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Andreea Gabriela Tanase[1]
Bucharest University of Economic Studies, Bucharest, Romania

Alexandru Florin Preda[2]
Bucharest University of Economic Studies, Bucharest, Romania

Raluca Florentina Cretu[3]
Bucharest University of Economic Studies, Bucharest, Romania

Viorel Costin Banta[4]
Bucharest University of Economic Studies, Bucharest, Romania

Modelling of an Economic Process Using Smart Technologies in Manufacturing in the Context of Industry 4.0: A Case Study

Abstract. *ERP-type systems emerged with companies needing to manage complex economic processes, such as supply chain management or sales e-commerce. This article benchmarks step by step how an existing business process in a complex information system such as ERP can be modelled, adapted, and implemented using emerging intelligent technologies. Based on a practical case for a factory in Romania producing subassemblies for the automotive industry, the authors seek to answer three questions: 1) What impact does integrating smart technologies have on the business environment to be competitive in an increasingly technological world? 2) Can the definition of relevant KPIs necessary to highlight the effectiveness of adopting and adapting smart technologies in day-to-day business be a factor in measuring the effectiveness of integrating emerging technologies? 3) Does reshaping business processes by integrating emerging technologies have a positive effect on the business environment? In this practical case, the research method used to remodel the economic processes was the interventionist method. Special attention was paid to how employees, the company's main resource, adapted to the changes that came with integrating these smart technologies into their way of working and how they perceived solving problems using smart technologies. The findings and results of this scientific paper support the positive correlation between the successful implementation of intelligent solutions and the contribution of employees putting them into practice. Thus, adopting and adapting intelligent solutions leads to better positioning the business in a world of constant competition. This paper provides a perspective on how companies need to rethink how they do business and apply policies that make technologies work to help business run smoothly in a changing world and an increasingly pragmatic and unpredictable business environment.*

Keywords: *RPA – robotic process automation, smart technologies, management, ERP, Industry 4.0, economic process, accounting.*

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[1] **Andreea Gabriela Tanase**, Doctoral School of Management, Bucharest University of Economic Studies, Bucharest, Romania.
ORCID 0009-0007-4346-0735

[2] **Alexandru Florin Preda**, Doctoral School of Economics and International Business, Bucharest University of Economic Studies, Bucharest, Romania.
ORCID 0009-0005-7203-6517

[3] **Raluca Florentina Cretu**, Department of Financial and Economic Analysis and Valuation, Bucharest University of Economic Studies, Bucharest, Romania.
ORCID 0000-0002-1751-1021

[4] **Viorel Costin Banta**, Department of Management Information Systems, Bucharest University of Economic Studies, Bucharest, Romania.
ORCID 0000-0003-1337-9374
E-mail: viorel.banta@cig.ase.ro (*Corresponding author*)

Андреа Габріела Танасе
Університет економічних наук Бухаресту, м. Бухарест, Румунія

Александру Флорін Преда
Університет економічних наук Бухаресту, м. Бухарест, Румунія

Ралука Флорентіна Крецу
Університет економічних наук Бухаресту, м. Бухарест, Румунія

Віорел-Костін Банца
Університет економічних наук Бухаресту, м. Бухарест, Румунія

Моделювання економічного процесу з використанням інтелектуальних технологій виробництва в контексті Індустрії 4.0: практичний приклад

