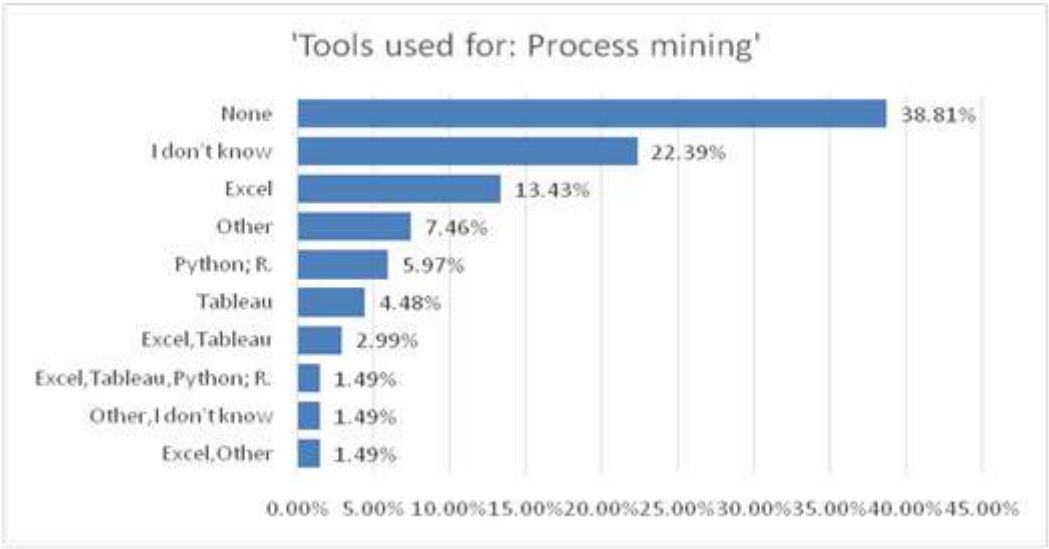

Fig. 16. Tools used for: Process mining
Source: Original results of the survey.

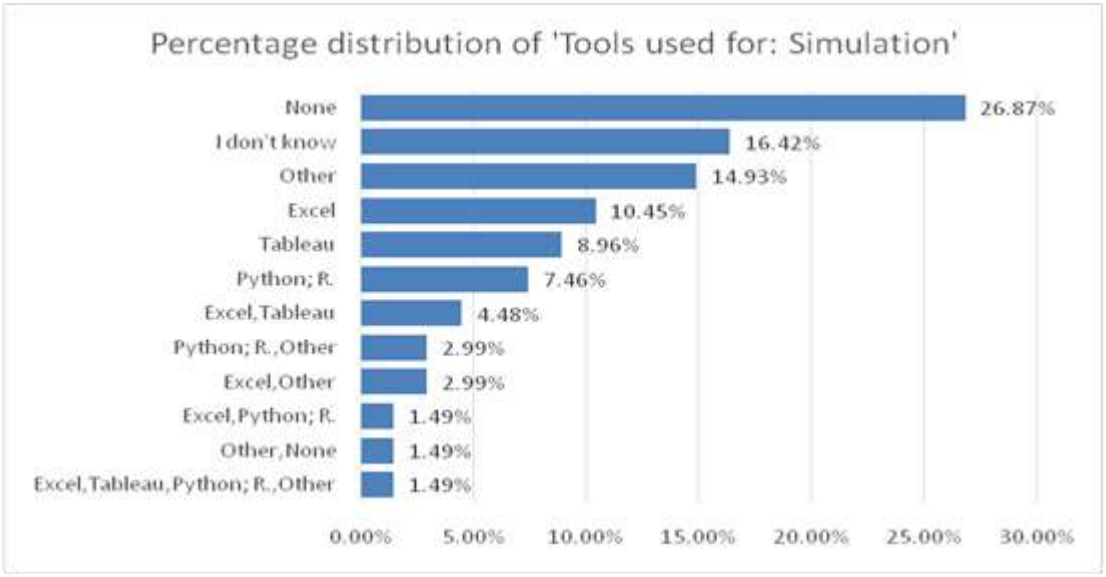

Fig. 17. Tools used for: Simulation
Source: Original results of the survey.

