Automation as a Factor of Sustainable Development: Analysis of its Impact on Productivity and Cost Optimization in Small Businesses

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Abstract. The study examines production automation approaches and their contribution to cost optimization in small enterprises, focusing on the challenging scenario of military conflict, as observed in the "Zeleninvest" case, and automation processes in the United Kingdom on the example of "Rolls-Royce Holdings plc". The research aims to understand the impact of these achievements in the field of automation under adverse conditions (Ukraine) and favorable conditions (the United Kingdom).

The research integrates literature reviews, case study analyses, expert consultations, and computer modelling based on a comprehensive approach.

The study shows that automation in cost management through a specific software module, "Enterprise Current Expenditure Optimization," significantly contributes to resource management, as demonstrated in the conditions of Ukraine, while software tools for automation processes in the United Kingdom help ensure the production of quality goods. Various perspectives on the feasibility of automation in different countries are also considered. This process facilitates the transformation of labor, material, and financial resources into minimized expenses, achieving desired business volumes.

The innovation of this research lies in demonstrating the effectiveness of the "Enterprise Current Expenditure Optimization" software module, presenting successful application of automation tools in the United Kingdom, and examining different views on the role and place of production automation in modern conditions. The module optimizes costs, supports achieving sales targets, and reduces unnecessary expenditures, offering a new perspective on cost management in small enterprises. While the extensive application of various tools in "Rolls-Royce Holdings plc" contributes to the production of quality goods, it also has negative aspects, such as an increased number of unemployed workers. Hence, a discussion on the progressive and regressive role of automation in production is presented.

Keywords: automation processes, impact of automation on expenses, expense optimization, automation as a factor of sustainable development.

1. INTRODUCTION

When discussing the level of development of our topic, attention should be focused on the following questions:

1. It is important to analyze the issue of automation in small businesses now because it is a period of rapid technological advancement and increasing market competition. The fast pace of change in the modern world demands effective management tools and optimization of business processes.

2. Analyzing the impact of automation on productivity and cost optimization in small businesses will lead to increased efficiency in their operations. This will contribute to enhancing the competitiveness of enterprises, stimulating their development, and fostering sustainable economic growth.

3. Studying the impact of automation on productivity and cost optimization in small businesses will contribute to the development of

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the scientific sphere, the expansion of scientific knowledge, and the exploration of new technologies and management methods.

4. Although the issue of automation in small businesses has already been studied, its development and impact on the economy have not been sufficiently researched. Many aspects of this problem remain unexplored, or a deeper understanding of them requires further investigation.

5. Research can help identify new opportunities and perspectives for automation in small businesses. It can also provide new insights into optimal strategies for implementing automation and its impact on different segments of small businesses.

The focus of the research lies in determining the impact of automation on productivity and cost optimization in small enterprises.

The main objective of the study is to model and present the effectiveness and benefits of using the "Enterprise Current Cost Optimization" software module for automating cost management in the enterprise. The attention is focused on elucidating how automation can help increase productivity, reduce costs, and enhance the competitiveness of small enterprises.

What is business process automation in the modern sense and why is it so important for small businesses?

First of all, these are technologies, the latest developments that allow companies to reduce the use of human labor, not only directly in the production process, but also in all other processes related to the business, for example: safety functions, security, material cost accounting, financial accounting, document management, market analysis and research, production testing and inspection, control of production processes and control of the use of human resources to optimize operating costs and consequently the company's products. The cost of services decreases, and the company's profits increase.

INNI analysis and integration modules are specially developed for the automation of business processes, as they enable the automation of operational control in the production and non-production areas of the company. The INNI software allows to automate the operation of the security system and make it significantly more efficient, reduce the impact of the human factor, eliminate employee errors, avoid negative consequences of inappropriate work by employees, etc.

Control of production, control of vehicle movement and movement of goods are all business processes that can be manually automated using certain parameters, with all the negative consequences of human factor influence. Technologies that automate business processes not only save the company money, but also mean a fundamentally different quality of the processes themselves and a different quality of management.

Automation allows to completely or partially free a person from performing cyclical processes or processes performed according to a specific algorithm. Now it is very difficult to imagine such a company that works without human intervention and calls only in case of emergency. Automation evolved for industrial and technological advancements. The analysis of thematic literature (Biletskyi, 2023) allows to establish that home automation has its origins in industrial enterprises, where the priority of increasing the speed of processes contributed to the introduction of the latest automation tools.

Automation of production enables to increase the number of vacant employees, optimize the use of time and the employment level of the workers, which will help increase the resource potential of the company. While at the end of the last century automation has got the role of performing routine cyclical tasks, now, thanks to the development of software and computer tools, entire production lines are automated and operate without human intervention. Despite all the mentioned advantages, it should be noted that the automation process itself requires significant financial investments and preparatory efforts. This is the main problem of automation development stagnation. Currently, automation is developing with complications due to the lack of free liquidity in many companies, the willingness of entrepreneurs to make decisions about the modernization of the enterprise, and the lack of qualified people who guarantee the implementation of such ideas.

Now, there is a tendency to reduce the potential of enterprises' technological and

technological base. However, innovation is a prerequisite for the development of both an individual company and the national economy as a whole. This opinion is consistent with the modern concept of technological systems, according to which the stage of the life cycle of the set of technologies used determines the speed of economic development of both national economies and individual enterprises (Gontareva, 2019).

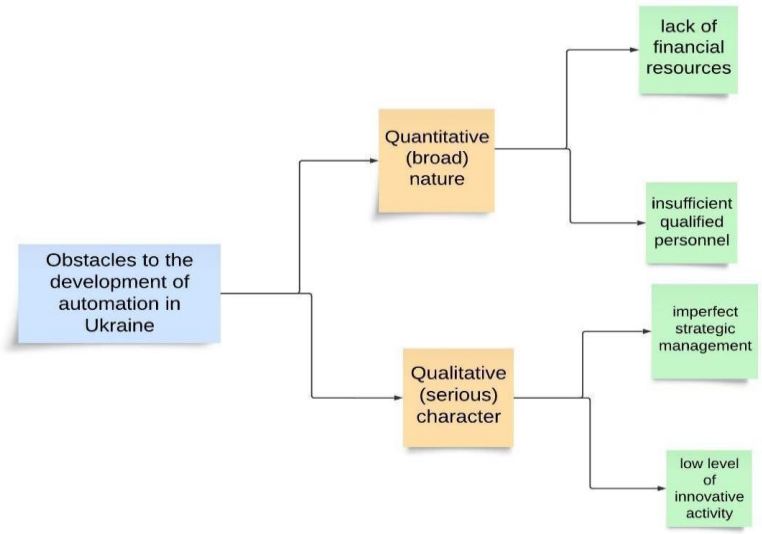

Figure 1 Obstacles to the development of automation at industrial enterprises
Source: Author's own development

Business automation is a very important step for a country to become successful. To succeed, it must take the following steps:

1. Combine IT and automation experience, learn from foreign manufacturers and enter the markets of other countries.

2. Inform the world about your skills and abilities through various advertising and social media campaigns.

3. Outsourcing design and installation.

4. Create a webplatform to share project information, knowledge, and experience.

5. Comply with international standards at all stages of the production cycle.

6. Establish the Ukrainian Union of Industrial Internet Technologies.

The article aims to schematically propose and theoretically explore local approaches to inventing possible ways for functional verification as a working model for automating accounting and analytical procedures at a Ukrainian enterprise. The aim is to facilitate convenient and prompt acquisition of information on various economic issues of real and forecasted activities for the purpose of sustainable optimization. No other purposes are provided for this article. Due to the military situation, the Ukrainian enterprise theoretically verified in this article operates unevenly and only a small part of it functions to the extent possible under the conditions of its relocation from its original location to areas lacking natural conditions for existence. The enterprise's website has been inactive for months, hindering complete production cycles and any economic analysis. At the initial stage, a model of an innovative mechanism using computer technologies for automating accounting in simplified Ukrainian was used. A trial incomplete model of some economic data with significant trial errors was also used, serving as partial theoretical benchmarks for our research. This is why it is impossible to translate the interface of the proposed program into English due to semantic translation discrepancies. Since March 12, 2022, the enterprise's website has not been operational. Therefore, the aim of our research is narrowly theoretical presentation of the mentioned accounting and audit automation mechanism at the analyzed enterprise, accompanied by primitive partial economic analysis and proposal of certain, unfortunately

primitive, functionally narrowed perspectives. This situation significantly narrows and complicates the tasks for any research and precludes rational determination of further investigations. In this regard, the formulation of any prospective economic research, whether comparative or innovative, is unacceptable. The value of our research lies in highlighting the initial "revolutionary" transformations in enterprises striving for civilized operation amidst intolerable conditions of war and martial law. The author does not envisage any other versions for expanding the research purpose under the objectively challenging conditions of the existence of the Ukrainian enterprise.

The goal will be achieved through solving the following tasks:

1. Defining the main objective of automating cost management at the enterprise, identifying the object of study.

2. Determining the logic of the methodology scheme for implementing automation.

3. Presenting approaches to the application of the presented automated model for managing operational costs of the enterprise and the balanced scorecard system for optimizing current expenses.

4. Presenting the model of automation of accounting and audit at the enterprise.

5. Providing a brief description of the capabilities of the scheme of this automation model and its prospects without conducting economic research. There are no other tasks to achieve the goal of our research. In our context, the automation of cost management at the enterprise is a mediated reflection of the higher cycles of social activity of Ukrainian legal consciousness.

2. METHODS

The competitive position of the "Zeleninvest" company was evaluated using the matrix portfolio analysis methodology, revealing that in the development of an effective strategy to enhance business efficiency, the researched enterprise has all the chances to secure high competitive positions in this market. Various methods, such as absolute differences, chain substitutions, the integral method, and correlation-regression analysis, were utilized to study the factors influencing the structure and dynamics of current expenditures at "Zeleninvest."

Functional models were constructed to depict the influence of labor indicators and expenditure capacity on changes in circulation expenses, the level of administrative costs, and turnover on administrative expenses. An additional growth in distribution costs due to the interaction of two factors, turnover, and distribution costs, was identified. Based on the analysis of the structure and dynamics of current expenditures at "Zeleninvest," the strategy for managing circulation costs should be aimed not at reducing their size but at optimizing them. Within the chosen strategy, an automated model for managing the circulation costs of the enterprise was introduced, along with a system of balanced indicators for optimizing current expenditures. This system comprises blocks such as finance, customers and service, internal business processes, and personnel management.

3. RESULTS and DISCUSSION

Let us consider automation processes as factors of sustainable development using the example of analyzing the impact of automation on productivity and cost optimization in the small enterprise LLC "Zeleninvest". LLC "Zeleninvest" is a limited liability company registered on March 31, 2006, and has been relocated to another address on January 27, 2024. The company is engaged in wholesale trade of grain, unprocessed tobacco, seeds, and animal feed through the activities of intermediaries in the trade of agricultural raw materials, live animals, textile raw materials, and semi-finished products, as well as in the wholesale trade of primary and other food products, including fish, crustaceans, and mollusks (Zelenvest, n.d.). The current expenses of enterprises engaged in production activities are referred to as production costs. The current expenses of enterprises engaged in sales, supply, trade intermediary activities are referred to as circulation costs.

Many economists have studied the issue of current expenses of trading enterprises, including Roblek et al. (2020), Demirkan et al. (2020), Bellucci et al. (2022), and others.

In the process of cost and production management, decisions are made on where and in what amount enterprise resources should be spent, where, why, and in what amount additional financial resources are needed, and how to achieve the maximum return on resource utilization (Verba, Danilenko, & Samoylenko, 2020).

The main purpose of cost management at the enterprise is to optimize their amount and level, ensuring the achievement of planned enterprise activity volumes. The choice of article topic is driven by the need for effective cost reduction and optimization, alongside improving product quality during the automation of business activities on the Ukrainian market. In the current economic conditions, only those enterprises survive that offer competitive products. The key factor of product competitiveness is a relatively low price, achieved through effective enterprise cost management.

The information base for the study includes legislative acts of state management bodies, materials of official state statistical, financial, and accounting reports of LLC "Zeleninvest", as well as analytical materials of the company. The enterprise uses labor, material, and financial resources for its operations. During economic and technological processes, these resources are consumed and transformed into expenses. Expenses, in monetary terms, characterize the actual volume of resources used to achieve a specific goal, regardless of financing sources. Operating expenses of the enterprise are grouped by the following economic elements: material costs; depreciation; contributions to social events; labor costs; other operating expenses. With the transition to new accounting standards, current expenses of enterprises are determined according to P(S)BU 16 "Expenses" (International Accounting Standard 2, n.d.; Verkhovna Rada of Ukraine, 2020). This standard defines the methodological principles of forming accounting information about enterprise expenses and its disclosure in financial statements (Form 2) "Financial Results Report" (Verkhovna Rada Ukrainy, 1999). By types of expenses, circulation costs are subdivided into elements and articles, the nomenclature and content of which are established by the "Methodical Recommendations on the Formation of the Composition of Expenses and the Procedure for their Planning in Trade", approved by the order of the Ministry of Economy and European Integration of Ukraine dated May 22, 2022, No. 145. The grouping of expenses by elements is standardized, uniform, and mandatory for all enterprises, as recommended by this Regulation. Expenses are consolidated into five main groups according to their economic content by the following elements: material costs; labor costs; contributions to social events; depreciation of fixed assets and intangible assets; other expenses.

Continuing further, it should be noted that cost automation requires optimization of their current state, and the functioning of enterprises in market conditions requires effective cost management. The tasks of fundamentally new solutions arising in this regard relate to the feasibility of various expenses. The primary focus in cost management should be on ensuring labor productivity growth, raw material and material savings, increasing cost efficiency to ensure the necessary profitability of the enterprise's core activities. To enhance the efficiency of enterprise activities based on optimization, automated cost management has been created — a system of purposeful influence on the composition, structure, and behavior of costs and their factors at all stages of cost formation and distribution. This system is based on the use of economic laws to ensure competitiveness in the market and achieve the strategic goal and current tasks of its development (Papushyn & Biletskyi, 2007). Therefore, the main task of cost management is to find the most efficient way to use available resources, namely cost optimization.

The process of optimizing enterprise activity in terms of costs is the search for the most efficient methods of economic management, where the enterprise obtains maximum results with minimal costs (Henry & Aziz, 2024; Lekhi, 2024; Slavkova & Hordiienko, 2019; Sadovska, 2019). Cost optimization is a continuous process of planning, accounting, analysis, and control of costs, as well as making decisions on further economic strategy and policy of the enterprise using motivation tools for employees at all levels of the formed organizational structure. Planning is carried out to determine the necessary level of costs to

ensure the effective operation of the enterprise and calculate the profit that will be obtained for a certain level and structure of costs. Business digital transformations, in particular, require the implementation of programs that allow rapid response to external changes in business. In the modern business organization system, cost management based on manual calculations is ineffective as it does not allow the full and timely utilization of available accounting information. In this process, fundamental factors objectively shaping circulation costs of economic entities are practically not taken into account (Schumpeter & Swedberg, 2021). The automation of cost management processes in enterprises is achieved through new modern software solutions. With their help, all management and organizational-economic tasks can be qualitatively and productively solved. Today, enterprises of any form of ownership and type of activity use programs such as 1C: Enterprise and the applied BAS ERP software solution. These programs allow for complete automation of management and financial accounting in both large and small productions.