Анотація. *Виникнення ERP систем було обумовлено потребою компаній ефективно керувати складними економічними процесами, такими як управління ланцюгом поставок або продажі в електронній комерції. У цій статті крок за кроком аналізується, як існуючий бізнес-процес у складній інформаційній системі, такій як ERP, може бути змодельований, адаптований і реалізований за допомогою нових інтелектуальних технологій. Ґрунтуючись на практичному прикладі заводу в Румунії, що виробляє вузли для автомобільної промисловості, автори намагаються відповісти на три питання: 1) Який вплив інтеграція інтелектуальних технологій має на бізнес-середовище, щоб зробити його конкурентоспроможним у все більш технологічному світі? 2) Чи може визначення відповідних KPI, необхідних для підкреслення ефективності впровадження та адаптації інтелектуальних технологій у повсякденному бізнесі, бути фактором вимірювання ефективності інтеграції нових технологій? 3) Чи має зміна бізнес-процесів шляхом інтеграції нових технологій позитивний вплив на бізнес-середовище? У цьому практичному випадку інтервенціоністський метод використаний для перебудови економічних процесів. Особливу увагу було приділено тому, як співробітники – головний ресурс компанії, адаптувалися до змін, пов'язаних з інтеграцією інтелектуальних технологій у їх спосіб роботи, і як вони сприймали вирішення проблем за допомогою цих технологій. Результати цього дослідження підтверджують позитивну кореляцію між успішним впровадженням інтелектуальних рішень і внеском співробітників, які впроваджують їх на практиці. Таким чином, впровадження та адаптація інтелектуальних рішень веде до кращого позиціонування бізнесу у світі постійної конкуренції. Ця робота пропонує ширше бачення того, як компаніям потрібно переглянути спосіб ведення бізнесу та застосувати політику технологічних змін, щоб сприяти безперебійній роботі бізнесу в дедалі більш прагматичному та непередбачуваному бізнес-середовищі.*

Ключові слова: *роботизована автоматизація процесів, інтелектуальні технології, менеджмент, ERP системи, Індустрія 4.0, економічний процес, бухгалтерський облік.*

INTRODUCTION

With the implementation of ERP (Enterprise Resource Planning) systems in various industries, especially in the area of production, purchasing, sales and distribution, it has been a challenge each time for those companies operating in the area of modelling, implementation and consulting for this type of information systems (Morawiec & Sołtysik-Piorunkiewicz, 2022). ERP-type systems are recognized worldwide as those that facilitate, in real-time, planning, production, sales and distribution, and purchasing, i.e. relations between the company and the rest of the actors in the business environment (Wachnik, 2017). An essential aspect related to ERP systems is the way of dialoguing with it in several international languages, facilitating legal and fiscal reporting, and connecting to each nation worldwide, the so-called software localization for each country. The emergence of this type of system came with the need for companies to manage a series of complex economic processes, such as supply chain management or sales e-commerce, which included not only local but also international global operations, which required information to be transmitted quickly, integrated to those with whom the business was done, namely business partners (customers, suppliers, etc.). Making all the settings for the myriad of sales possibilities, from different sales organizations and various distribution channels to divisions working closely with so-called sales offices, in turn, linked to sales groups, challenging each time those who implemented the software solution the company benefited from. The Internet has radically changed the possibilities of dialogue and the use of time spent in front of various devices for information. Even distance is no longer so difficult to overcome when discussing matters. Today, global thinking involves implementing software solutions to manage economic processes and business strategies.

This article benchmarks how an existing business process in a complex information system such as ERP can be modelled, adapted, and implemented using emerging intelligent technologies. The authors want to highlight step by step what happens when such an economic process undergoes the necessary changes to adapt to smart technologies.

LITERATURE REVIEW

In recent years, the manufacturing sector has been transitioning to digitization, yet many enterprises lack the resources to capitalize on these opportunities. The benefits obtained by integrating smart technologies into production processes are not only about economic performance and optimization but also about flexibility and efficiency in production to keep pace with the complexity and changes in the market (Mourtzis, 2024).

Innovating a business model involves understanding the company's performance, establishing the goal towards which that company is aiming and the area that needs improvement. Improving economic performance, increasing profitability and gaining competitive advantage is achieved by tracking and measuring key performance indicators (Piechowski & Meller, 2023). El Kihel et al. (2023) summarized the results of previous studies to identify the role of KPIs in production processes, highlighting the trends related to measuring the performance of a production process using smart technologies in the future. In addition, they discuss the impact of these technologies on traditional and contemporary methods for overall operational success. In the real-time production process, production KPIs provide instantaneous data about the status of equipment, resource consumption or product quality (Misra et al., 2024). Nowadays, enterprises are still struggling to understand I4.0 technologies and how they can be used. Process performance and product quality can be measured using industry standards (Chen et al., 2018). Marinagi et al.'s (2023) research presents how manufacturing companies benefit from new technologies, analyzing current practices, production norms, and KPIs to understand the benefits of Industry 4.0 through data processing.