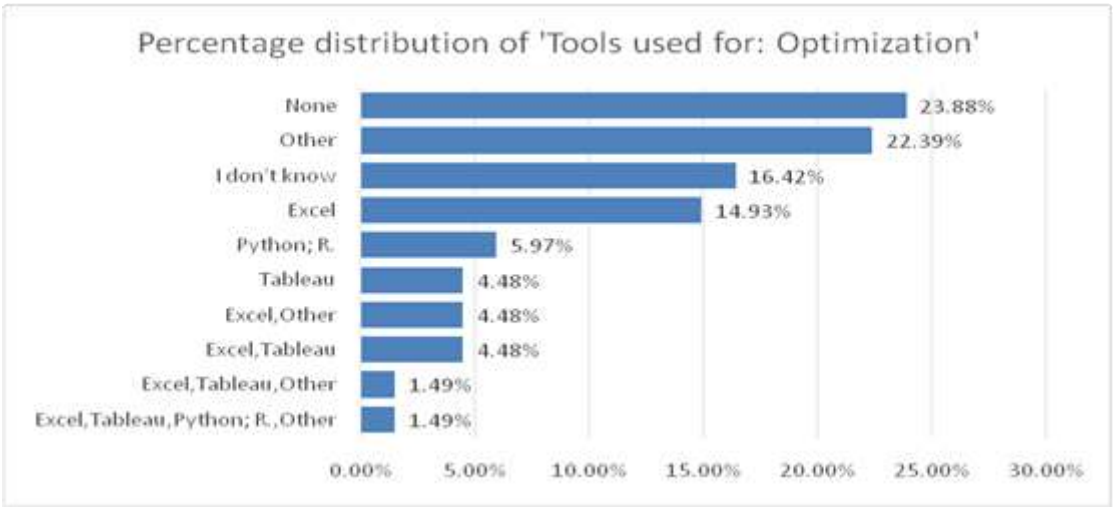

Fig. 18. Tools used for: Optimization
Source: Original results of the survey

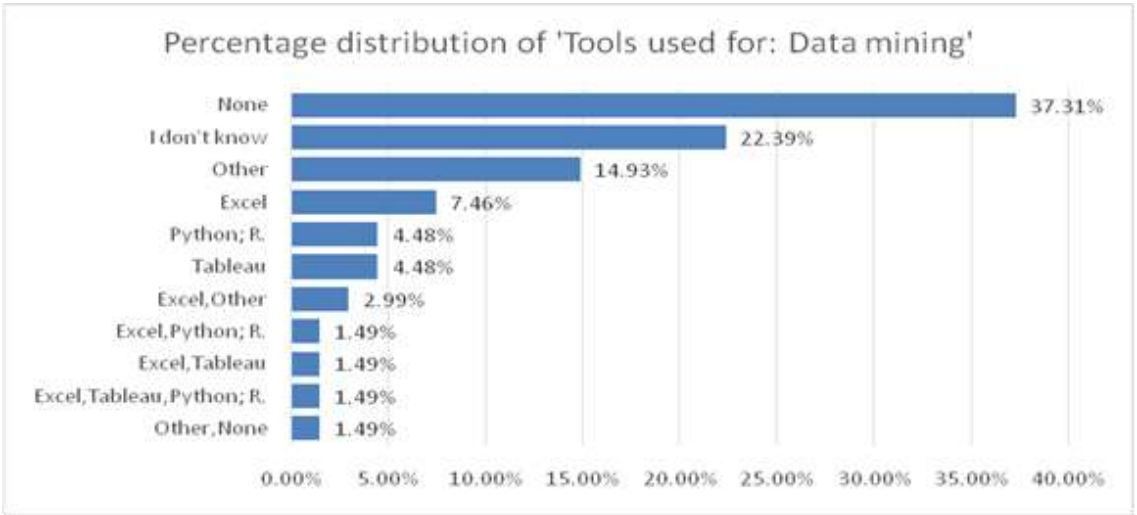

Fig. 19. Tools used for: Data Mining
Source: Original results of the survey.

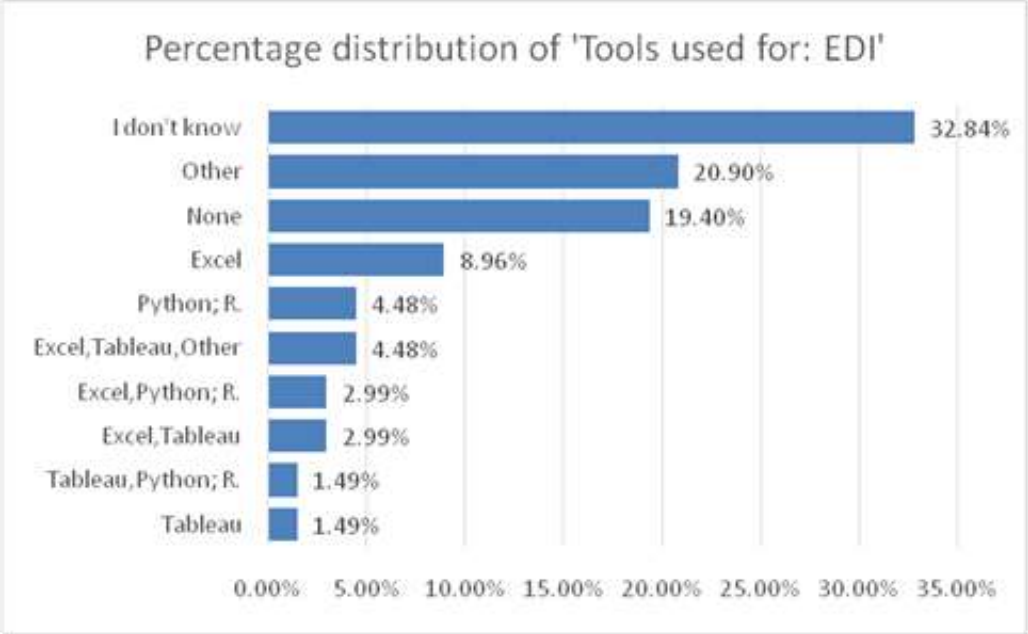

Fig. 20. Tools used for: EDI
Source: Original results of the survey.

As expected, the "None" or "I don't know" responses were present in a proportion of over 40% to questions related to the advanced use of data in companies, an element correlated with previous results related to organization and competent.

(5) Other tools

Since a significant number of responses to the chapter on applications used for advanced data processing were of the "Other" type, it is considered important to present them in Figures 21...29.