Therefore, cost management is based on the development of a set of calculation algorithms and economic-mathematical models that allow processing available information and conducting multivariate planned calculations. The subject of the developed program of planned economic calculations is the process of automating cost management of the enterprise. The automation process as a factor of sustainable development in the context of its impact on productivity and cost optimization in small enterprises aims to program the cost management process. In this regard, the creation of a program — a software module "Optimization of current enterprise costs" should be defined, which ensures the optimization of enterprise costs in the planned period, during which the planned volume of enterprise activity (and product implementation) is achieved, and the elimination or reduction of those costs that are unproductive or unreasonable for the enterprise.

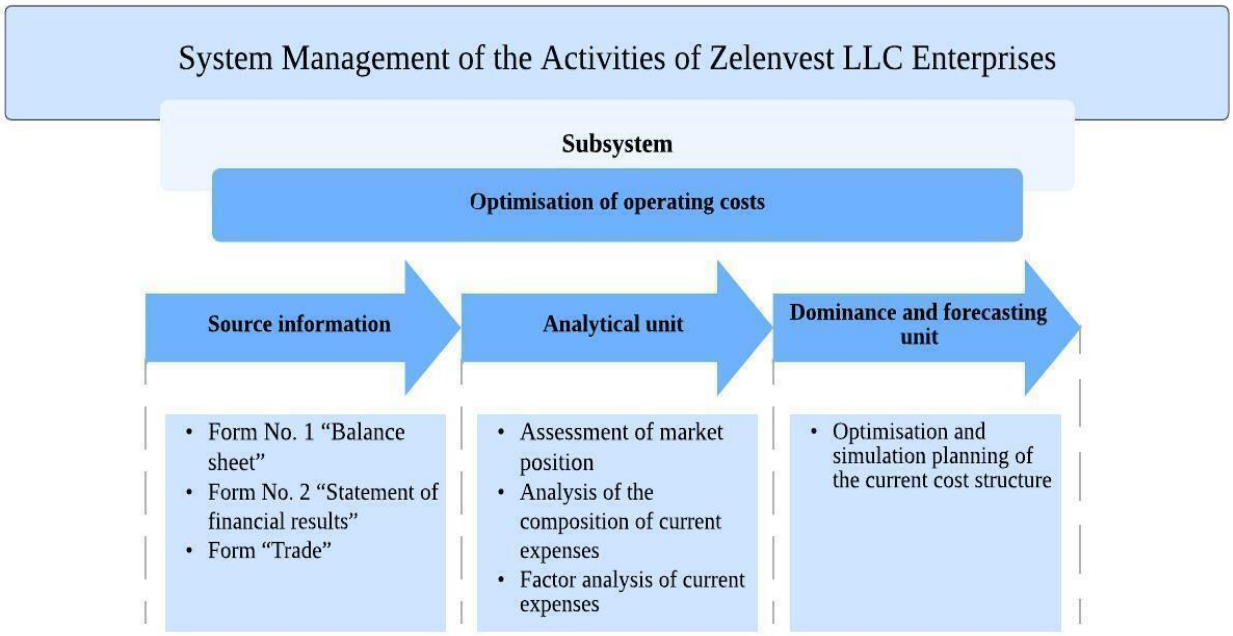

Figure 2. Software module "Current Cost Optimization for the Enterprise"

Source: author's own development.

Due to the fact that the enterprise offered to us is located in Ukraine and conducts business exclusively in the state Ukrainian language, to avoid any cross-dimensional misunderstandings, we provide the documentary basis of the research in the original language — Ukrainian (including the program interface, tables, and illustrations).

The adaptation to the functioning conditions of a trading enterprise is a distinctive

feature of the developed program. The main tasks of automating the cost management process of the enterprise include:

1) formation of enterprise costs and prime cost for individual types of products, as well as for their entirety;

2) establishment of selling prices for each product and determination of their profitability;

3) identification and practical utilization of cost-saving reserves and reduction of prime cost;

4) monitoring the state and nature of changes in the actual prime cost and expenditure sizes compared to the planned indicators approved by the enterprise and analyzing them dynamically.

The presented program for cost and prime cost management of the enterprise's products is characterized by user-friendliness and flexibility. It can be used as a basis for the enterprise's cost planning process, the results of which can be utilized to enhance the efficiency of economic and financial activities. The application of this program for further budgeting of costs and production prime cost for the specified enterprise's products would also be reasonable. The time saved through programming will allow economists to focus on a creative approach to determining the means to achieve the strategic goals of the enterprise and identifying potential opportunities. The object of our research is the structural unit of the LLC "Zeleninvest" whose activity involves trading in plants, care products for them, and relaxation furniture. The company operates both online and offline.

Internal business processes are aimed at improving the overall efficiency of the enterprise through the elimination of bottlenecks in its operational management system. The customer and service component are crucial for trading enterprises, as an effective marketing system promotes an increase in turnover and market share for the researched enterprise. In the context of the growing role of the workforce as a significant resource in the activities of a trading enterprise, improving the efficiency of personnel utilization contributes to the optimization of the enterprise's current expenses. The key success factors for the implementation of each proposed component are presented in Fig. 3.

Composite	Strategic goal	A key success factor
Finances	Optimization	Increase in turnover
		ncreasing the cost-effectiveness of current costs. Increasing the cost-effectiveness of procurement costs.
		Improvement of loan capital management policy.
		irowth in the profitability of circulation costs. Growth of commercial profitability.
Clients and cepsic	Share growth market and level of satisfaction customer demand	Quality work with clients
		Image support, advertising
		Expanding the assortment of goods.
Internal business-processes	Improvement efficiency activity	Effective use of fixed assets
		Effective logistics management. Rational use of retail spaces.
Management staff	Increase efficriency Ursing staff	Retention of key personnel
		Increasing the efficiency of personnel use
		Increasing the competence of employees. Motivation of the staff

Figure 3. Key success factors for LLC "Zeleninvest"

Source: author's own development.

Some issues of quantitative assessment of current expenditures can be addressed using correlation-regression analysis. It allows assessing both the strength of the relationship between the studied indicators using correlation coefficients and calculating the proportion of variation in the dependent variable (expenditure level) influenced by individual factors. Analyzing circulation expenditures through correlation-regression analysis is advisable using EXCEL and involves the following sequence of steps.

Stage 1. Formation of the initial information table.

The correlation-regression analysis requires having a set of economic information on the quantitative characteristics of the studied indicators over a certain period or on a certain number of objects. In this study, selected factors include revenue from sales, turnover, and labor productivity. All data is taken for two years and segmented by quarters. The examination of multicollinearity based on the study of the matrix of pairwise correlation coefficients showed the feasibility of including all factors in multifactor correlation models. In the case of inventory, this factor has a functional dependence on the current expenditure indicator, so it should be excluded from the model.

Stage 2. Formulation of a hypothesis about the presence and form of the relationship.

Determining the existence of a connection between the studied indicators and selecting a specific type of connection should be done in several steps. Construct a graph of the dependency distribution for each indicator.

Stage 3. Construction of an econometric model or regression equation.