Thus, business globalization has led to difficulties in supply chains, the emergence of new technologies has influenced the management of its KPIs, and the way of working has changed markedly with the reshaping of economic processes (Braglia et al., 2022).

RESEARCH OBJECTIVES

This study has three objectives:

1) To describe how integrating smart technologies impacts the business environment so that it can be competitive in an increasingly technologized world.

2) To define relevant KPIs to highlight the effectiveness of adopting and adapting smart technologies in daily life.

3) To disclose how the reshaping of economic processes has been successful, showing the advantages found in the production area, where it is well known that there is close cooperation between the technical side – production engineers and the economic side – economists, which is normal and essential in a competitive working environment.

All these objectives come from discussions with the company's management. These objectives are the subject of a field study carried out while implementing the UiPath solution dedicated to RPA in a factory in the automotive industry. The integrated system in which the company's activity is carried out is SAP, the market leader in ERP-integrated IT solutions. The goal was to automate the production process related to processing production orders for a major automotive brand (series and reorder) using UiPath as an external application integrated with SAP; the departments involved were logistics and production. Until the implementation of UiPath, these orders were done manually.

RESEARCH METHODOLOGY

The data used in this scientific research come from an implementation project collected within a year. The authors of this article are participants in the project. There were a series of interviews with the actors of the processes found in production, from production manager, production engineers, operations manager, production planner, quality control inspector, manufacturing technician, CNC machine operator to robotic welder operator. They helped the implementation team to understand better how these production processes work, where to intervene to automate specific steps, and what the link between production and accounting is. In addition, it was important to understand the roles of supply chain specialists, cost accountants, cost analysts, financial controllers, budget & forecast managers, management accountants, inventory accountants, procurement accountants, internal auditors, and tax & compliance accountants. Each of them, who occupied the roles specified above, had a series of remarks, which were welcome. Thus, at the end of the workshop, it was possible to analyze how to implement and adapt intelligent solutions in the work area related to the production of car subassemblies for the automotive industry – the special area dedicated to the processing of AUDI orders (series and reorder).

The research method used to remodel the economic processes was the interventionist method. The interventionist research method is a methodological framework that does not limit itself to observing a phenomenon but involves active intervention in economic processes to analyze and optimize the results. With this method, those who optimize economic processes by reshaping them work directly with the business environment to implement strategic changes, measuring impact and adjusting processes in real-time.

Figure 1 presents business goals and strategies to implement the processes found in the business environment.