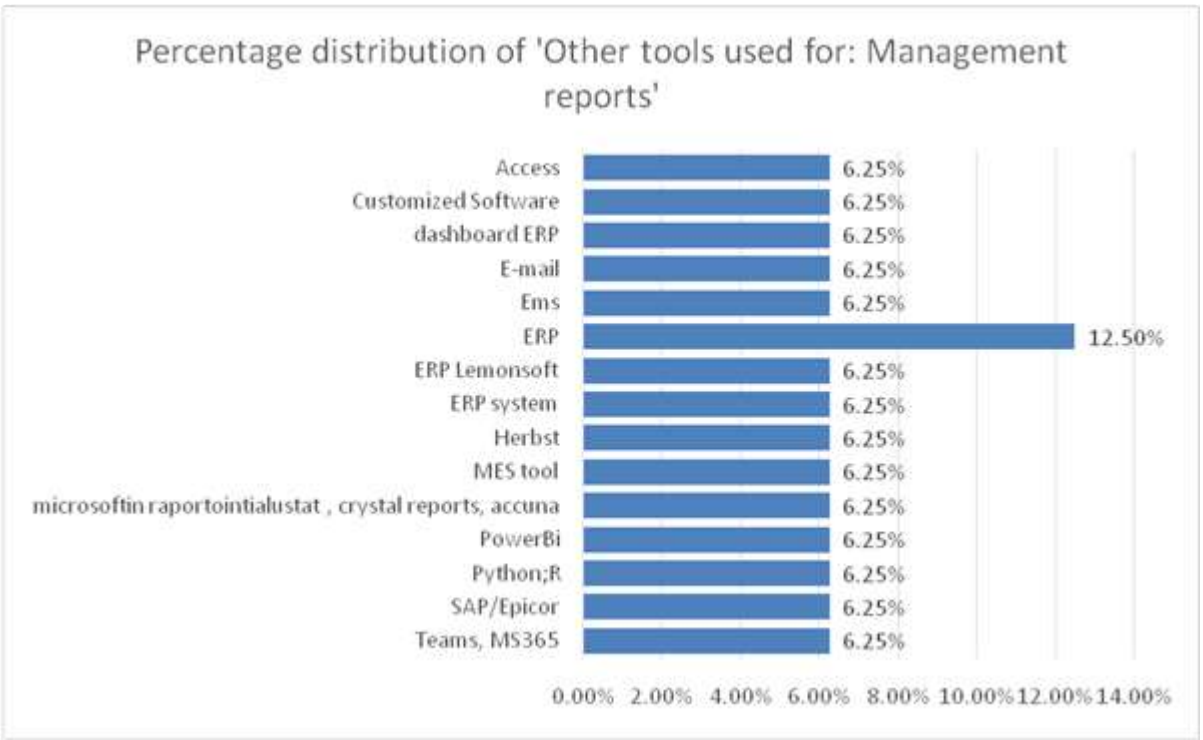

Fig. 21. Other tools used for: Management reports
Source: Original results of the survey.

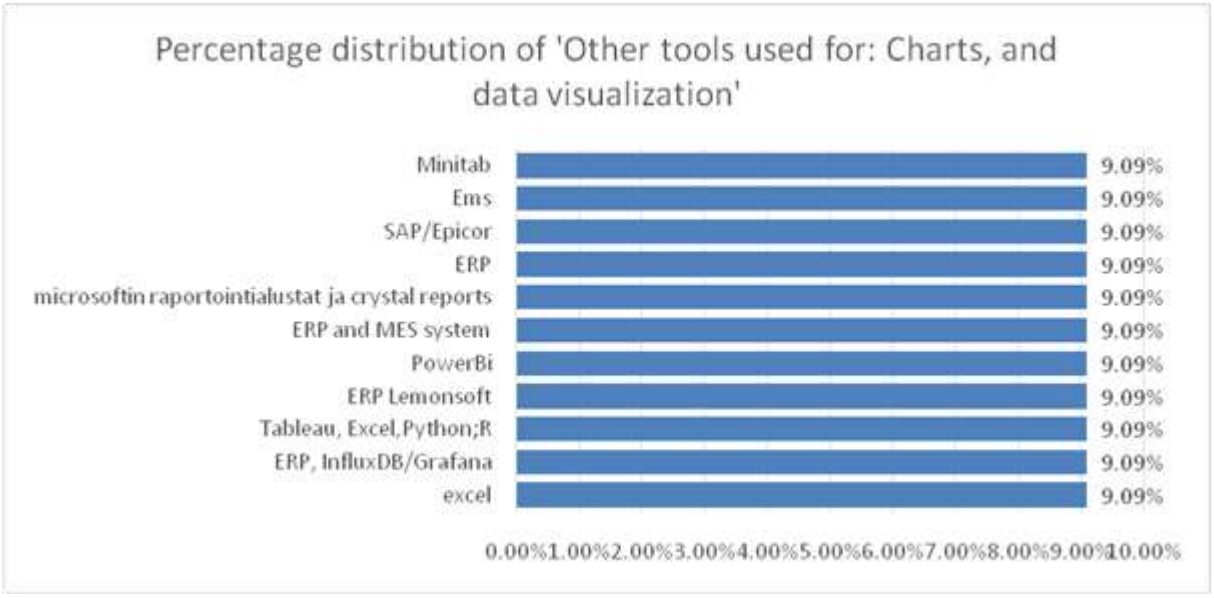

Fig. 22. Other tools used for: Charts, and data visualization
Source: Original results of the survey.