Stage 4. Examination of the econometric model.

Stage 5. Construction of a graphical illustration of the model.

At this stage, it is necessary to extrapolate the data obtained based on the conducted correlation-regression analysis. Thus, it can be concluded that correlation-regression analysis allows building adequate cost models that can be used in forecasting current enterprise expenses. Having analyzed the current expenses of the trading enterprise related to operational activities identified shortcomings in its operation, it is necessary to further develop.

The amount of expenses depends on the volume of resources that support a certain level of enterprise activity. The enterprise should strive to use a set of production factors that ensure the same level of activity (revenue from sales) with the least expenses for the used production factors. Therefore, when justifying expenses, calculations should be made based on the possibilities of alternative resource utilization and the selection of the most appropriate option. Thus, the development of a strategy for managing circulation expenses should be aimed not at reducing the size of circulation expenses but at their optimization.

The automated circulation expense management system "Zeleninvest" is one of the subsystems of the overall enterprise management system. It closely interacts with management subsystems: turnover, gross income, and profit. The process of managing circulation expenses is quite complex, as it requires accounting for various interests: industry, contractors, customers. Thus, the main task of creating an automated management system at "Zeleninvest" is to reconcile these interests and create a self-regulating mechanism for their formation and change. It is important to prioritize interests based on their significance. The cost management system in market conditions is defined as a system of economic means and methods aimed at influencing the interests of the industry, the enterprise, and employees to optimally coordinate with the interests of consumers and society as a whole, in compliance with socially necessary ones, taking into account consumer demand, proportions in cost formation. The most important indicator characterizing the quality of cost management is the cost management indicator — the ability to dynamically change cost parameters within specified limits according to changes in the system of economic methods and means.

The process of optimizing the management of circulation expenses at "Zeleninvest" should include:

1. Organization of information support according to the content, composition, and structure of expenses, and target guidelines.

2. Assessment of the capabilities of cost formation in the past and planned periods, i.e., assessment of the functioning conditions of the enterprise.

3. Complete analysis of circulation expenses in dynamics and for the current period.

4. Forecasting the size and level of expenses using different methods for different turnover and profit volumes, taking into account existing constraints.

5. Planning max and min permissible levels of expenses.

6. Standardization of expenses by expense categories.

7. Conveying the planned level of expenses to subordinate units, departments, and individuals.

8. Control and operational management of circulation expenses considering changes in the functioning conditions of the enterprise.

9. Improvement of cost accounting.

10. Search for reserves to reduce expenses and their implementation.

Thus, we can see that it is advisable for "Zeleninvest" to review the cost circulation optimization management system, starting from the informational support of the management process and ending with the search for cost reduction reserves, utilizing modern methods and tools for accounting, planning, and cost management. One mechanism for improving the management system is the development and implementation of a balanced scorecard proposed by D. Norton and R. Kaplan in 1992. The technology of evaluating the optimization of enterprise activities according to this concept allows managing towards planned goals and, most importantly, tracking the degree of their achievement in a timely manner, identifying and eliminating "weak links" in the enterprise management system. The balanced scorecard enables balancing short-term goals with the mission and strategy of the enterprise in the long term, encompassing all financial and non-financial indicators, and internal and external factors of enterprise activity. D. Norton and R. Kaplan proposed managing and accessing. Thus, we can see that it is advisable for "Zeleninvest" to review the cost circulation optimization management system, starting from the informational support of the management process and ending with the search for cost reduction reserves, utilizing modern methods and tools for accounting, planning the financial and economic condition of the enterprise using a balanced scorecard based on four main components: financial, customer, internal business processes, and learning and development.

Based on the analysis of current expenditures within the proposed model of enterprise cost management for "Zeleninvest", a balanced scorecard for optimizing current expenditures of the researched enterprise should consist of the following blocks: finances, customers and services, internal business processes, and personnel management. Financial indicators in the balanced scorecard evaluate the economic consequences of all measures taken in the planning process of the enterprise's economic activities and serve as indicators of the enterprise's achievement of set goals. Internal business processes aim to increase the efficiency of the entire enterprise's activities by eliminating bottlenecks in its operational management system. The component of customers and service is crucial for trading enterprises, as an effective marketing system contributes to the growth of turnover and the market share occupied by the researched enterprise. In the context of the growing role of the workforce as an important resource for the activities of a trading enterprise, improving personnel utilization efficiency contributes to the optimization of the enterprise's current expenditures.

The interrelation of accounting-analytical system and accounting software automation enables to:

1. Improve business manageability by receiving daily reports on:

- the activity and financial condition of the enterprise: in terms of goods in both natural and monetary measures, with precision for each item; in the breakdown by departments and personnel; formation of profit, expenses, and financial results; movement of inventory, accounts payable, accounts receivable, and other elements of working capital;

- when using automation information systems, the enterprise should be guided by the following principles: the automation system should consider the specificity of the enterprise and be adapted to current needs; the project should be economically justified, and implementation should make the enterprise

more profitable; the automation system should have the ability to expand, scale, and increase functionality; the automation system should integrate with existing computer systems in the enterprise. One of the most significant advantages of obtaining operational accounting-analytical information is its incredible flexibility and, as a result, the ability to customize it individually to the specific needs of the enterprise, ensuring automation. In general, using the software allows a significant reduction in the workload of all departments of the enterprise by automating typical tasks and eliminating slow paper circulation, facilitating control over activities through various reporting forms, and minimizing the likelihood of errors caused by end-users;

- the effect of implementing an automated accounting-analytical information system and its characteristics;

- the effect of implementing market analysis of price deviations from suppliers, competitors, partners;

- sales trends, ABC sales analysis, XYZ sales analysis;

- sales analysis for different customer groups, allowing to identify the most "promising" ones and focus efforts on working with them;

- analysis of the state of work with clients, employee performance results, analysis of the client base;

- automation of the sales cycle, allowing for a quick assessment of the likelihood of closing a deal.

2. Automation of the process:

- significantly simplifies procedures and substantial time savings for sales, allows automating routine operations, control processes, and sales team management; Accelerates the organization and conduct of personalized electronic mailing of advertising information to different customer groups, where tasks can be planned for each potential customer;

- significantly speeds up the preparation, distribution, and processing of electronic surveys, providing the opportunity to periodically send offers for new services or more favorable pricing conditions. Each employee has the right to carry out operational planning and control of actions in accordance with their responsibilities.

Confidentiality of information is maintained by using different access rules, ensuring the preservation and integrity of data through the maintenance of a common customer database, where all aspects of interactions with customers are recorded.

At a certain point, the opportunity arises to effectively increase management efficiency, allowing to monitor employee activity and analyze the causes of contractual violations to prevent them in the future. This includes improving the motivation system, carrying out operational analyses of contracts and employees' work, and documenting customer loyalty in detail in each contact.

The manager and manager receive complete information about the client, which allows them to more accurately determine the transmission category and determine the resources needed to solve the problem.

The analysis of various software products (1C, Parus, M.E.Doc, etc.), which are used for both automated and analytical accounting procedures, allowed to conclude that they have many common features that ensure:

1) information security — a two-level security system; secure storage of large volumes of information, data integrity;

2) unlimited number of users working simultaneously;

3) user confidence in the information provided by the system;

4) convenience and ergonomics of employees' daily work through the interface;

5) system compactness: simplicity, intuitiveness for the user;

6) ability to process with analytical precision all information stored about each element, a necessary condition for the existence of the enterprise in existing market conditions;

7) high productivity when receiving complex analytical reports;

8) automation of almost all of the company's business processes;

9) purchasing and inventory management;

10) financial planning and comparison of planned and actual indicators;

11) plan material needs based on production or sales plans;

12) operational calculation of the cost of manufactured products.