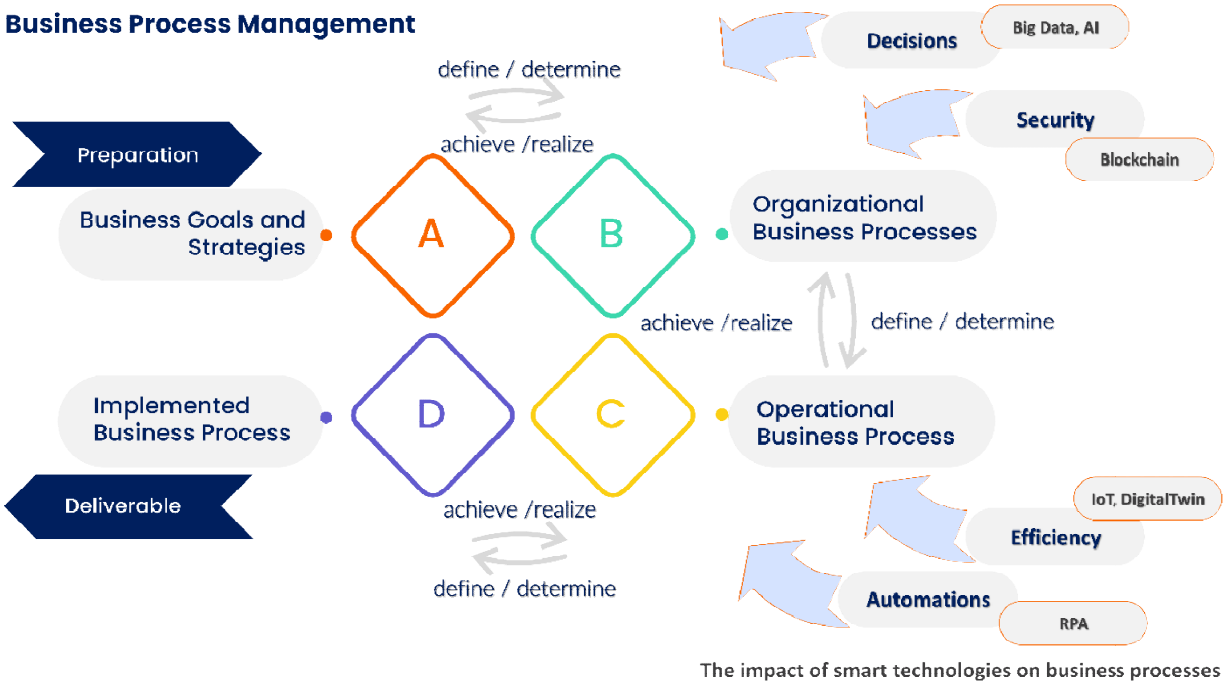

Figure 1. The impact of smart technologies from business goals and strategies to implemented business process

Source: Developed by the authors (2025).

Research questions:

1) What impact does integrating smart technologies have on the business environment to be competitive in an increasingly technological world?

This question stems from the company's management's discussions about integrating smart technologies to meet customers' demands at the best possible time. Digitizing some steps in the economic process helps improve customer service.

2) Can the definition of relevant KPIs necessary to highlight the effectiveness of adopting and adapting smart technologies in day-to-day business be a factor in measuring the effectiveness of integrating emerging technologies?

Since the beginning of the implementation project, the management of the company producing subassemblies found in the automotive industry has discussed with the project management and the implementers how to define KPIs that highlight the benefits brought by the integration of smart technologies.

3) Does reshaping business processes by integrating emerging technologies have a positive effect on the business environment?

Integrating smart technologies also changes how companies work with existing business processes. That is why, too, a number of changes were made at the process level, integrating these technologies where the stage in the process allowed. However, here, the change in the way of working was continuous because certain steps were readapted after each process test.

RESULTS AND DISCUSSION

The case study presented in this article deals with adopting smart technologies in a dynamic economic environment, marked by digitalization, globalization and rapid changes in the markets, reshaping economic processes becoming necessary for organizations that want to maintain their competitiveness. Economic transformation cannot be achieved by theoretical analysis alone, but it requires a practical and experimental approach that involves modifying and testing solutions in real environments. The approach of the authors of this paper to the interventionist research method is not an accidental one, as they desire to reshape the discussed process, namely the processing of AUDI (serial and reorder) orders in SAP to introduce intelligent technologies for utilization of this process as automated as possible.

Figure 2 details the process before remodelling and automation. It aims to highlight the points where it was possible to intervene and where it was not (mention manual action) to achieve automation using UiPath RPA solutions. Some steps require intelligent technologies because company management no longer desires manual action.