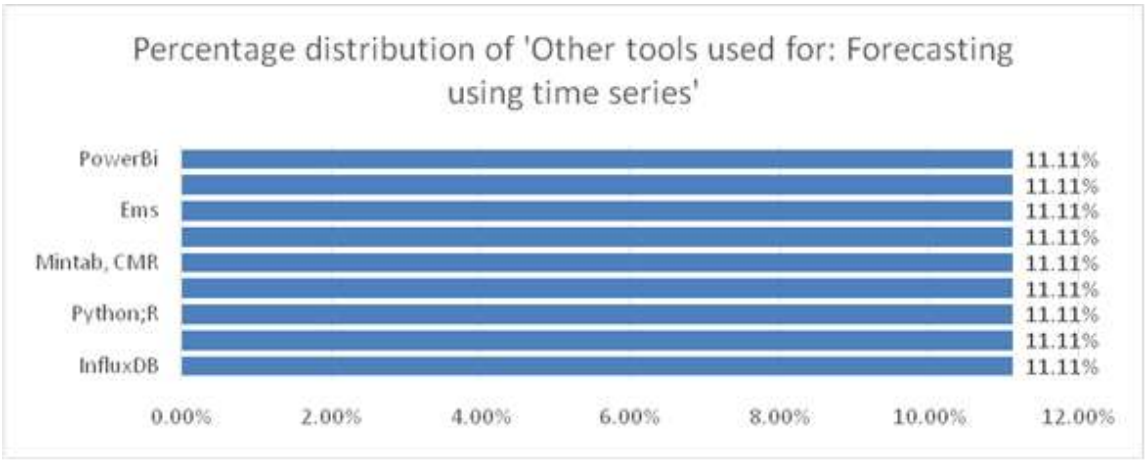

Fig. 23. Other tools used for: Forecasting using time series
Source: Original results of the survey.

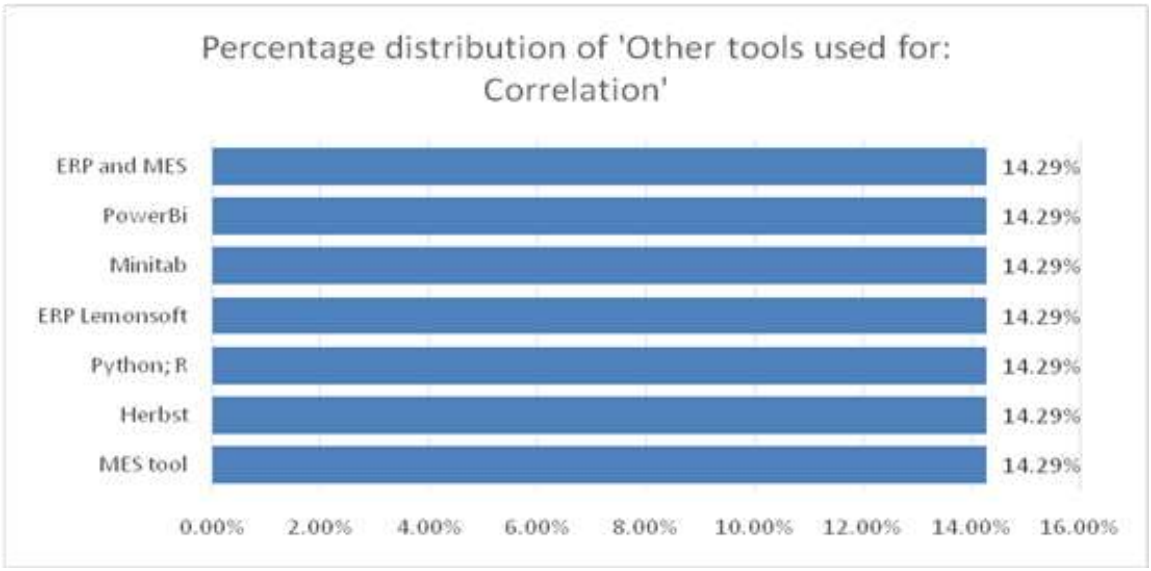

Fig. 24. Other tools used for: Correlation
Source: Original results of the survey.

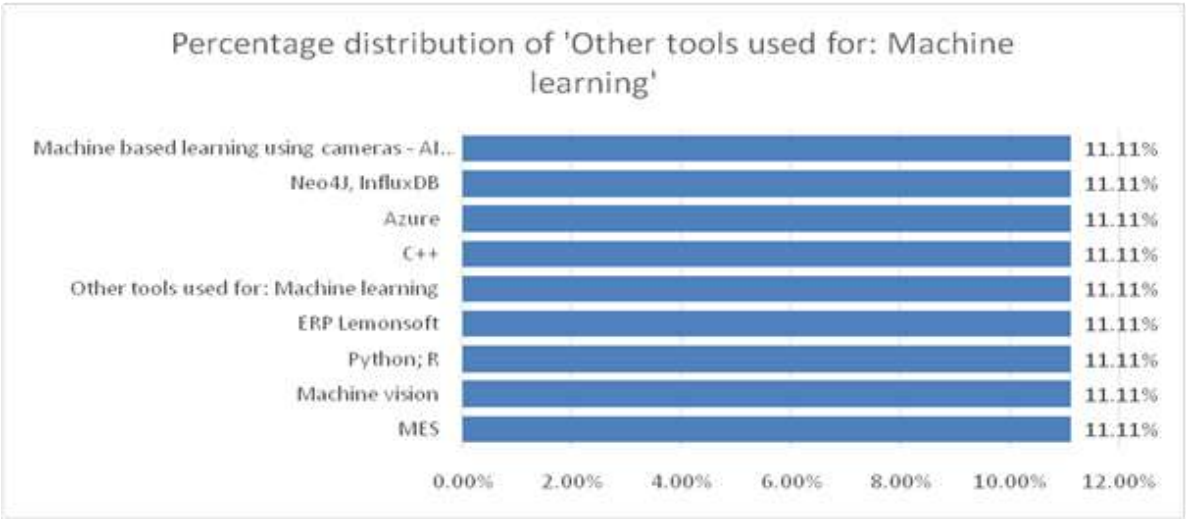

Fig. 25. Other tools used for: Machine learning
Source: Original results of the survey.