Currently, many specialized companies are involved in the development and distribution of

specialized (industry) solutions on the platform.

Each of them creates a specialized mass solution, using common methodological solutions, focused on the specific needs of a specific sector. Examples of such industrial solutions are automation programs for retail trade, pharmaceutical industry, spare parts trade, car repair, agricultural companies, military units, etc. The range of successfully applied industrial solutions is constantly expanding. Besides, the capabilities of software products enable the creation of individual solutions taking into account the specific needs of a particular company. Such solutions usually involve the development or modernization of a mass standard or specialized solution tailored to a specific situation.

This allows managers to choose the best automation option based on their business needs, task priorities, acceptable deadlines, and implementation costs. It is important to highlight that, using the same system, it is possible to carry out progressive automation, receiving real feedback at each step. Starting with the implementation of standardized and specialized mass solutions, companies can effectively solve the main automation tasks — with a minimum of time and costs — and then develop the system in accordance with the individual characteristics of the enterprise.

It is critical to acknowledge how automation, particularly in the realm of accounting and analytical procedures, serves as a pivotal factor for sustainable development within small businesses. The transition towards computerized systems not only streamlines the process of generating and transforming accounting information, but also significantly influences the managerial decision-making process. Automation contributes to both productivity gains and cost reductions by facilitating more efficient operations and enhancing the accuracy of financial data.

Moreover, the adoption of such systems embodies the principle of sustainable development by promoting resource efficiency and reducing the environmental footprint of business activities. As small businesses increasingly adopt these practices, they do not only optimize their operational costs but also contribute to a broader economic and environmental sustainability agenda.

Furthermore, the theoretical framework that encapsulates the "accounting and analytical procedures for obtaining information" through automation emphasizes the strategic importance of technology in navigating the complexities of modern business environments (Ma et al., 2023). It underlines the need for small businesses to adapt to technological advancements not as a matter of choice but as a prerequisite for survival and growth in an increasingly competitive landscape.

The embrace of computerized accounting and auditing systems within small businesses is not merely a trend but a strategic imperative that aligns with the principles of sustainable development. As these businesses continue to harness the power of automation, they are set to reap the benefits of improved productivity and cost optimization, positioning themselves as resilient entities in the face of economic and environmental challenges.

Effective management is impossible without the creation of automated management systems that allow optimal organization of the company's internal business processes and the acquisition of operational information for making informed management decisions. A comprehensive study, involving the creation of an information model of the enterprise that takes into account the goals and tasks of automation and development strategy, alongside developed recommendations for optimizing management processes, contributes to increasing the effectiveness of software solutions and, therefore, the efficiency of management within the company.

Hontareva (2011) identifies one of the fundamental directions for updating the topic of analyzing the impact of automation on productivity and cost optimization in small businesses. This direction involves determining and theoretically substantiating the organization of accounting procedures and analytics using information and technological means to automate the acquisition of information. Furthermore, it seeks to establish the fundamental level of such research on the economic activity of the enterprise.

Scientists such as Holiachuk and Rykhliuk (2012), Sadovska (2019), Al-Refiay et al. (2022), Shahzad et al. (2023), and Koval, Slobodianiuk, and Yakubyshyn (2024) carried out a significant amount of research. This discussion enriches our understanding of the multifaceted impact of

automation on small businesses, extending beyond operational efficiency to encompass legal, ethical, and governance considerations.

However, according to Sytnyk (2018), there are still many controversial issues that do not sufficiently generalize their place in the process of the company's economic activity. All this determined the choice of the theme of the article to promote theoretical, methodical and practical research.

The tasks of automating accounting and management may differ significantly depending on the type of activity of the company, the sector, the specifics of the products or services provided, the size and structure of the company, the level of automation required. It is difficult to imagine a single program designed for mass use that would meet the needs of most businesses. At the same time, on the one hand, the manager needs a solution adapted to the specifics of his company, but on the other hand, he understands the advantages of using a mass-tested product.

Sadovska (2019) notes that the accuracy of the computerization of accounting information should not be absolute, but relative, that is, sufficient to make effective management decisions. Accuracy is yet another legal aspect of accounting. Property rights and obligations are not subject to accounting; these are legal relationships. At the same time, the scope of accounting is significantly expanding, going beyond the framework of accounting itself — to the border of political economy. The approach to the accuracy of accounting data depends on the specific conditions of the enterprise's activity — internal (organizational structure, management system, level of professional management and chief accountant) and external (state tax policy, social, cultural and environmental orientation of the company, degree of economic security of national companies) (Verkhovna Rada of Ukraine, 2010).

In turn, Holiachuk and Rykhliuk (2012) indicate that the main task of accounting automation is to provide interested mass users with accounting and analytical information, necessary when making management decisions that can significantly affect the financial situation of a business entity, the well-being of owners (shareholders), directors (managers) and employees.

Effective accounting and analysis of information relevant to management decision making will enable the shift from automated management of business costs to management of the company as a whole. Such a position requires a targeted impact on the costs of developing an integrated system for its management. Achieving this goal will contribute to the production of competitive products and their profitability. Information and automated support systems should focus not only on accounting and cost analysis, but also on their impact on the growth of the company's profitability (Villani et al., 2018).

Koval, Slobodianiuk, and Yakubyshyn (2024) indicate that it is necessary to collect, systematize and process a large amount of diverse information, and continuously monitor the situation, adjust previously developed financial plans based on its results, and consider handling a large amount of additional information. requires the development of an information management system. In other words, management automation requires the construction of a holistic concept that allows making optimal and real decisions based on objective and subjective information, which will contribute to increasing operational efficiency.

Sytnyk (2018) refers to the formation of an integrated information system for the needs of intellectualizing a computerized management system of an industrial company. The structural components of this information system include an internal reporting subsystem, an intellectual knowledge reference subsystem, intellectual knowledge transmission and analysis. Management effectiveness depends on many factors.

One of the most important is the manager's ability to organize work with information sources. To make decisions, control their implementation, form the company's image and monitor employee loyalty, various information is needed. In the information process which is a management activity, information acts as a very important resource. Management can be considered as the process of purposefully processing information and developing a course of action. Information is one of the most important and expensive resources. Providing the company with the necessary information in a timely manner is the most important requirement for the company to function effectively in a competitive market environment. The use of computer technology in automation

increases the efficiency of analytical work, reduces analysis time, more fully identifies the influence of factors and replaces approximate calculations with more precise calculations. Such information should enable the implementation of process management capabilities and guarantee the function of data integration between different information and accounting systems.

The exploration of automation within small businesses, particularly in accounting and management, underscores its significance in steering these enterprises towards sustainable development. The integration of automated systems facilitates a comprehensive analysis of financial data, which in turn enhances decision-making processes. This technological evolution contributes to a paradigm shift in how small businesses approach their operational frameworks, emphasizing the importance of adaptability and strategic foresight in today's dynamic economic landscape. Naseer (2023) delves into the complexities associated with implementing automated solutions tailored to the specific needs of businesses. The challenge of finding a balance between customized and mass-produced software solutions highlights the nuanced considerations that small businesses must navigate to leverage technology effectively. This complexity emphasizes the necessity for a strategic approach to automation, one that is in alignment with the unique characteristics and objectives of each enterprise.