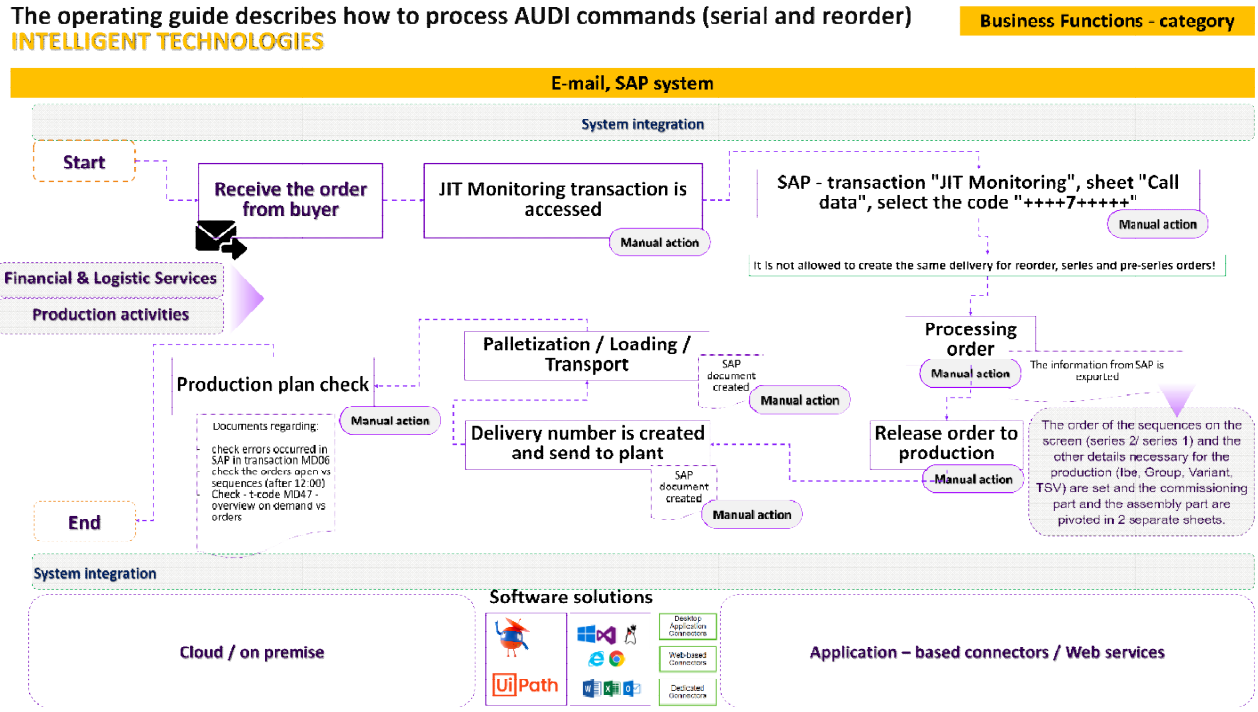

Figure 2. Non-automated process for reorder order processing

Source: Project data (2025).

As can be seen from Figure 2, certain steps could be automated, and a number of them even eliminated. Running the production process in the context of Industry 4.0 using RPA solutions could be done by combining several steps necessary to simplify the economic process discussed.

Thus, from the receipt of the order, which is realized every working day, the system checks the new open orders for the series, so the JIT Monitoring transaction is accessed. After that, the user with which the t-code is accessed is deleted, and "AG_PKM" is chosen in the "sold to party" field (the customer), after which the match code "1500" is chosen, using processing status from 120 to 300. Here, it is clear that the option thought of by those who realized the adaptation process of intelligent solutions was to automate this step, which is realized through the UiPath solution.

To extract the necessary information, manually executed, the pre-series will be excluded as follows: in SAP, we use t-code "JIT Monitoring", sheet "Call data", select the code "++++ +++++" - and this step was automated by creating a robot that used as input variables the code necessary for exclusion. The order processing stage is realized by exporting the selected data from SAP, which is executed manually. Then, the order of the sequences on the screen (series 2 / series 1) and other necessary production details (Ibe, Gruppa, Variant, TSV) are established, after which the commissioning part and the assembly part are pivoted in 2 separate Excel sheets. Once the file has been checked, it is sent to the production department. The 3rd step related to this economic process concerns the monitoring part "Jit Monitoring", where "proc status" Q100 to Q400 will be selected; after that, the status will be changed step by step from Q100 to Q400. In Q300, the system allocates a unique delivery number. The delivery number is passed to the parts file and sent to the warehouse one day before loading. In the Q400, the sequences appear on the screen and are output labels for the magazine.

