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Neuronal Models for the Optimization of Inventory, Waste and Informational Flow

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The present study aims to identify and put into practice certain solutions for economic improvement using the Lean Six Sigma (LSS) methodology within companies from the wood processing industry. The main objectives refer to estimating those effects, which are generated by the informational flows in terms of the decision-making process and to identify those areas corresponding to the manufacturing process, which can be improved by using this methodology. The research strategy is based on the use of a questionnaire during 2019–2021, which has addressed to over 150 most important companies from the wood processing industry. In developing the neuronal models for the improvement of stock, the informational flow of the management accounting, costs and for the reduction of the overstock risk in relationship with the waste management was discovered by applying the LSS methodology that the issues were related to inadequate quality records, formality, procedures, and management systems.

Keywords: *Accounting Informational System; Lean Six Sigma; Managerial Decisions; Production's Improvement; Neuronal Networking.*

Introduction

The recent revolution in the fields of management and accounting has resulted from the increasing complexity of business relationships combined with intense competition over the distribution and use of financial resources as well as the marketplace tendering process. These fields serve as primary sources of information and support for decision-making (Tiron-Tudor *et al.*, 2021). In this context, the motivation of the researchers is based on the fact that the complexity and configuration of both the functional and technical and organizational structures of the enterprises, as well as the diversity of the concrete activities that require the presence of managerial accounting, are considered to be essential components of the accounting system. Taking into account both the external and the internal factors, companies are forced to use the production factors, which are reflected by the economic optimum with minimized consumption, namely, their efforts, and to maximize profits accordingly, namely the results of the resources' allocation and use (Siminica *et al.*, 2017; Dumitrascu *et al.*, 2017). In today's economic landscape marked by hostility and tough turbulence, any type of organization tries to find an answer to what seems to be an easy question such as: How can new products or services add an extra value by satisfying the client's requirements based on high standards with low costs and a high quality?

The applicability of Lean Six Sigma in the wood processing industry and the critical elements that lead to waste reduction and productivity improvement are currently the subject of a few studies conducted in Romania; the impact of these factors is still unknown and is primarily addressed in other domains, such as supply chains and the energy sector. Most of the research on this subject uses the quantitative questionnaire approach. For example, Grosu *et al.* (2019) provides solutions for the woodworking industry based on complex reporting and evaluation systems, utilizing a variety of techniques such as Kaizen (a component of Lean Manufacturing), 5Why, Six Sigma, etc. Paltan *et al.*'s (2019) study sought to apply total quality management (TCM) to offer strategies and tactics for streamlining the wood industry's manufacturing. The authors contend that increased customer satisfaction, waste reduction, quality improvement, and product lifecycle management boost profit and increase satisfaction among staff members. Another study conducted at national level (Racolta-Paina & Bunea, 2020) aims to identify the negative and positive aspects from the perspective of the LSS implementation team in a company operating in the business-to-business market. According to the study, members of the LSS implementation team must have a great deal of experience in order to change organizational culture, lower operational costs, boost performance, and enhance customer service. This is because the D.M.A.I.C. Methodology's (Define, Measure, Analyze, Implement, Control) analysis process is difficult due to the volume of data involved.

Therefore, in order to fill the above-mentioned gaps in national research, this study aims to identify and utilize new economically efficient solutions based on the use of Lean Six Sigma (LSS) in the wood processing industry. For this purpose, we used a quantitative research, based on a questionnaire, which was applied among more than 150 Romanian entities in the field. Our analysis reveals that while evaluating the impact of using the latest methodology, there has been both a quantitative and a qualitative improvement of the selected factors as well as of the performances of those who have been part of the project combined with organizational gains combined with the efficiency of using the methodology as such. Also, while estimating the impact of using the latest methodology, the efficiency of both the prices and the costs has been observed and a positive impact on the implementation procedure of the LSS projects in the wood processing industry has been found.

Therefore, by discussing and investigating the strategies for re-engineering the business process and offering solutions to optimize decision making to produce long-term changes in quality, cost, service, leadership, flexibility, and innovation in woodworking companies, we hope to advance knowledge in the field. First, by identifying the limits and obstacles in the implementation of LSS, we were able to estimate the results generated by the information flows in the decision-making process, as well as the delimitation of the corresponding areas of the production process that can be improved. Second, we were able to create a useful tool to boost productivity and guarantee the long-term viability of the company by developing neural models to enhance inventory, management accounting information flow, expenses, and the risk of overstocking in connection to waste management. Also, the use of the neuronal methods can serve as an important guide for the companies in this specific field of activity that prefer the use of the LSS concepts to monitor their activities more rigorously. Finally, this study’s aim is to increase public awareness of the effective handling of waste and rejects arising from the production of wood materials.

Subsequently, the relevant papers for the scientific approach are examined in the following section. The following sections present the study's methods, results, discussion as well as the study's limitations and conclusions.

Literature Review and Hypothesis Development

The topic of using LSS as part of the companies’ activity in the wood processing industry as well as its impact on the managerial decision-making, the efficiency of costs and processes or the optimization of the activity have led to a plethora of the recently published studies (Shokri *et al.*, 2021). Nevertheless, there are still gaps in terms of adjusting this methodology to certain fields of activity such as the wood processing industry. As far as the LSS methodology is concerned, it refers to more than a set of techniques than a philosophy or an attitude, which refers to the continuous efforts to best reduce and eliminate the waste from an organization, the main focus being the client’s demands, namely its relationship with him/her from the point of view of the profit or non-profit brought about by the internal processes (Parwani & Hu, 2021; Hardy *et al.*, 2021). The added value activities represent the only activities for which a client is willing to pay.

In the next stage of the study, the research hypotheses were formulated. In constructing them, the previous findings obtained in five inspiring and internationally relevant researches (Urbina *et al.*, 2022; Purnomo & Lukman, 2020; Sujova *et al.*, 2017; Guerrero *et al.*, 2017; Sujova & Marcinekova, 2015). Further validation of hypotheses will be a milestone in the development of neural optimization models.

Rejikumar *et al.* (2020) state that employee perceptions of a process's complexity or ease of use play a significant moderating role in decision makers' intentions to adopt an appropriate infrastructure that can disseminate accurate and timely data. Sujovaa & Marcinekova (2015) also point out that, in the wood-processing industry, decision-makers should consider internal process management, which they claim is at the lowest level, in addition to product quality. in this context, we establish the first working hypothesis which is as follows:

Hypothesis 1– When the information channels are complex, the qualitative input from the informational flow could negatively affect the management decision (i.e., the information itself might be inappropriate).