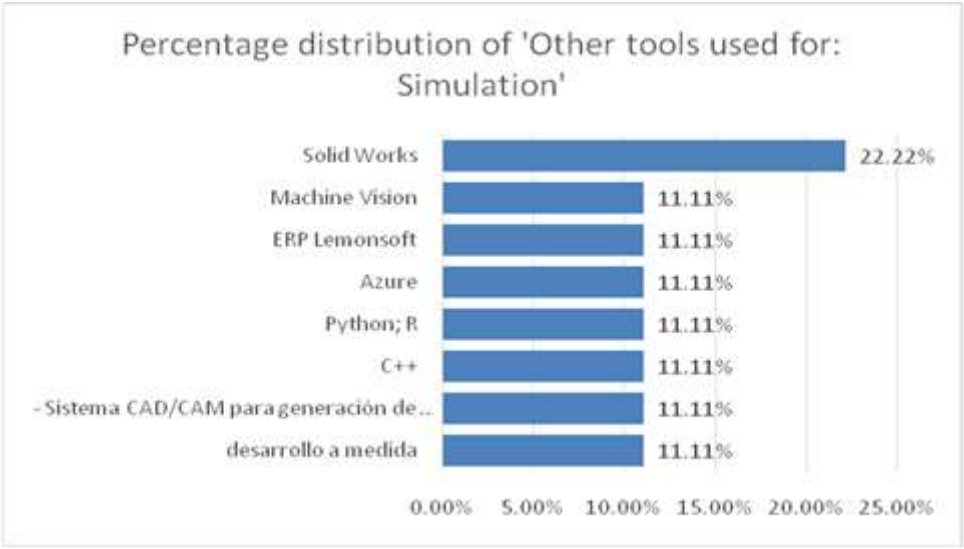

Fig. 26. Other tools used for: Simulation
Source: Original results of the survey.

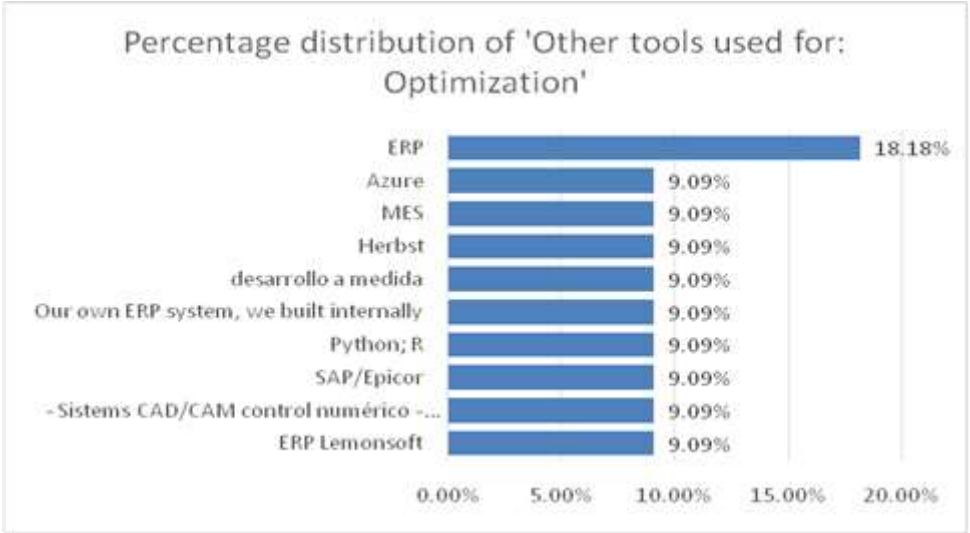

Fig. 27. Other tools used for: Optimization
Source: Original results of the survey.