After the sequences have been put on the screen, the status of the orders is checked, and where necessary, orders are opened for completion. These steps could not be fully automated because some inputs had to be left to be executed manually - we mention here the passing of the delivery number to a file intended for production and the opening of supply orders for completion. Concerning the step used for palletizing/loading/transportation, this is used to execute some steps in which the parts are packed in EPP boxes and placed on a pallet. Then palletized pallets are palletized, after which they are loaded into a truck according to the loading scheme drawn up by the dispatch department. After all the steps have been completed, we arrive at the production department where we will execute, step by step, the production plan check, the SAP error check using t-code MD06, the open production orders vs sequences (after 12:00), and finally, an overview check on demand vs orders using t-code MD47 and of course the material groups.

Figure 3 shows a sequence of the realized RPA solution, which is realized based on the received emails with the sales orders. All the actual production of what was requested by that received email is transformed using UiPath into a sales order in SAP.

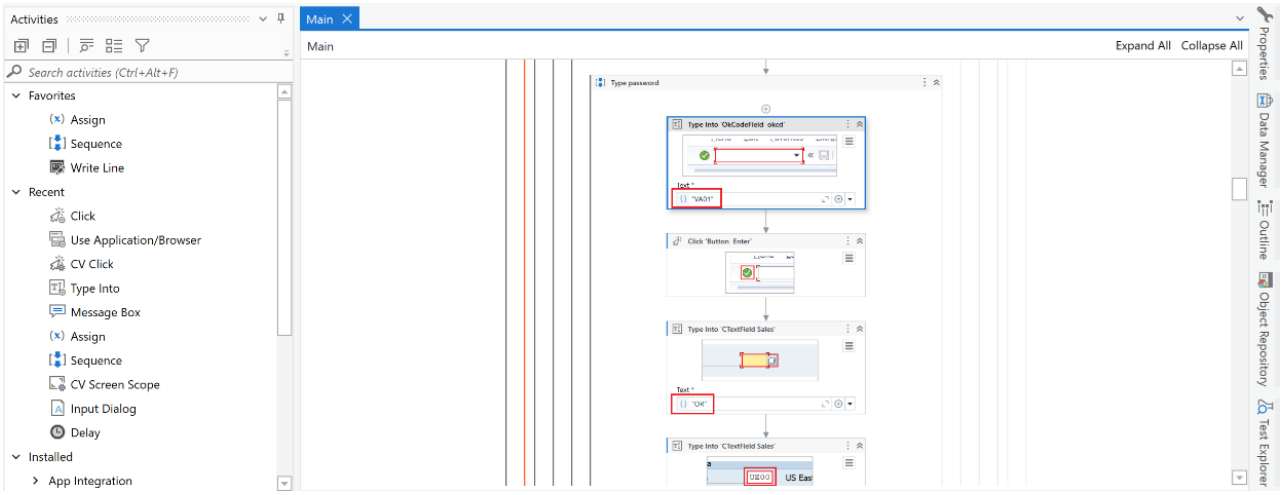

Figure 3. UiPath solution adapted for reorder order processing

Source: Project data (2025).

Figure 4 shows how the process will look after modelling the related process "reorder order processing". However, some steps still remain to be executed manually.