According to Folinas *et al.* (2017), there is no significant correlation between Just in Time (JIT) and important zero-level stock management practices and elements and financial-based performance indicators. This is the result of applying a quantitative method to examine whether JIT practices positively affect business performance. Also, according to Grosu *et al.* (2019), establishing a Lean production flow is necessary to enable the provision of goods and services only when necessary, in the appropriate amounts, and with the necessary degrees of quality. Numerous gaps and inconsistencies in the information flow revealed by the production process and other economic or business processes could be reduced if different stages of the process were connected and dedicated instruments for data collection, distribution, and gathering were created, allowing information to be provided even to the external environment. Based on these facts, we state the second working hypothesis, namely:

Hypothesis 2 – Both the disorder of the bookkeeping (i.e., the overdue bookkeeping) and the over stock (i.e., the maximized costs) are significantly impacted by the informational flows of management accounting.

When discussing sustainable production, Sujova *et al.* (2017), highlights that it has to do with how efficiently production processes operate, which is usually determined by managerial choices regarding direct costs and fixed costs. To create an abstract model of the manufacturing process, the authors use the numerical optimization method, in particular the artificial neural network method, to analyze measured and calculated experimental values of input and output parameters. Based on these findings, we formulate the following hypotheses:

Hypothesis 3 – Production cost optimization can be implemented based on managerial decisions that estimate cost reduction through reducing direct expenditures and fixed costs.

Although in the literature the use of LSS is considered to bring many benefits such as the fact that it accelerates problem solving, aimed at reducing costs and waste and improving customer satisfaction (AlArjani *et al.*, 2021; Wang & Chen, 2012), negative aspects have also been identified, such as the fact that it is not flexible and universal. Moreover, its implementation will fail to generate added value (Kesterson, 2018). Furthermore, there are erroneous approaches which are caused by the misunderstanding of the Lean concept, such as its implementation which would lead to a reduction of jobs in those companies making use of this tool in spite of the fact that the main reason of the very use is nothing but making the workforce more efficient (Singh *et al.,* 2021). The solving methodology of issues related to the Six Sigma has been used for the improvement of the processes as such. This is the reason why the DMAIC stages have been well-defined and standardized, however, the steps related to each, and every stage may vary according to the reference which has been used (Panayiotou *et al.,* 2020; Yadav *et al.,* 2019; Grosu *et al.,* 2019; Ertürk *et al.,* 2016). The Defining stage is the one during which the aim of the ongoing process is defined, whereas the aim of the Estimation stage is to understand and estimate the present process. The Analysis stage interprets the data that have been gathered during the Estimation stage in order to identify the profound causes of the identified issues. Consequently, in the Improvement stage certain mechanisms and solutions for the improvement of the processes are being used. It is followed by the Control stage (Patel, 2016) which ensures that the improvements have had a positive impact and that they will be supported and monitored in the future. In this context, we also state the fourth hypothesis, namely:

Hypothesis 4 ‒ One of the most important components of the management strategy is reducing waste through manufacturing process optimization. This can only be done if manufacturing processes are linked to the accounting information system to share the weaknesses, which are the overstock and the lack of accounting information.

Experience across a broad range of industry sectors has demonstrated that applying the LSS strategy is a useful means of locating and measuring the primary problems in a production process in order to boost output, profitability, and quality. In spite of this, there aren't many instances of LSS adoption in small businesses, particularly in the wood products industry (Susanty *et al.,* 2021).

The study conducted by Minh (2023) identifies ten key factors that are essential to the successful implementation of an LSS project. The most significant of these are thought to be employee commitment to effective communication that fosters team leadership and management, as well as top management involvement and direction, and a project's clear direction and goals and objectives. Furthermore, Laukkanen *et al.* (2017) contend that managers ought to create opportunities for staff members to interact and communicate with different stakeholders more, as well as between sales, production, R&D, and customers. These interactions can spur idea generation and improve comprehension of an organization's capacity for innovation. Thus, based on previous literature and empirical findings, we formulate the last hypothesis:

Hypothesis 5 – The best management accounting evaluation of the storage procedures can only be attained if the stakeholders' demands are met by the current informational system, as long as internal operational control is carried out promptly and accurately and communication with the decision-making mechanism is operating as intended.

In light of this, earlier research contends that the concept of developing a value flow as a component of the manufacturing process itself correlates with providing goods and services at the appropriate times, in the appropriate amounts, and in accordance with the anticipated standards of quality.

This is the reason why the LSS tools are the most frequently used for eliminating errors, waste or in order to get value flows (Parwani & Hu, 2021; Cudney *et al.,* 2014). Taking into account the fact that the LSS represents an approach focussing on quality improvement, the reduction of variation and waste elimination within an organization (Cudney & Agustiady, 2016), we could state that it represents a mixture of a couple of improvement programs (i.e., Six Sigma and Lean Enterprise). For example, Cudney *et al.* (2014), believe that the Lean tools are most frequently used in eliminating waste and in improving flows such as: Value Stream Mapping, 5S and the visual management, Single Minute Exchange of Dies – SMED, Flow, Pul land Kanban, Mistake proofing, Standardization, and the Theory of constraints. On the other hand, LSS is considered a methodology, which is used for the analysis of the manufacturing stages and has, as its final goal, the increase of clients' satisfaction, the improvement of the production costs and the enhancement of profitability (Panayiotou *et al.,* 2021; Singh *et al.,* 2020; Uluskan, 2019; Onofrei *et al.,* 2019). Nowadays, LSS is being presented as a well-structured concept which is used in different types of activities such as: the efficiency of the existing processes with the help of DMAIC (Define, Measure, Analyse, Improve, Control) (Panayiotou *et al.,* 2021; Hardy *et al.,* 2021; Sahno *et al.,* 2015); the analysis and the improvement of the cost of the finished products; as a support instrument in designing new products using Design for Six Sigma (DFSS) (Kouroush *et al.,* 2018).

In order to delineate more clearly the sectors within the manufacturing processes, which can be improved based on Lean Sigma as a result of the estimation of the results that are generated by the informational flows within the decision-making process, we have provided a synthesis of the main research studies, which have got up-to-date relevant results (see Annex 1).

By analyzing the authors' interest over time, we can state the fact that a fairly large number of organizational innovations such as Total Quality Management, JIT, Lean manufacturing, Six Sigma have come up recently. In this particular context, the business' sustainability has become more and more relevant for the companies' long-term success. This fact confirms that those companies which fails to reconsider their business model, will not succeed in creating a competitive advantage for themselves (Andreev *et al.,* 2022; Socoliuc *et al.,* 2020). However, no study has examined the organizational culture or has estimated the availability in terms of the sustainable implementation of the LSS projects for the manufacturing sector (Shokri *et al.,* 2021). Under these circumstances, we have focused on an empirical analysis in order to identify the solutions for the waste and inventory's optimization as well as of the informational flows, which will be able to ensure a sustainable development of an entity as such and which will also contribute to the improvement of the specialty literature itself.