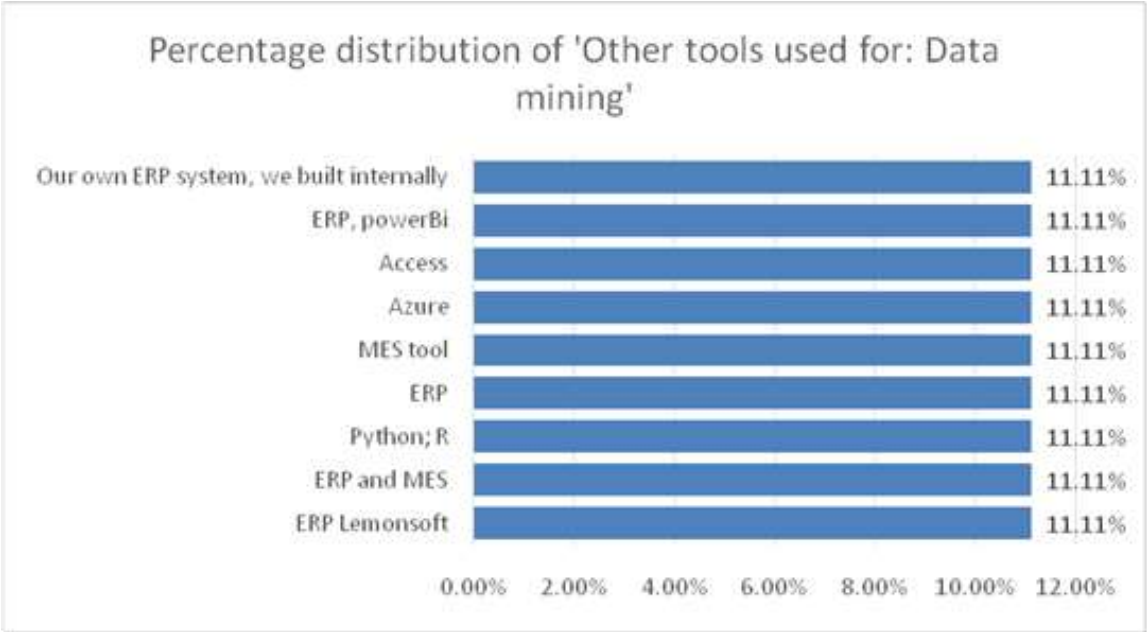

Fig. 28. Other tools used for: Data mining
Source: Original results of the survey.

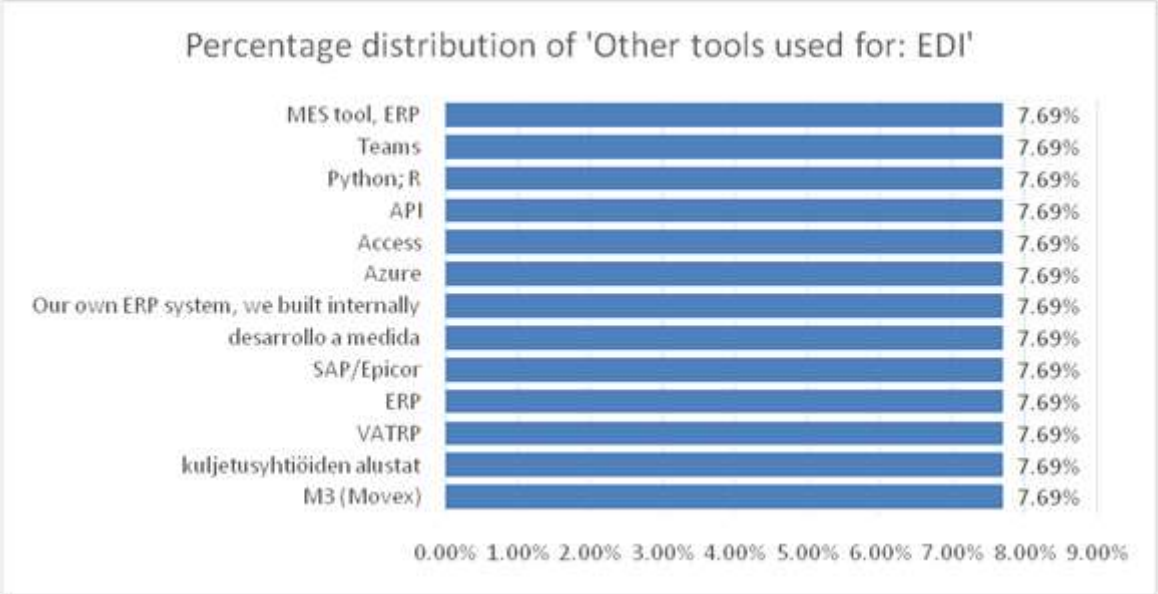

Fig. 29. Other tools used for: EDI
Source: Original results of the survey.

Among these applications, there is a preference for the use of ERP-type integrated systems, which reach percentages of 18% in the "Optimization" chapter or Solid Works with 22% in the "Simulation" chapter.

(6) Performance

An interesting analysis refers to the reflection of the digitization advance in the companies' performance, as it is perceived by the respondents.

Regarding the company's profit, "Much better than other organizations" was recorded in only about 12% of cases, which suggests that the digitalization of companies does not always imply a significant increase in profit. However, there is an optimistic perception, as almost 50% of the answers foresee a "Slighly better than other organizations" type situation (Fig. 30).

It is also interesting that under these conditions, the growth of companies in the last year was 41% "Slighly better than other organizations" and almost 27% "Much better than other organizations" (Fig. 31).

Digitization brings benefits in the relationship with clients, as can be seen from Figure 32 in which it can be seen that 39% of cases are "Slighly better than other organizations" and about 25% are "Much better than other organizations".

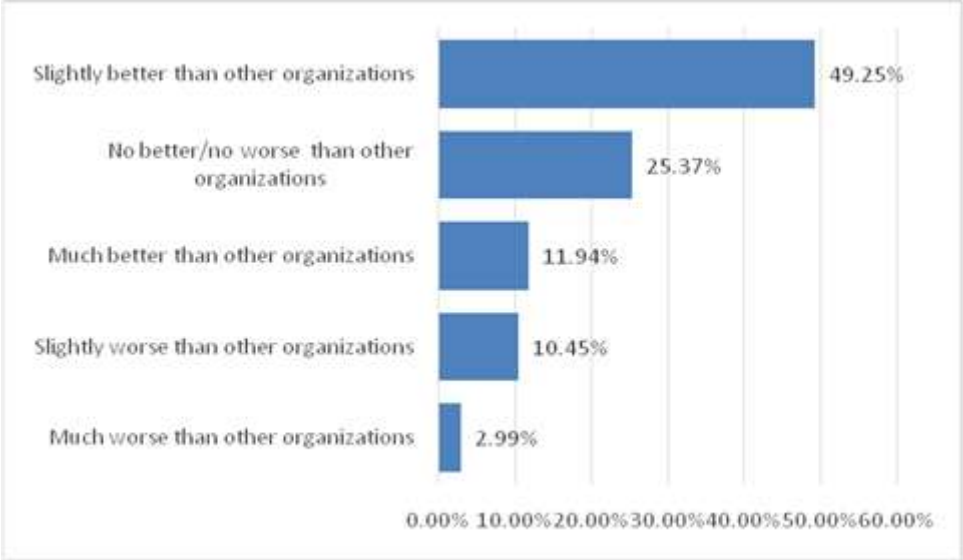

Fig. 30. Performance in: Profitability
Source: Original results of the survey.