The intersection of automation with sustainable development principles presents a compelling narrative for small businesses. It not only underscores the efficiency gains and cost optimization benefits, but also highlights the role of these enterprises in advancing a sustainable economic model. The shift towards automated systems reflects a broader commitment to eco-friendly practices and resource conservation, further embedding sustainability into the core operational strategies of small businesses.

In essence, the discussion regarding automation as a factor of sustainable development in small businesses presents a holistic view of its transformative potential. As small businesses continue to navigate the complexities of automation, their journey highlights the importance of strategic adaptability, ethical considerations, and a commitment to sustainability in shaping the future of business operations.

Let us try to examine how automation processes are implemented in small businesses in the United Kingdom. In the United Kingdom, there are several companies known for their high levels of manufacturing automation. Here are a few examples:

1. Rolls-Royce Holdings plc: Rolls-Royce is one of the leading manufacturers of engines for the aviation, maritime, and energy industries. They utilize advanced technologies and automation systems in their manufacturing processes.

2. Jaguar Land Rover: As a premium-class automobile manufacturer, Jaguar Land Rover employs advanced automation systems in its factories for automobile production.

3. BAE systems: This company is one of the largest manufacturers of defense technologies in the United Kingdom. They utilize various automated systems for the production of equipment and security systems.

If talking about analyzing a company with a high level of automation, it may be interesting to consider Rolls-Royce Holdings plc. This company is one of the leading manufacturers of engines for the aviation, marine, and energy industries. Rolls-Royce is known for its advanced technologies and automation systems in manufacturing processes. Analyzing this company can help understand how a high level of automation affects their competitiveness, production efficiency, and innovation. It can also be interesting to see how they implement new technologies in the field of aviation and marine engines.

Let us take a detailed look at the impact of automation on the resilience of production processes in Table 1.

Table 1

The impact of automation on the sustainability of production processes using automation mechanisms (in 2023 for Rolls-Royce Holdings plc)

Specific automation mechanisms	**Characteristic**	**Conclusion**
Profitability calculation	Before automation: Net profit / Total expenses = $500 million / $2 billion =	Automated quality control systems are utilized to improve

	25% After automation: Net profit / Total expenses = $700 million / $2 billion = 35%	profitability by avoiding defects and reducing production costs
Production efficiency calculation	Labor productivity before automation: Production volume / Number of employees = 10,000 engines / 5,000 employees = 2 engines per employee After automation: Production volume / Number of employees = 15,000 engines / 4,000 employees = 3.75 engines per employee	Automation mechanisms such as production lines, assembly, testing, and packaging contribute to increased efficiency
Reduction in financial obligations	Total liabilities before automation: $5 billion After automation: $4.5 billion	Automated inventory and logistics management systems are implemented to optimize inventory and reduce its cost
Enhancing innovation and competitiveness	Research and development expenses before automation: $300 million After automation: $400 million	Automation systems such as data analytics and artificial intelligence are utilized to identify new opportunities and optimize production processes

Source: author's own development

Several mechanisms of automation play crucial roles in enhancing the efficiency and sustainability of production. Industrial robots automate the assembly and transportation of components. Quality control systems automatedly identify defects to maintain superior product quality. Automated production management systems streamline process optimization and resource distribution. Integrated systems for logistics and inventory management refine supply chain operations and diminish inventory expenses. Collectively, these mechanisms bolster product quality, elevate productivity, and lower costs, thereby enhancing a company's production competitiveness and sustainability. The direct influence of automation on production process sustainability significantly marks the overall product quality.

Several automated quality control mechanisms can enhance production profitability effectively:

1. Inspection systems employ cameras and specialized software to identify defects and discrepancies in products automatically. These systems are adept at spotting surface flaws in components and assembly system defects.

2. Automated measuring systems measure the dimensions and parameters of products with high precision and rapidity. They ensure product dimensions adhere to established quality standards.

3. X-ray inspection systems are capable of uncovering internal flaws and structural anomalies in products that are challenging to identify using other methods. Such systems are invaluable for discovering microcracks in metal parts or foreign objects within packaging.

4. Ultrasonic inspection systems utilize ultrasonic waves to find internal defects and material irregularities. Predominantly used in the metalworking sector, they are essential for detecting issues in welded joints.

5. Quality control systems based on machine learning and artificial intelligence. These systems use machine learning algorithms to analyze large volumes of data and detect anomalies and defects in production, thus ensuring accurate and efficient quality control.

These automated quality control systems help prevent defects and ensure a high level of product quality, resulting in increased production profitability.

Automation in production affects the stability of production by improving product quality, reducing production deviations and reducing the risk of unforeseen events.

Take, for example, the visual quality control system implemented in the production of automotive components before automation.

Before automation, staff manually inspected each component for defects. In this case, the quality level of the manufactured parts would be 85%.

After implementing an automated quality control system, defects can be detected more accurately and efficiently. For example, visual quality control systems can automatically detect small defects that are difficult to detect manually. Implementation of such a system can increase the level of product quality up to 95%.

Thus, by automating production and implementing a quality control system, companies can increase the quality of their products from 85% to 95%, contribute to increased production stability, and positively affect customer satisfaction and the company's reputation.

Various mechanisms can be used to automate production, such as visual quality control systems, automatic weighing systems, X-ray control systems, ultrasonic control systems, and quality control systems based on machine learning and artificial intelligence.

For example, the implementation of a visual quality control system involves the installation of cameras and specialized software to detect product defects. Once such a production system is implemented, workers will no longer need to manually inspect each product, reducing the chance of errors and ensuring more accurate and efficient quality control.

Thus, automation mechanisms are implemented through the installation of specialized equipment, development of software, and personnel training for effective utilization of these systems. This enables the enhancement of product quality and ensures stability in production processes.

Common automation mechanisms that can be used to improve production quality include:

1. Review systems. Used for automatic detection of defects or inconsistencies in products using cameras and special software.

2. Metrology automation systems. Responsible for automatic measurement of product dimensions and parameters with high accuracy and speed.

3. X-ray control systems. Used to detect internal defects or irregularities in the structure of products.

4. Ultrasonic inspection systems that use ultrasound to detect internal defects or inconsistencies in materials.

5. Quality control systems based on machine learning and artificial intelligence. Machine learning algorithms are used to analyze large volumes of data and detect anomalies or failures in production.

Automated lighting systems use various technologies to optimize and control lighting in industrial and commercial spaces. Here are some ways to automate lighting:

- motion sensors detect the movement of people or objects in the space and turn the lighting on or off accordingly;
- lighting systems with brightness control: technology to automatically adjust the brightness of the light based on natural light or user preferences;
- lighting control software: programs that allow to plan, program and control various aspects of lighting through a centralized control system;
- network communication systems: allow lighting to be connected to the Internet for remote control and monitoring;
- use of temperature and light sensors: sensors determine the light level and temperature in the space and automatically adjust the lighting for optimal comfort and energy efficiency.

The abovementioned technologies can be integrated into a single automated system that allows you to effectively manage lighting with minimal human intervention. The following models are introduced into production (Table 2).

Table 2

Models of automated lighting control systems

Model name	**Examples of models**
Motion sensors	In-ground motion sensors
	Passive Infrared (PIR) motion sensors
	Ultrasonic motion sensors
Dimmers	LED automatic dimming systems
	Dynamic lighting control systems

Software for lighting management	Building Automation Systems (BAS)
	Smartphone-controlled lighting systems
	Centralized lighting control systems
Network communication systems	Wireless lighting control systems
	Internet-connected lighting control systems

Source: author's own development

After applying modern models of automated lighting control, there is a positive indicator. We have the following result before and after changing education to a new, improved one:

- old lighting: accepted products: 800 units, failures: 20 units, total manufactured products: 1000 units, production time: 50 hours;

- new lighting: accepted products: 850 units, failures: 15 units, total manufactured products: 1000 units, production time: 50 hours.