Research Methods

We chose a quantitative research approach based on a questionnaire that was sent to over 150 of the most significant companies in the wood processing industry between 2019 and 2021 in order to accomplish the study's goal. The research design includes 45 questions in total, all based on specialized literature (Purnomo & Lukman, 2020; Pinto *et al.*, 2022; Minh, 2023). Respondents were evaluated based on a mixed set of questions, with the questions pertaining to managers or accountants who are involved in the process of reporting their own companies or accounting experts within rehabilitation companies who are accountable for these companies' financial reporting. The questionnaire is divided into 3 sections, namely: S1 – The analysis of the analytical indicators; S2 – The analysis of the risk indicators; S3 – The analysis of the optimization indicators (see Annex 2).

The sample comprised wood processing companies from the Northeast region of Romania; these companies were chosen based on their adherence to the principle of continuity of activity over the previous five years, regardless of their size (hierarchy corresponds to turnover, total assets, and number of employees). Companies in industries related to wood processing, businesses that are not registered in Romania, businesses that withheld pertinent information about stock management, businesses that did not fully respond to every question in the questionnaire, and businesses that have shut down within the last five years were also not included in the sample. After applying these standards, the survey consisted of only 128 companies.

We consulted the primary approaches to stock efficiency (Total Quality Management (TQM), Just in Time (JIT), Lean Management, LSS, and Balance Scorecard) when creating the inventory optimization matrix (see Annex 3). The primary functions assigned to each methodology, along with their operational level and methods of achievement, have all been determined.

Results and Discussions

The questionnaire's questions themselves have been used to determine the key variables that were chosen (as demonstrated in Annex 2, which assigns a number to each question in the questionnaire). The primary areas of weakness in the management of the stocks have been determined, along with potential areas for optimization using neural models, based on the correlations between the variables that were chosen. After taking into consideration the specific answers received from using the questionnaire itself, the following conclusions can be made:

- From the perspective of the end result, a sizable portion of the sample—31.3 %—has reported losses; the respondents have responded to all questions regarding turnover.

- The information about stocks is more satisfactorily satisfied by the current informatics programs than that about waste (61.7 %); the primary concern regarding the management of the stocks is the lack of or inadequate accounting information. This could be brought on by either inadequate or nonexistent operational information that goes into the accounting data.

- The primary cause of those gaps in the managerial or accounting decision-making mechanisms is a lack of or an inadequate amount of operational information.

- The tasks of processing, polishing, and assembling are the most wasteful in manufacturing. These are closely related to the human capital that gives rise to waste in the first place. Therefore, the primary issues that cause financial loss for businesses in the wood processing sector are an unskilled workforce, distractions, and inappropriate equipment use.

- In the future, the respondents expressed interest in using an informational program that would enable them to keep an eye on the various stages of the manufacturing processes, as well as waste and material records for raw materials and unfinished products, all of which are closely related to these processes. Additionally, by identifying procedures that optimize the use of raw materials, materials consumption, etc., and do not create added value, this software can assist managers in making decisions. Most of them (i.e., 66.4 %) are eager to learn more about the program or are considering testing or buying it.

The design of the inventory's optimization matrix

In the present statistical analysis, the respondent companies have been classified according to size, namely their turnover. This type of structuring has allowed a much more accurate dissemination of the information. As a result of analyzing the main levels which were initially established combined with a specific implementation methodology for each and every program, it could be observed that there are a series of advantages and disadvantages based on their use as such according to the company's size and the particular interest for fulfilling a maximum level of the related functions. This aspect results primarily from the object of developing the method (i.e. costs' control, processes' control etc.) as well as from the company's size. It has been observed by the data interpretation that large business companies tend to take better control of the inventory issues, yet they have a lower control on the manufacturing processes as well as the quality on different levels. Unlike large companies, the small companies tend to have a better control on the production quality, which is geared towards inventory, the optimization of the space etc.

As far as the TQM is concerned, the utility function revealed by the model is 81, 25 % (maximum level). Consequently, the method focusses on the reduction of the production costs, on the elimination of the defective products prior to their shipment, on the reduction of the costs of the defective units during the manufacturing process, on the reduction of the external costs (i.e. warranty, recalls, financial losses resulting from the loss of reputation), yet it is not capable of providing a holistic image of the manufacturing system. Quality-wise, the method's impact percentage on its insurance of 48,44 % leads to the conclusion that the quality assurance function becomes a complementary one which is like the efficiency function of 81,25 %. As far as the efficiency function of 48.44 % (average score), it can be considered as a usability function. These findings are in line with the results of the study undertaken by Paltan *et al.* (2019), which states that once properly implemented, TQM is highly effective in meeting its objectives as the company grows larger. The analysis of the statistical data shows that those processes generating losses are those related to the processing and polishing processes. When relating them to the companies' value, the conclusion is that the losses of the processing and polishing stages come up more frequently for the macro entities or for the small entities. This fact is the result of the lack of specialized departments or of specialized software for monitoring the companies' waste, which allows us to validate working hypothesis 3. As far as the JIT method is concerned, the usability model revealed by the model is 85.94 % (maximum degree). Unlike the TQM, this method focuses on the reduction of the production costs, on the reduction of the costs for the flaw units within the manufacturing process, on the reduction of the processes for their optimizing as well the management of the production areas and the inventory. The study has shown that quality assurance function is of 50 % (average level). We believe that it is a very efficient method when implemented and monitored accurately (85.94 %). The rationale behind these results is that the JIT method is widely recognized as the cornerstone for attaining flexible manufacturing performance. The impact of JIT practices can be amplified in organizations that prioritize Total TQM; in the absence of TQM, the JIT method falls short of providing a comprehensive view of the manufacturing system (Phan *et al.*, 2019).

As far as Lean Management is concerned, the usability function revealed by the model is 85.94 % (maximum). The method's focus is the client himself as well as his availability of paying for a high-quality product at a competitive price. The method focuses on the reduction of the production costs, the reduction of the costs for the flaw units during the manufacturing process, the reduction of the costs of the processes based on their optimization and on the management of the production areas and of the inventory, too. Moreover, the method monitors the waiting time of the machinery with the help of SMED (Cudney *et al.*, 2014). The above-mentioned matrix shows the fact that the method is efficient only when implemented and monitored accurately (85.94%). The implementation speed is slow, yet it has a high impact in the future. As far as the quality assurance function is concerned, our findings are in accordance with previous studies (Hosseini & Peer, 2022) how states that the percentage is high (i.e. 60.16 %) yet not enough to address a series of errors and deficiencies such as: the lack of operational information influencing the efficiency, the optimization of the manufacturing processes etc. The efficiency function is high (i.e. 85.94 %) which means that the inventory's control, the processes' control, the prevention of errors and the improvement of the distribution chains are accomplished at an optimal level. This method also comprises a monitoring function for a high performance (i.e. 85,94 %) which confirms the fact that the respondent companies focus on its further optimization and monitorization in order to design an accurate future operation framework. Similar to TQM method and unlike the JIT, the Lean Management method provides a holistic image of the manufacturing system. The method itself is efficient if it is implemented and monitored correctly, whereas the implementation method is slow and has a significant impact in the future. The LSS has a higher usability function (i.e. 90.63 %) than Lean Management due to the fact that it refers to the possible extra use of certain statistical and simulation tools.