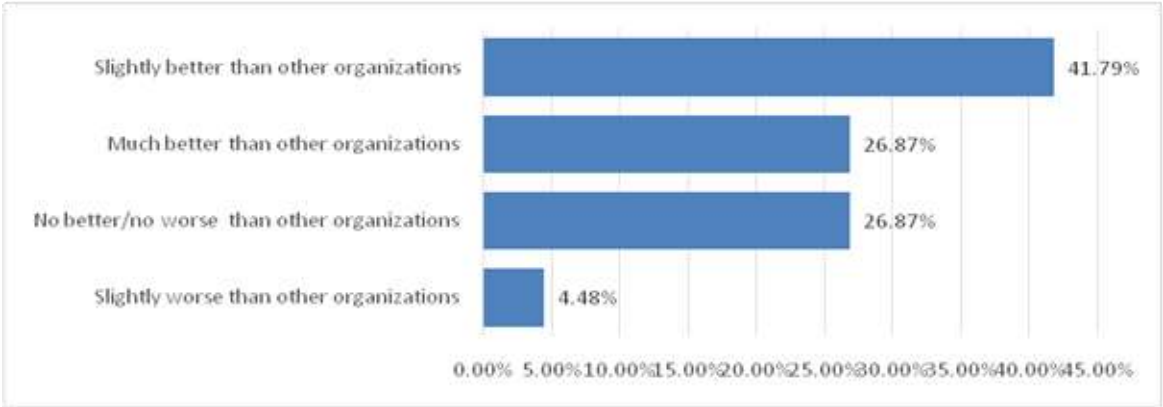

Fig. 31. Performance in: Growth in past years
Source: Original results of the survey.

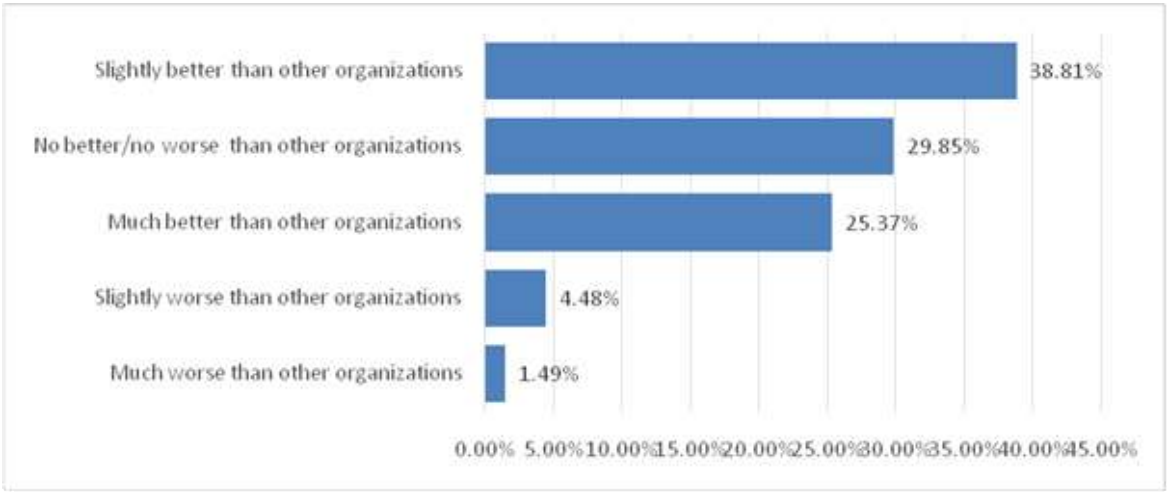

Fig. 32. Performance in: Customer satisfaction
Source: Original results of the survey.