Now we can use the following formulae to assess the impact of the lighting change on the quality and stability of production (Table 3).

Table 3

Formulae to assess the impact of the lighting change on the quality and stability of production

Concept	**For assessment**
Production Quality (Q) = (Number of accepted products) / (Total manufactured products)	For the old lighting: Q = 800 / 1000 = 0.8
	For the new lighting: Q = 850 / 1000 = 0.85
Production Stability (S) = (Number of failures) / (Total manufactured products)	For the old lighting: S = 20 / 1000 = 0.02
	For the new lighting: S = 15 / 1000 = 0.015
Production Efficiency (R) = (Total manufactured products) / (Production time)	

Source: Author's own development.

In these formulae:

1. Q represents production quality, measured in percentages. The numerator indicates the number of accepted products, and the denominator — the total number of products manufactured by the company. Thus, this formula shows the ratio of the number of accepted products to the total number manufactured, expressed in percentages.

2. S determines production stability, also measured in percentages. The numerator specifies the number of defective products, and the denominator — the total number of products manufactured by the company. Also, this formula shows the ratio of the number of defective products to the total number manufactured, expressed in percentages.

3. Thus, both formulas provide a percentage assessment of the quality and stability of production, where a value close to 100% indicates higher quality and stability of production, while a value close to 0% indicates less satisfactory performance.

For both cases, the production time remains unchanged, so R remains the same.

GlaxoSmithKline (GSK): GSK is one of the largest pharmaceutical companies in the world and employs a high level of automation in its manufacturing processes for pharmaceuticals.

These are just a few examples. The United Kingdom has many other companies with high levels of automation in various industrial sectors.

The implementation of production automation significantly affects the stable operation of enterprises. Firstly, it contributes to increasing production efficiency by optimizing processes and automating routine operations. This enables cost reduction and improvement in product quality, creating competitive advantages in the market. With the help of automated quality control systems, enterprises can ensure the stability and reliability of production, which positively influences the company's reputation.

However, it is important to consider

other aspects as well. For instance, automation may lead to a reduction in manual labor, which can result in increased unemployment and changes in workforce requirements. Additionally, there is a risk of dependence on technologies and potential issues with their reliability. Therefore, it is crucial to be cautious and attentive when implementing automation and consider all possible consequences for the sustainable development of the enterprise.

In Rolls-Royce Holdings plc, production automation plays a crucial role in their business. It enables the company to ensure high product quality and optimize manufacturing processes. Thanks to advanced automation technologies and systems, Rolls-Royce delivers engine manufacturing for aviation, maritime, and energy industries at the highest level of efficiency and reliability. Automated systems help reduce costs, increase productivity, and ensure compliance with the highest quality and safety standards. It is known that the management of Rolls-Royce Holdings plc actively supports initiatives for production automation. They understand that automation is a key element in ensuring market competitiveness and increasing productivity. Rolls-Royce invests significant resources in research and development of advanced automation technologies to improve product quality and optimize manufacturing processes.

But in Britain and other developed countries, alongside those who are strong advocates of automation, there are also its opponents (the official website of Rolls-Royce Holdings plc: www.rolls-royce.com). Speaking about the ambiguous attitude towards automation implementation in Britain, it should be noted that the current issue for the United Kingdom is not a job scarcity caused by automation, but rather the economy's incapability to generate higher wages and better job quality. Two points can be emphasized here. The first is the tendency of technology to add to the volume of work in society. The second point is the tendency of technology to undermine job quality. Although workers in the United Kingdom may not encounter an immediate threat of technological unemployment, the likelihood of technology worsening the quality of their jobs is real. Beyond hyperbolic rhetorical statements about "robots taking all the jobs" (BBC, 2014; Daily Mail, 2019; Elliott, 2018), it will be argued below that there is a more objective understanding of the paid work that remains, but under conditions less favorable to many workers. The key aspect here is how low-paid and low-productivity work is reproduced and possibly entrenched alongside technological progress.

It should be noted that contemporary researchers and studies emphasize the significance of examining the context in which automation occurs. In the United Kingdom, there are long-term structural barriers to investment (Kitson and Michie, 1996). On the one hand, this underscores the fact that the UK is short of the dynamic forces that can be necessary for widespread automation. For example, manufacturing in the UK remains lagging in the use of robots (see IFR, 2018a). On the other hand, the trend towards low-skilled and low-productivity employment in the UK suggests that, as automation advances, opportunities to use technological advancements to reshape job assignments and redefine professions in an advanced manner may be overlooked. Some existing narrowly focused jobs may be recognized as obsolete in the UK (BBC, 2014; BBC, 2015).

Debates in economics already suggest that technological progress "extends" the labor market (Goos and Manning, 2007). This discussion is based on the idea that the effect of computerized technology depends on the nature of the work. Where jobs primarily involve routine cognitive or manual tasks, computers and robots may replace human labor. Instead, where jobs are affluent in non-routine cognitive activities, computers act as aids, providing analysis and information to support decision-making, problem-solving, and communication. Empirical research has shown how technology has been directed against routine, moderately skilled jobs in recent decades. These include service jobs as well as in industry. For example, bank cashiers diminished due to the development, initially, of ATMs, and later online banking. Administrative roles involving record-keeping also diminished, while automation increasingly replaces jobs on production lines and assembly in manufacturing and distribution. Nonetheless, technology cannot replace non-routine, manual jobs such as hairdressing, care work, or catering, and alongside high-skilled roles, some of these low-skilled jobs have also

grown in the last years (see data in section 4). Thus, technology has most impacted jobs in the middle part of the income distribution. The elimination of these jobs, in turn, has contributed to greater inequality (Goos and Manning, 2007). Studies such as that conducted by Goos and Manning (2007) confirm the fact that the labor market is becoming more divided, with a growth in "lousy" jobs at the bottom and a growth in "lovely" jobs at the top, with computerized technology as a primary driver.

Recently, there has been growing concern that automation technology is approaching a point where the threat from automation is the loss of jobs altogether. The development of robotics and artificial intelligence (AI) is claimed to be so advanced that they could replace many non-routine, cognitive, and manual tasks, threatening jobs at all skill levels (see Brynjolfsson and McAfee, 2014; Ford, 2015). Academic study, as will be discussed below, remains relatively cautious about the potential extent of employment deprivation; however, as noted above, this caution has not stopped hyperbolic headlines in the media about the likely extinction of work as we know it (for example, BBC, 2014; Elliott, 2018; Daily Mail, 2019). Ideas about the "Second Machine Age" (Bell & Blanchflower, 2018; Berman, Bound, & Machin, 1998; Berriman & Hawksworth, 2017; Brynjolfsson & McAfee, 2014) and the "Fourth Industrial Revolution" (Schwab, 2016) have indeed fueled broader concerns that society is entering a world where human workers, regardless of their skills, will become redundant. One of the often-cited examples of potential automation is driverless cars. Driverless automobiles, which were once unimaginable, are already undergoing testing on public roads. Their widespread usage in the future poses a danger to many driving-based vocations, such as those of taxi and truck drivers. Certain middle-class jobs in healthcare and journalism are also threatened by AI technologies that can diagnose illnesses and write news articles. Additionally, algorithms may replace some legal profession roles (R. Susskind & D. Susskind, 2015; Donnelly, 2018; Goos & Manning, 2007).