In terms of the quality assurance role, the proportion is sufficiently high (i.e. 60.16 %), similar to the one of Lean Management due to the fact that is makes use of the same group of methods and tools. The efficiency and efficacy functions have similar percentage with Lean Management, whereas the monitoring function of the performances within the LSS methodology has a major impact in terms of the design and the monitoring of an optimal system for controlling each stage of the manufacturing process. By analyzing the issues arising within the studied companies, we can observe the fact that big companies, unlike the small ones, have greater control of the inventory. However, the weak points appear the moment when the manufacturing processes are monitored. The long and complex streams comprise inherent issues generating losses. This statement is further reinforced by Dao (2021), which emphasizes how these flows are fundamentally connected to inefficient processing times, storage areas during two processing stages, extended machine configuration times, etc. In retrospect, we can state the fact that the LSS stands for a natural step in the development of the integrated control of production quality.

The Design of the Optimization Neuronal Models

The variables corresponding to Model 1 (10PINF; 11SOLUTIL; 12EfMDM; 13EfIC; 14EfCOP; 15EfOPTPP) were subject to the use of the neuronal correlation and the covariance test on those levels, which were generated by the 3NSal and 4CA variables. The test has generated valid values for 128 cases, and it was excluded for 24 cases. The sample's testing percentage was 71.7 % whereas for 28.3 % certain optimization options have been generated. The volume of the statistical optimization test in a network has generated a covariation standardized index and tangent hyperbolic activation function for a 3-level sequential entropy corresponding to 9STCPB dependent variable.

In terms of the variables of the model 2 (16RbPREL; 17RbACHIZ; 18RbFINIS; 19RbDESF; 20RbASAMBL), the covariation test was used on the levels that were generated by the 3NSal and 4CA variables. The summary of the test has generated valid values for 128 cases and 24 excluded cases. The testing process of the sample was 65.6 % whereas for the rest of 34.4 % several optimization options have been generated (see Table 1). The size of the statistical optimization test as part of a network has generated in terms of 9STCPB dependent variable a standardized covariation index as well as a tangent hyperbolic activation function for the level 4 sequential entropy. This fact confirms the H1.

Through the SPSS program, the neural correlation procedure was applied to define the neuronal model for the optimization of the informational flows in relationship with the inventory's management by using the multilayer perception model of the following variables:

- 10PINF – The software satisfies the informational requirements for the inventory record;
- 11SOLUTIL – There are solutions for solving the supra storage issues when they were identified;
- 12EfMDM -The lack of operational information influences the efficiency of the managerial decision-making;

- 13EfIC – The lack of the operational information influences the efficiency of the accounting information;
- 14EfCOP – The lack of the operational information influences the efficiency of the operational control;
- 15EfOPTPP – The lack of operational information influences the optimization of the manufacturing processes.

Table 1

Networking Diagram for the Four Neuronal Optimizations of the Inventory/ Waste/Informational Flows

			Network Information			
			Model 1	**Model 2**	**Model 3**	**Model 4**
Input Layer	**Factors**	1	10PINF	16RbPREL	30SPOPT	41VAB
		2	11SOLUTIL	17RbACHIZ	31MONITPINF	42ChDir
		3	12EfMDM	18RbFINIS	32DMSIG	43ChIndir
		4	13EfIC	19RbDESF	33ICDECIZ	44ChFix
		5	14EfCOP	20RbASAMBL	34PRTBCstPROD	45ChVar
		6	15EfOPTPP		35PRTBCstAchiz	
	Covariables	1	3NSal	3NSal	3NSal	3NSal
	Number of Units[a]		12	11	20	12
	Rescaling Method for Covariables		Standardized	Standardized	Standardized	Standardized
Hidden Layer(s)	Number of Hidden Layers		1	1	1	1
	Number of Units in Hidden Layer 1[a]		3	3	1	4
	Activation Function		Hyperbolic tangent	Hyperbolic tangent	Hyperbolic tangent	Hyperbolic tangent
Output Layer	Dependent Variables	1	9STCPB	9STCPB	9STCPB	9STCPB
	Number of Units		3	3	3	3
	Activation Function		Softmax	Softmax	Softmax	Softmax
	Error Function		Cross-entropy	Cross-entropy	Cross-entropy	Cross-entropy

Source: Own based on SPSS vs 25

The covariation test has been used on these variables corresponding to the levels which were generated by the 3NSal variables, the number of employees (the supra storage is directly influenced by the ability of the individuals to plan, manage and forecast the optimal volume of the inventory). The summary of the test has generated valid values for 128 cases whereas 24 cases have been excluded. The sample's testing summary was 68 % whereas for the rest of 32 % optimization choices have been suggested. The size of the optimization statistical test in a network has generated for the dependent variable 9STCPB – The main issues identified in the management of the inventory of finished products, raw materials a covariation standardized index and a tangent hyperbolic activation function for a 3rd degree sequential entropy (based on Table 1). The findings of the model reflect the causality relationship of the complex variable for a supra storage especially due to the lack of information (i.e. overdue bookkeeping), 58.1 % detrimental to the unique causes (i.e. supra storage or lack of information), 41.9 % according to the Figure 1.

The percentage of the variables, which have been used is higher than the testing percentage. This fact validates the neuronal model and proves that, from the sensitivity point of view, the lack of information due to the overdue bookkeeping is one of the causes of supra storage and not vice versa. The variation in terms of the trend curb is more flattened when there is a poor management of the information based on the specialized software (i.e. 10PINF). There is a lack of interest for searching for useful solutions to avoid the supra storage (i.e. 11SOLUTIL), a decision-making mechanism suffering from the lack of information (12EfMDM), the accounting information are distorted given the absence of certain information from the operational activity (i.e. 13EfIC). Also, there is an unjustified trust in the efficiency of the of the operational control given the absence of the operational information (i.e. 14EfCOP), the lack of information as a result of the operating activity has a negative impact on the optimization of the efficiency of the manufacturing processes (i.e. 15EfOPTPP). This finding confirms the validity of H4.