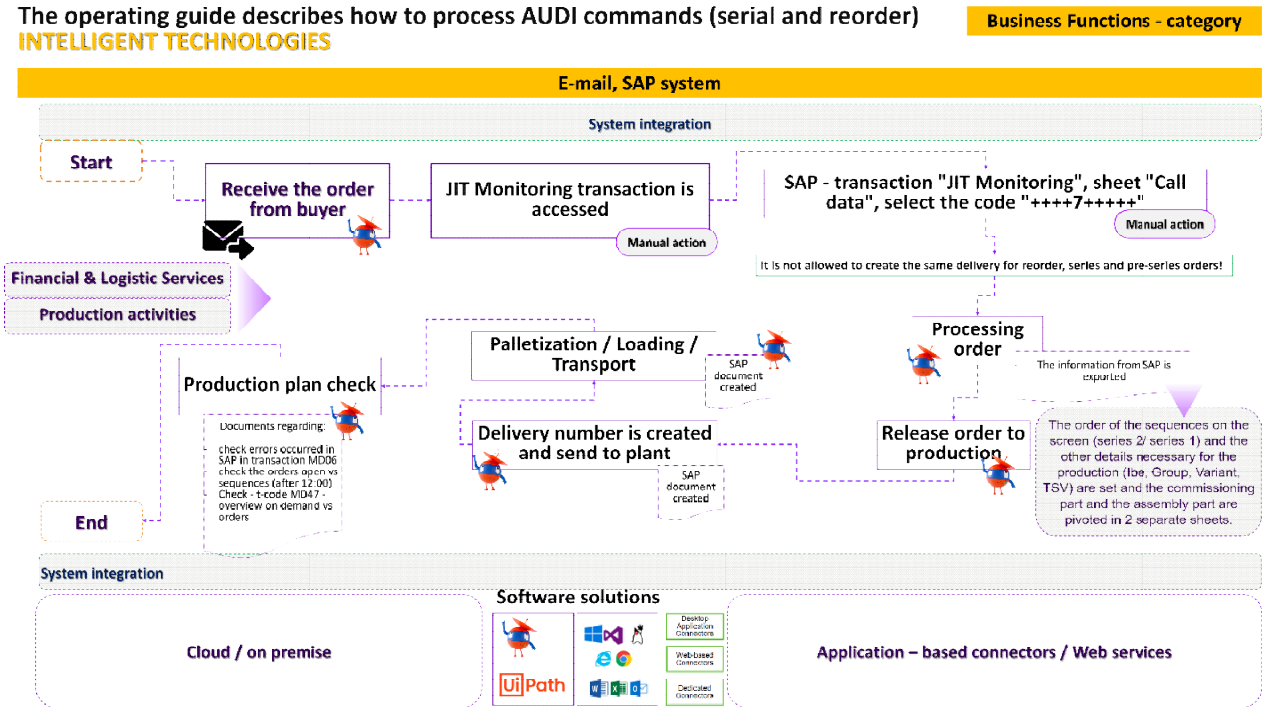

Figure 4. Automated process for reorder order processing

Source: Project data (2025).

As KPIs set by the company's management, we recall here one of them, with the data collected from the implementation of intelligent solutions – the automation of some steps in the economic process studied, the one related to the creation of production orders about the number of employees (Figure 5).

The operating guide describes how to process AUDI commands (serial and reorder)

Business Functions - category

INTELLIGENT TECHNOLOGIES

KPI – Key perfomrance indicators for producţio process

Production	
KPI issued production orders	
Orders	2024 Q Av.
No of issued orders in PP (A)	1.680
No of PP orders / FTE (B)	134
% Automatic PP orders (C)	52,9%
FTE PP orders (D)	12,5
-manual orders (E)	792,0
-automatic orders (F)	888,0

B = A / D

C = F / A (%)

D = AVERAGE (Q1, Q2, Q3, Q4)

Q1, Q2, Q3, Q4 => quarterly measurements

manual orders

F = A - E

Production					
KPI issued production orders					
Orders	2024 Q Av.	Q1/24	Q2/24	Q3/24	Q4/24
No of issued orders in PP	1.680	1.490	1.680	1.750	1.800
No of PP orders / FTE	134	106	120	146	180
% Automatic PP orders	52,9%	34,2%	51,8%	58,7%	63,7%
FTE PP orders	12,5	14,0	14,0	12,0	10,0
-manual orders	792,0	980,0	810,0	723,0	654,0
-automatic orders	888,0	510,0	870,0	1.027,0	1.146,0

Figure 5. KPI's definition for production orders

Source: Project data (2025).

Figure 6 shows the ratio evolution between the orders placed manually and those placed automatically. We can see a percentage increase from 34% to 64%, which shows that implementing automated solutions has added value to the company.