In low-skilled professions in retail and catering, which, otherwise, can be considered somewhat insulated from technological advances due to their non-routine elements. Loss of jobs, it is acknowledged, will lead to societal hardships. If those displaced by technology cannot find alternative sources of income, levels of poverty are likely to rise, which could have destabilizing consequences for the economy and society (Ford, 2015). A paid job loss will also result in social and personal costs. In a society that values work and where dignity derives from employment, automation is anticipated to undermine overall quality of life. There is also a threat that automation will exacerbate inequality in society. These assessments have not been without controversy. A fundamental issue is the methodology used to determine the risk of automation, and within this, how the effect of computerization and automation on work is conceptualized (see ONS, 2019b for a short overview). Consequently, as examined further below, estimates of potential job losses from automation differ substantially between studies, and there is yet to be a clear consensus.

The possibility of automation has elicited various policy responses. For instance, Brynjolfsson and McAfee (2014) advocate policies aimed at enhancing workers' skills. If workers can elevate their qualifications through improved education and training, they will be better prepared to interact with the intellectual machines of the future. Others, such as Ford (2015), who sees a decline in jobs as highly probable even with improved investment in human capital, support a "guaranteed basic income." This would provide people with access to income when jobs disappear. Finally, progressive commentators, such as Srnicek and Williams (2015), endorse a program of "full automation." These writers advocate for an industrial policy that hastens the transition to a "post-capitalist" future, where work is annulled.

Nonetheless, a fundamental premise unites these disparate policy responses: a large range of employment are vulnerable and may become less so in the future. It is not a matter of whether jobs will go, but rather of when and how much (Turner, 2018). This premise, though, could be disputed. The next section argues that there are good reasons to think that automation is not going to evolve in a certain way and that institutional context and significant counterbalances should be considered. According to this viewpoint, large-scale employment will persist despite and even as a

result of the ongoing, rapid advancement of technology.

Considering that the effect of new computer and artificial intelligence technologies will be much more unequal across different sectors, and indeed, across different countries. Germany, Japan, and South Korea are considered countries that correspond to the first case, where labor shortages stimulate changes aimed at increasing productivity, while the United States — and, as we argue below, the United Kingdom — are more aligned with the second case (Acemoglu and Restrepo 2019). Another important aspect emphasized by Acemoglu and Restrepo (2019) is the possibility of "redeployment effect" as a result of automation, where new assignments are created in which labor has a comparative advantage. This may arise from the automation itself, with an increase in demand for additional tasks performed by humans.

Frey and Osborne (2017) raise concern that artificial intelligence and cognitive technologies enable the displacement of work in an increasing number of tasks that previously had relatively little impact, as they focused on cognitive abilities. Simply put, they cast doubt on the continuation of the historically significant effect of reinstallation. Akçomak and Restrepo (2019, 25-26; 2020) also point to the recent weakening of the force of the reinstallation effect, but they highlight the significance of institutional factors over the secular trend toward inevitable automation. For example, they note that in industrialized economies, tax systems usually favor the substitution of capital for labor through subsidies for the former and payroll taxes for the latter. This bias toward capital gain affects automation research as much as automation itself, further deepening the transition to labor-displacing technologies (Akçomak & Restrepo, 2020). Beyond purely economic incentives, large technology companies also play a pivotal role in shaping the nature and trajectory of research. Specifically, their innovation strategies and business models are geared toward eradicating the human element from production. The supremacy of these companies in innovation clusters shapes the industry and, through collaboration with universities, dictates the scientific agenda, leading to the risk of entrenching a certain path in the development of artificial intelligence and machine learning technologies (Akçomak and Restrepo, 2020, 8-9). As public funding and impact on innovation direction wane, and the private sector takes the lead, additional impetus has been given to the study that yields short-term profit (and labor displacement) over social welfare goals, such as developing technologies that supplement labor and stimulate the preservation or creation of jobs (Akçomak & Restrepo, 2020). We may also add here how more extensive changes in corporate governance mechanisms - particularly, the rise of the shareholder value model — have strengthened this pressure for automation for short-term gain (Slater & Spencer, 2014; Ford, 2015; Frey & Osborne, 2017). Together, these institutional factors point to the reasons for the likely decline of the "reinstallation effect." They also help explain why, despite the adoption of new technologies, productivity has remained low over the past decade — it turns out that too many "so-so" innovations have been adopted in pursuit of short-term gains.

High estimates of automation risk obtained through such an approach are tricky for several reasons. Firstly, the basis of automation risk assessment relies on the opinions of machine learning experts. This overlooks issues of organizational and job design—namely, the extent to which work can be reorganized and redesigned to adapt to new technologies. It also fails to consider the relative cost of factors and assumes that if current work can be automated, it will be. However, computer scientists and engineers tend to present alternative choices in the nature and degree of integration of new technologies within organizations and are often overly optimistic about the practical application of current technologies (Totterdill, 2017; Davenport & Ronanki, 2018; Felstead & Green, 2017; Green, 2006; Green, Felstead, Gallie, & Henseke, 2016).

Secondly, even if experts fully accounted for organizational capabilities and limitations in assessing the automation potential of jobs in the United States, there is no reason to assume they would be the same in different countries. In this case, something more than just reflecting risk across national systems of job classification is needed.

Thirdly, as Arntz et al. (2016, 2017) extensively discussed, the Frey and Osborne approach neglects internal heterogeneity within

professions, although it may restrict the potential for automation.

The Frey and Osborne approach implicitly supposes that the task composition of a profession is the same across all jobs within the professional class and, as noted above, across countries. However, it is evident that task composition is related to organizational choice and will be determined by management decisions, sectoral context, the availability of workforce skills, existing investments in technology, and entrenchedness, as well as considering the importance of international relations and, at the international level, additional legal, social, and institutional factors (Spencer & Slater, 2020). These various variables, in turn, can be anticipated to influence the level and extent of automation within and across professions, disrupting any clear prediction of massive employment deprivation derived from assessments of the automatability of typical tasks.

In recent years, this problem has been exacerbated by declining real wages. Despite this, we see them as important contributions to the broader discussion that the British economy lacks the necessary social and institutional forces for modernizing production and service provision. The relative cheapness of labor has not incentivized investments, including in new digital technologies. Faced with relatively expensive and risky new technologies, too often firms in the UK opted for the cheaper and more trustworthy option — labor (Clark & Colling, 2017; Clarke et al., 2017; Coulter, 2016). Where new automated technologies have been implemented, there is evidence that they often focused on control or further routinized activities, rather than being seen as an opportunity to reconfigure work tasks and introduce new automated technologies in a way that could enhance long-term productivity prospects. It is not surprising, then, that there is a "productivity problem" in the UK. Discussions about technical change and employment often argue that jobs and new digital technologies complement high-skilled, professional, and managerial roles and help explain the growth of these professions. For the same reason, beyond the primary technologically determined rationale underlying many forecasts of future job risks, there is no reason why medium- and low-skilled jobs cannot be reconfigured to supplement new technologies (and even co-designed with them) (Elliott, 2018). Indeed, it is important to examine the synergies between the design and implementation of new technologies as regards human and organizational factors to ascertain their successful adoption. However, in the UK, there is a risk that there are too few incentives for the positive embrace of automation in these directions.

We recognize that these interventions require further countries to leverage the potential of automation in positive directions. There is a big necessity to depart from the current economic and labor model of the United Kingdom by implementing new investment policies and a renovated industrial and labor market strategy. What we would like to propose here is a critical shift away from a policy of restraint and the adoption of an economic renewal program. Such a program would entail state support for high levels of investment through public expenditure and the raising of minimum wages and labor standards.

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