The same neuronal correlation procedure has been used in terms of the neuronal optimization model for the informational flows in relationship with the management of the inventory in order to define the neuronal risk model of supra storage in relationship with waste management based on the multilayer perception of the variables such as:

- 16RbPREL – The highest waste number is related to the processing stage;
- 17RbACHIZ – The highest waste number is related to the purchase of the material;

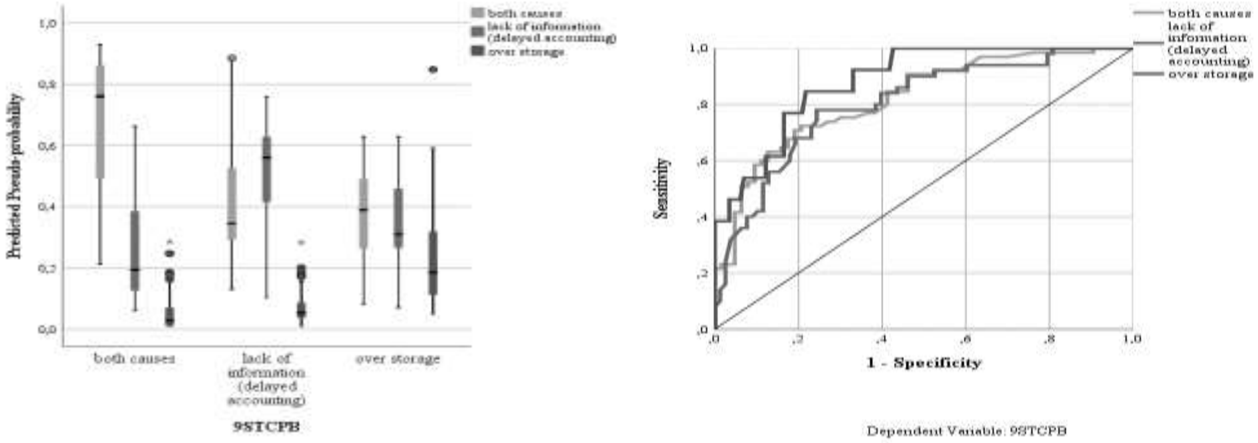

Figure 1. Sensitivity Analysis and the Forecast Distribution Probability of the Dependent Variable on Components (Complex and Unitary Causes on the Malfunction in Terms of the Inventory's Management) for the Neuronal Optimization Model 1

- 18RbFINIS – The highest number of wastes is related to the polishing stage;
- 19RbDESF – The highest number of wastes is related to the retail stage;
- 20RbASAMBL – The highest number of wastes is related to the assembling stage.

The covariation test has been used on the above variables on the levels, which were generated by the variable entitled "Number of employees" (i.e. 3NSal). The summary of the test has generated valid values for 128 cases and 24 ruled out ones. The testing percentage of the sample was of 71.1 % whereas for the rest of 28.9 % some optimization options have been generated. The size of the statistical test for the optimization of the network has generated for the dependent variable entitled 9STCPB – The Main Issues Which Were Identified in the Management of the Finished Products, Raw Materials a standardized covariation index as well as a tangent hyperbolic activation function for a 3rd level sequential entropy (according to Table 1). The results of the model show the causality relationship of the complex variable in the event of a supra storage mainly due to the lack of information (i.e. overdue bookkeeping), 60.4 % detrimental to special situations (i.e. supra storage or lack of information), whereas 39.6 % are shown in the figure below. This finding leads to the validation of H2.

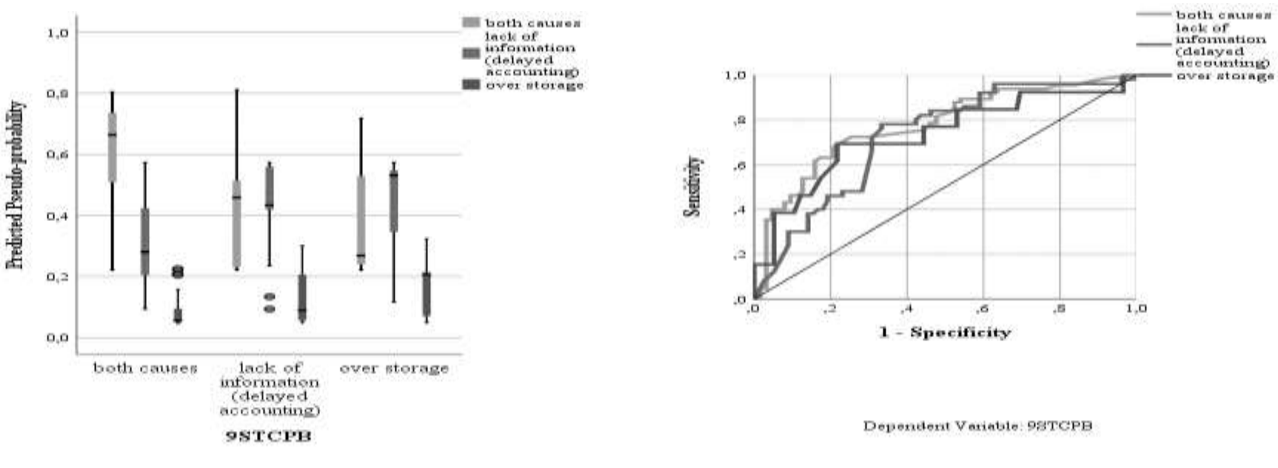

Figure 2. Sensitivity Analysis and the Forecast Distribution Probability of the Dependent Variable on Components (Complex and Unitary Causes on the Malfunction of the Inventory's Management) for the Neuronal Optimization Model 2

Regarding optimization model 2, the implemented variable percentage (67.6 %) outperforms the testing percentage (57.1 %). This fact supports the neural model and shows that, from a sensitive perspective, the supra storage cause—rather than the vice versa—is the lack of those data resulting from past-due bookkeeping. Due to a lack of data regarding the amount of waste generated, mostly during the processing stage, the variation in the trend curb is more flattened. (i.e. 16RbPREL) and followed by the polishing stage (i.e. 18RbFINIS) and the assembly stage (i.e. 20RbASAMBL), while the volume of waste does not have a significant impact on the supra storage in the retailing stage (i.e. 19RbDESF) as well as the purchasing stage (i.e. 17RbACHIZ).

In order to design the neuronal model 3 for the optimization of the management accounting system in relationship with the timeliness and the availability of those information which are useful for the inventory management, the multilayer perception procedure of the variables refer to:

• 30SPOPT – The optimal use of the space where the manufacturing activity takes place;

• 31MONITPINF – The monitoring of those processes based on a software program is beneficial for the business itself;

• 32DMSIG – The managerial decisions are based on information pertaining to the management accounting;

• 33ICDECIZ – Accounting data satisfy the informational requirements in the decision-making process;

• 34PRTBCstPROD – The decision-making process can be disturbed by the overdue gathering of the information on the production cost;

• 35PRTBCstAchiz – The decision -making process can be disturbed by the delay of information gathering regarding the purchase cost of the products.