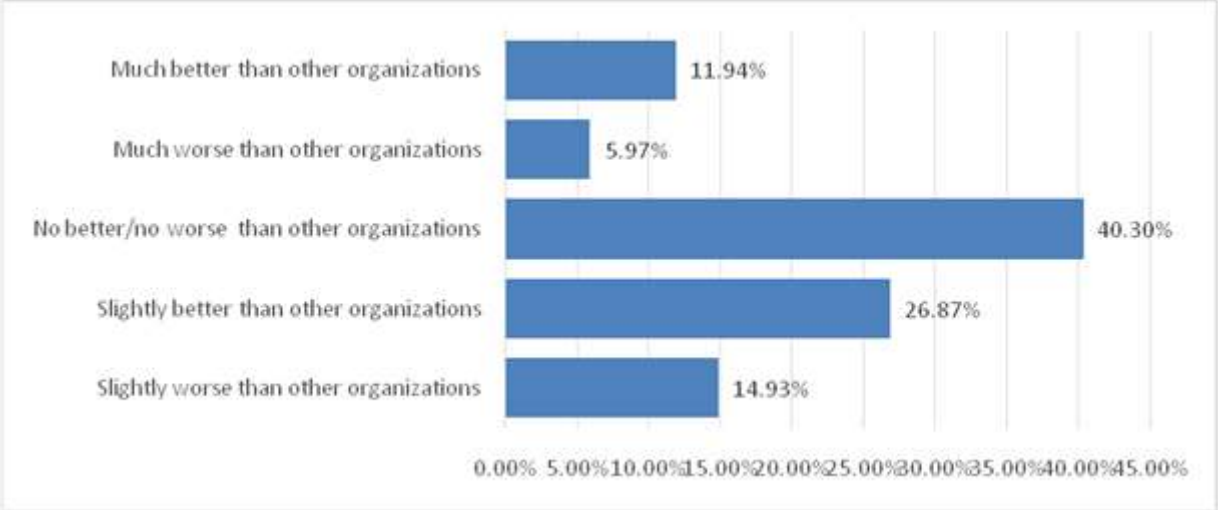

Fig. 33. Performance in: Employee satisfaction
Source: Original results of the survey.

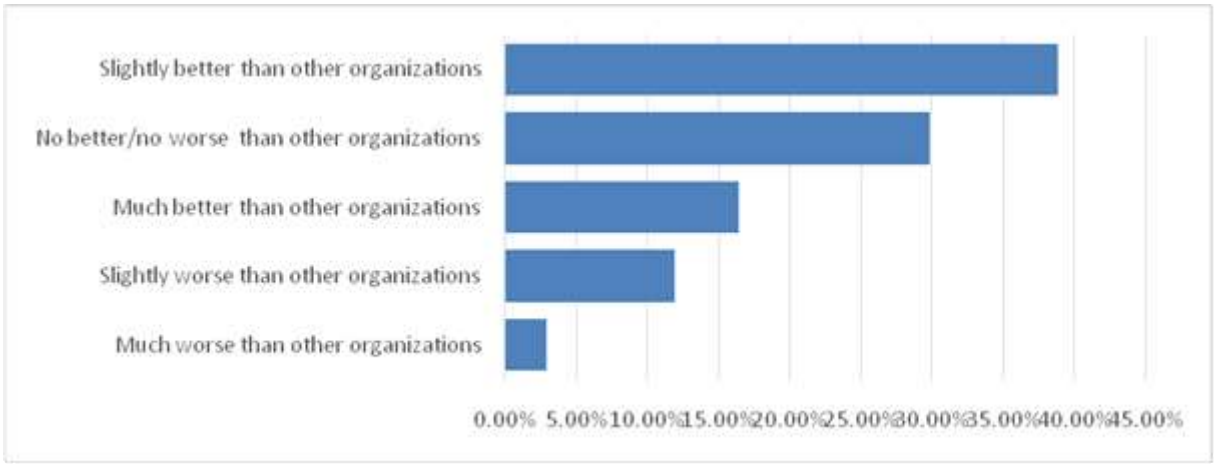

Fig. 34. Performance in: Social & Environmental practices
Source: Original results of the survey.

It seems that employees still do not fully appreciate the benefits of digitization processes, as their satisfaction is below the impact on profit, growth in recent years or customer satisfaction. From Fig. 33, employee satisfaction reaches rates of about 12% "Much better than other organizations" and 26% "Slightly better than other organizations".

The performance in "Social & Environmental practices" is relatively high, the perception being about 40% "Slightly better than other organizations" and over 15% "Much better than other organizations" (Fig. 34).

CONCLUSIONS

The study on the digital maturity of companies in the context of the Industry 4.0 era highlights several key aspects regarding the degree of digitalization, the use of digital technologies, and their impact on organizational performance. Analysing data collected from seven partner countries, including Finland, Spain, Ireland, Croatia, Romania, Austria, and Argentina, the results suggest that although many companies have begun the digitalization process, the majority are still in the early stages of this transition.

A significant percentage of companies, about 58%, are in the "learning and discussion" phase or are novice users of data, with only 10% fully embracing analytics as a business vision. Additionally, only 22% of companies identify as being "data-driven organizations," which indicates that digitalization is still developing in most cases.

Another important observation is the predominant use of Excel for data management

and reporting, despite the existence of more advanced solutions such as Python and Tableau. This suggests a strong reliance on traditional tools and a limited adoption of integrated applications like ERP for data management and process automation.

However, there are positive signs regarding the performance of companies that have started adopting digitalization.

Approximately 50% of companies reported a slight improvement in profitability, while nearly 27% reported significant growth in recent years.

Furthermore, digitalization has contributed to increased customer satisfaction, with around 39% of companies reporting better performance compared to other organizations.

Nonetheless, the impact of digitalization on employee satisfaction remains limited, with only 12% of companies reporting much higher employee satisfaction than other organizations. This suggests that digitalization processes are not yet fully leveraged to improve the work environment.

In conclusion, while the analysed companies have begun to implement digital technologies in their operations, most are still in the early stages of digital maturity.

It is crucial for organizations to adopt a clearer strategy for digitalization, invest in employee training, and continue developing the necessary infrastructure to fully benefit from the advantages of digitalization.

Full digital transformation remains an ambitious but achievable goal, provided that current challenges, such as data security, interoperability, and digital skills development, are addressed in an integrated manner.

This conclusion reflects an ongoing transition where companies have the potential to improve operational performance, competitiveness, and sustainability by better integrating digital technologies into their business processes.

ACKNOWLEDGEMENTS

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