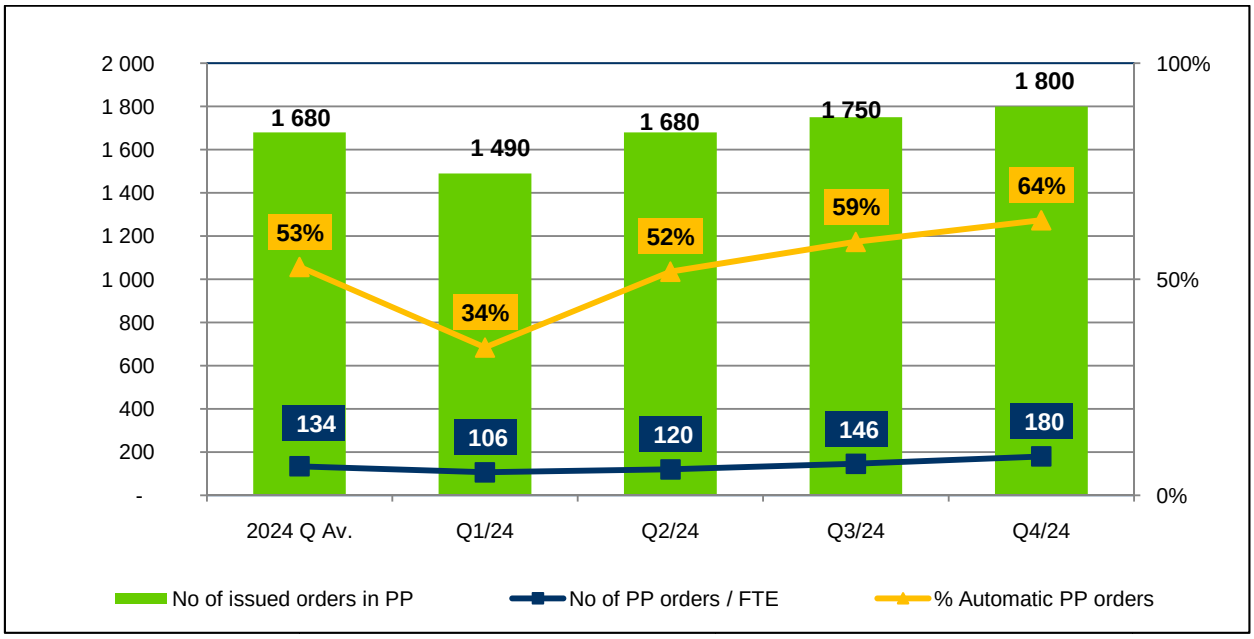

Figure 6. KPI's definition for production orders

Source: Authors' calculations based on project data (2025).

Returning to our research questions, we can say that realizing business process automation brings an average of 53% of automatic production orders. The graph in Figure 6 and the data in Figure 5 show how automation has affected the efficiency of the economic process. In addition, the remodelling of economic processes through integrating emerging technologies positively impacts the business environment. In our case, the positive effect is felt in the way that we see a substantial increase in production orders created automatically by RPA software solutions.

CONCLUSIONS

ERP solutions aim to improve business management by implementing strategies to coordinate the activities of users belonging to the organization at all levels. Of course, implementing such solutions is not necessarily about innovation, procedures, individuals or progress. On the other hand, the specialized literature mentions the resistance of users found among the company's employees, so the management must intervene proactively in managing such problems. It is well known that when it is desired to implement a software solution, this must be done with great care, and more training of employees must be done in advance.

In the practical case considered in this article, management has very well managed the implementation of intelligent technologies related to the economic processes found in the production work area. The graph in Figure 5 shows a significant increase in the automatically realized orders. The findings and results of this scientific paper support the positive correlation between the successful implementation of intelligent solutions and the contribution of employees putting them into practice. Thus, adopting and adapting intelligent solutions leads to better positioning the business in a world of constant competition.

As recommendations, it would be good to emphasize that a more laborious training of employees in intelligent solutions would be a strong point, which would help to rethink other economic processes in the direction of automation. Another aspect would be the co-option of young graduates, who are open to the use of intelligent technologies, especially now that the curricula of faculties include subjects in the area of expertise of RPA, ERP, etc.

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