The covariation test has been used on these variables from the levels, which have been generated by the 3NSal Number of employees variables. The results of the test have generated valid values for 125 cases and 27 excluded ones. The testing percentage of the sample was of 67.2 %, whereas for the rest of 32.8 % certain optimization options have been generated. The size of the statistical optimization test in the network has generated for the dependent variable entitled 9STCPB – Main issues identified in the management of the inventory of the finished products a standardized covariation index and a tangent hyperbolic activation function for a 3rd level sequential entropy as shown in Table 1. Unlike the first two models, the results of the model show the causality relationship of the complex variable for the supra storage especially due to the lack of information (i.e. an overdue bookkeeping), 71.4 % detrimental to some unique causes (i.e. supra storage or lack of information), 28.6 % as shown in the Figure 3:

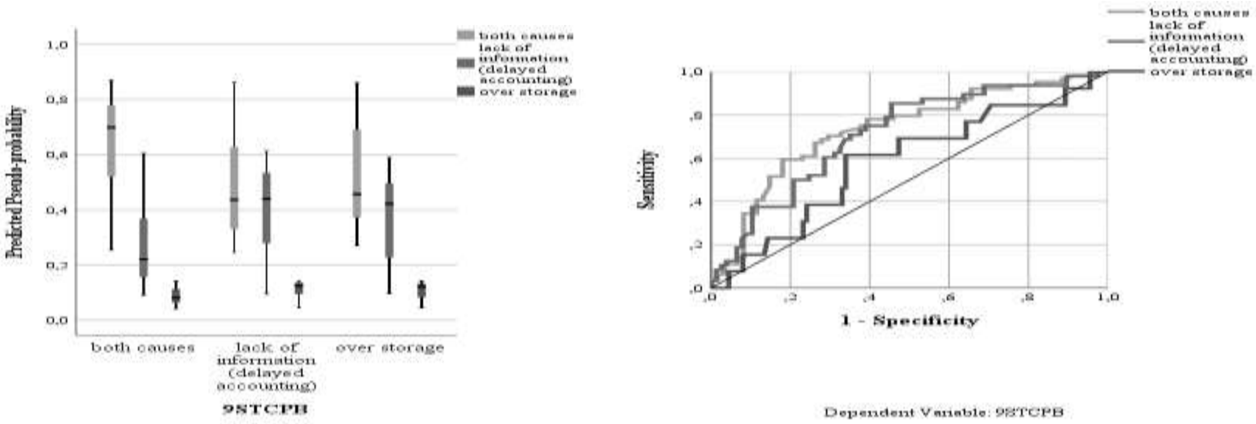

Figure 3. The Sensitivity Analysis and the Forecast Distribution Probability of the Dependent Variable on Components (i.e. Complex and Unitary Causes Regarding Malfunctions of the Inventories' Administration) for the Neuronal Optimization Model 3

We can observe that the percentage of variables that were used (63.4 %) in the optimization model 3 is higher than the testing percentage (59.5 %). This finding supports the neural model and shows that, from a sensitive perspective, the supra storage is what leads to the managerial accounting's shortcomings. Furthermore, the inability to obtain information on the purchase cost contributed to the decision-making process's support for the trend curb variation, which is more flattened for the supra storage (i.e. 35PRTBCstAchiz), the production cost (i.e. 34PRTBCstPROD), the lack of monitoring those processes using the specialized software (i.e. 31MONITPINF), the misuse of the production spaces (i.e. 30SPOPT), the misuse of the management decisions based on those information which is generated by the management accounting (i.e. 32DMSIG) and meeting the inside stakeholders' informational accounting requirements (i.e. 33ICDECIZ).

In order to design the neuronal model 4 for the optimization of the production costs in relationship with the optimization of the direct and indirect expenditures, of the fixed and variable expenditures based on the variables' multilayer perception procedure, the following issues need to be considered:

• 41VAB – The possibility of identifying the activities/processes which fail to generate added value to the activity itself;

• 42ChDir – The value of the production costs which can be improved represent direct expenditures;

• 43ChIndir -The values of the production costs which can be improved represent indirect expenditures;

• 44ChFix -The values of the production costs which cannot be improved are fixed expenditures;

• 45ChVar- The values of the production costs which can be improved are variable expenditures.

The covariation test has been used on these variables on the levels, which were generated by the variable entitled "Number of employees" (i.e. 3NSal). The summary of the test has generated valid values for 128 cases and 24 ruled out ones. The testing percentage of the sample was of 75 % whereas for the rest of 25 % some optimization options have been generated. The size of the statistical test for the optimization of the network has generated for the dependent variable entitled 9STCPB – The Main Issues Which Were Identified in the Management of the Finished Products, Raw Materials a standardized covariation index as well as a tangent hyperbolic activation function for a 3rd level sequential entropy (see Table 1). The results of the model show the causality relationship of the complex variable in the event of a supra storage mainly due to the lack of information (i.e. overdue bookkeeping), 51 % detrimental to special situations (i.e. supra storage or lack of information), whereas 49 % are shown in the figure below:

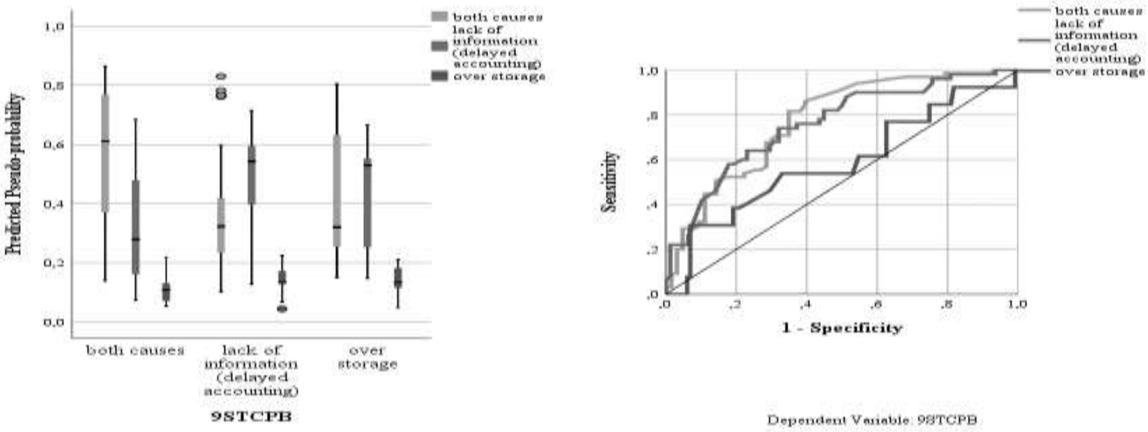

Figure 4. The Sensitivity Analysis and the Forecast Distribution Probability of the Dependent Variable on Components (i.e. Complex and Unitary Causes Regarding Malfunctions of the Inventories' Administration) for the Neuronal Optimization Model 4

Regarding optimization model 4, the employed variable percentage (65.6 %) is higher than the testing percentage (62.5 %). This finding supports the neuronal model and shows that, from a sensitive perspective, inadequate management of production costs—direct, indirect, fixed, and variable expenses—is a result of the supra storage. Regarding the dependent variable's variation in relation to the trend curb, there is a flattening that, in the supra storage case, is related to the inability to identify those processes that lack the added value (i.e. 41VAB), by the absence of the information generated by the management accounting or by the management's interest regarding the percentage of the direct expenditures (i.e. 42ChDir), by the indirect expenditures(i.e. 44ChFix), by the variable expenditures (i.e. 45ChVar) out of the total of the production costs. This finding supports H3.

In conclusion, the results correspond to the information technology and to these methods and tools. Consequently, having in view the present-day degree of economic development, the serious shortage of internal information which the management of the micro entities, the small and average entities must face, the present economic and sanitary crisis, certain software need to be designed in order to allow the control of inventory of materials, disposables, the intermediate products, manufacturing recipes based on technical details from the wood processing industry. These have been basically the main points which have served as the foundation for the designed software application. It helps in the formulation of the answers and solutions to the questions aa well as of the shortcomings of the present-day operational systems.

Conclusions

The present-day dynamics of the markets has had the management of the manufacturing companies revolutionize the internal processes in order to have a quick response to the external fluctuations. Moreover, companies' main interest has shifted towards the strict control of the cost in terms of the management of the clients' demands in terms of the quality of products, their prices as well as the speed of the shipments as such. As a result, businesses must create management models that can provide effective design solutions, monitor the cost system, analyse economic processes, and enhance them from the perspective of both their value flows and timeline. Thus, we can state that it is a fact that the future trends in terms of the management accounting will naturally address the dilemmas of the decision-making systems by answering the following questions such as: What is the best way of improving the quality of the goods and services? How could productivity be improved?

The analysis of the main present activity's optimization systems leads to a series of big opportunities in terms of the use of informational technology at a larger scale (Grosu *et al.,* 2023). Therefore, it is a fact that, from the perspective of accounting, processes related to economic and financial activity will become even more computerized in the future. This is because larger data sets and accounting quantities, or those that have an accounting impact, will be analysed, interpreted, and used in the decision-making process.

As the final remark, the authors would like to emphasise that the results can really aid in the design of a software application, which will respond to the information technology for these methods and tools. Thus, having in view the present-day economic development stage, the serious lack of internal information that the management of the micro entities must face, the small and average ones have to design certain software, which will enable the control of the inventory of materials and of other disposables, the control of the inventory of the intermediate products, manufacturing prescriptions based on technical specifications from the wood processing industry. This research contributes to the existing body of knowledge, by offering answers and solutions to the questions and drawbacks of the present-day operational systems. The solutions offered by the present study can be reused for any company, which is specialized on manufacturing wood products. These solutions deal with the problems of effectively managing inventory, minimizing, or doing away with manufacturing process defects, and handling extra inventory inside processes. It also covers topics like how to minimize manufacturing flaws linked to irreversible waste, cut down on management errors, and save time lost to inefficient operations. As a result, for this kind of work, a management system that is always focused on improvement must be put in place, and employee training ought to be given top priority right now. It is crucial to apply specific operating procedures and address different issues within the organization, but it's also necessary to be able to apply internationally recognized standards (like ISO 9000).

A number of the study's limitations were noted. The study examined distinct consumption and production processes using a single final product across multiple batches and manufacturing dates. The application was developed and used in the company under analysis due to the complexity of the work and the need to cover all aspects related to stocks. As a future research direction, we propose to include every product in the investigated company's portfolio. In the future, we also intend to expand the KataFlow program to incorporate computer monitoring of production processes, resulting in a comprehensive information flow and a powerful control tool for the management of the business. Moreover, we intend to modify the software to monitor production processes in these industries as well after analysing the various production types (food, textiles, etc.).

Annexes

Annex 1

The Synthesis of the Main Impact Studies on the Researched Field

Authors, year	Studied phenomenon	Results	Timeliness and impact on the research
Kaswan *et al.*, 2023	This paper addresses the selection of sustainability-oriented Green Lean Six Sigma (GLS) projects in manufacturing in a complex decision-making environment.	Using grey relationship analysis (GRA) to classify potential GLS projects into a production industry based on six sustainability criteria, the study demonstrates that the productivity criterion is the most significant among the other criteria.	It is an impact study that demonstrates that decision making is becoming complex enough to select an effective project due to the intriguing nature of various criteria, sub-criteria, and aspects of sustainability.
Urbina *et al.*, 2022	This paper puts forward a pilot program that will lower issues and have a positive economic impact by boosting productivity and cutting costs.	This study suggests a quality management model that makes use of Lean Manufacturing techniques to decrease defective product counts and enhance internal quality.	This impact study shows how businesses are implementing methods and procedures to gradually cut waste and modify the production paradigm to meet market demands in response to a range of challenges.
Hosseini, & Peer, 2022	Based on literature, the opportunities offered by streamlining decision-making processes in the wood manufacturing industry are examined, along with related obstacles and difficulties.	The design and implementation of optimal decision-making systems is addressed in the paper by examining the methodologies used in the literature.	It is an impact study because it identifies research gaps and suggests future directions for further investigation, as well as offering guidelines and references for scholars and manufacturers who are interested in the subject.
Singh & Rathi, 2021	A broad analysis of the implementation impediments of the LSS in the SMEs so that the use of the LSS is much more fluent in terms of the SMEs.	The ISM model points out the fact that the significant barriers for the management itself play a key role in influencing the implementation of the LSS in the SMEs.	The present study presents the original research papers in terms of identifying and designing those barriers which are associated with the implementation of the LSS in the SMEs based on the ISM-SEM hybrid approach.
Singh *et al.*, 2021	The factors enabling the efficient implementation of the LSS in the SMEs.	As far as the favoring factors of the LSS are concerned, the research outcomes reveal that strategic based enablers are leading in nature, followed by environmental-based enablers.	The study represents an argumentative impact research regarding the implementation of environmental LSS in MSMEs to achieve the goal of various sustainable initiatives; the results are validated through the Analytical Hierarchy Process and Analytical Network Process.
Chavez *et al.*, 2020	The study suggests a value chain of processes, emphasizing components that enable the removal of non-value-adding activities and regulate the critical process' variability.	By cutting production expenses and times without sacrificing product quality, SMEs are becoming more productive.	It gives manufacturing managers the ability to assess operating systems, apply integrated methodologies, raise Six Sigma levels by fifty percent, and enhance operational outcomes by six percent in furniture manufacturing firms.
Panayiotou *et al.*, 2020	The study refers to the implementation of the LSS in a manufacturing entity from South-East Europe in order to understand the importance of the key success factors (CSF) in using LSS and in order to identify the company's profits.	The analysis of the case study reveals the fact that the company benefits financially, operationally and organizationally from the implementation of the LSS.	The study suggests a specific set of tools for small projects based on DMAIC, which can be implemented in other LSS projects.

Source: Author's compilation

Annex 2

Centralization of Questionnaire Responses and their Classification According to the Nature of the Indicators

Type of indicator/ Section	Description	Symbol	Versions of answers
Counter	Number of respondents	V1	152 out of which 128 valid respondents and 24 excluded ones
Analitical	Geographical location	V2	Botosani 17 respondents 13,28 %; Vrancea 9 respondents 7.03 %; Bacău 15 respondents 11.72 %; Neamț 33 respondents 25.78 %; Vaslui 9 respondents 7.03 %; Galați 5 respondents 3.91 %; Suceava 37 respondents 28.91 %; Iași 3 respondents 2.34 %.
Analitical	Number of employees	V3	1 20 respondents 15.63 %; 10 50 respondents 39.06 %; 50 44 respondents 34.38 %; 100 10 respondents 7.81 %; 150 3 respondents 2.34 %; 200 0 respondents 0 %; 250 1 respondents 0.78 %; 300 0 respondents 0 %.
Analitical	Value of turnover (in Euros)	V4	0 - 500,000 64 respondents 50 %; 500,001–1,000,000 27 respondents 21.09 %; 1,000,001–2,000,000 19 respondents 14.84 %; over 2,000,000 18 respondents 14.06 %.
Analitical	The size of the economic entity	V5	micro entity 79 respondents 61.72 %; small entity 39 respondents 30.47 %; average or big 10 respondents 7.81 %.
Analitical	Total assets (in Euros)	V6	0 - 500,000 64 respondents 50 %; 500,001–1,000,000 31 respondents 24.22 %; 1,000,001–2,000,000 17 respondents 13.28 %; over 2,000,000 16 respondents 12.5 %.
Analitical	Total equity (in Euros)	V7	1 - 500,000 87 respondents 67.97 %; 500,001–1,000,001 29 respondents 22.66 %; 1,000,001–2,000,001 5 respondents 3.91 %; over 2,000,001 7 respondents 5.47 %.
Analitical	Value of net profit (in Euros)	V8	loss 40 respondents 31,25 %; 0–100,000 60 respondents 46.88 %; 100,001–500,000 23 respondents 17.97 %; over 500,000 5 respondents 3.91 %.
Risk	Issues related to the inventory management	V9	not 1 respondent 0.78 %; supra storage 13 respondents 10,16 %; lack of information (overdue bookkeeping) 49 respondents 38.28 %; supra storage, lack of information (overdue bookkeeping) 65 respondents 50.78 %.
Risk	The existence of the software for the inventory records	V10	No one 17 respondents 13.28 %; to a small extent 48 respondents 37.5 %; to a high extent 48 respondents 37.5 %; to a huge extent 15 respondents 11.72 %.
Risk	The existence of the solution in order to solve the issues generated by the supra storage	V11	Not interested 2 respondents 1.56 %; strict monitoring done by an individual 6 respondents 4.69 %; specialized software 120 respondents 93.75 %.
Risk	The lack of information influencing the decision-making process	V12	Yes 60 respondents 46.88 %; No 68 respondents 53.13 %.
Risk	The lack of information influencing the efficiency of the accounting information	V13	Yes 111 respondents 86.72 %; No 17 respondents 13.28 %.
Risk	The lack of information influencing the efficiency of the operational control	V14	Yes 98 respondents 76.56 %; No 30 respondents 23.44 %.
Risk	The lack of information influencing the efficiency of the optimization of the manufacturing processes	V15	Yes 46 respondents 35.94 %; No 82 respondents 64.06 %.
Risk	The prevalence of a big volume of waste in the trimming stage	V16	Yes 126 respondents 98.44 %; No 2 respondents 1.56 %.

Type of indicator/ Section	Description	Symbol	Versions of answers
Risk	The prevalence of a big volume of waste in the acquisition of supplies	V17	Yes 19 respondents 14.84 %; No 109 respondents 85.16 %.
Risk	The prevalence of a big volume of waste in the finishing stage	V18	Yes 81 respondents 63.28 %; No 47 respondents 36.72 %.
Risk	The prevalence of the big volume of waste in the retailing stage	V19	Yes 10 respondents 7.81 %; No 118 respondents 92.19 %.
Risk	The prevalence of the big volume of waste in the assembly stage	V20	Yes 82 respondents 64.06 %; No 46 respondents 35.94 %.
Risk	The prevalence of a big quantity of waste in the storage stage	V21	Yes 11 respondents 8.59 %; No 117 respondents 91.41 %.
Risk	The occurrence of waste, whether recoverable or irrecoverable, due to insufficient or inadequate staff expertise	V22	Yes 102 respondents 79.69%; No 26 respondents 20.31 %.
Risk	The issue of what can be recovered or cannot be recovered due to staff negligence	V23	Yes 115 respondents 89.84 %; No 13 respondents 10.16 %.
Risk	The issue of recyclable or non-recyclable waste resulting from mishandled equipment	V24	Yes 109 respondents 85.16 %; No 19 respondents 14.84%.
Risk	The problem of recoverable or non-recoverable waste resulting from inaccurately calibrated equipment	V25	Yes 14 respondents 10,94 %; No 114 respondents 89,06 %.
Risk	The problem of recyclable or non-recyclable waste resulting from staff apathy	V26	Yes 115 respondents 89,84 %; No 13 respondents 10,16 %.
Risk	Waste management is done with an appropriate software	V27	highly unlikely 79 respondents 61,72 %; to a small extent 36 respondents 28,13 %; to a large extent 8 respondents 6,25 %; to a very large extent 5 respondents 3,91 %.
Risk	The existing solutions for solving the waste issues	V28	not interested 3 respondents 2,34 %; strict monitoring by a single individual 10 respondents 7,81 %; specialized informatic program 115 respondents 89,84%.
Risk	The percentage of the recoverable/irrecoverable of CA waste	V29	5-10 % 101 respondents 78,91 %; 11–20 % 21 respondents 16,41 %; over 20 % 6 respondents 4,69 %.
Optimization	The optimum value of the working space	V30	highly unlikely 6 respondents 4,69 %; to a small extent 22 respondents 17,19 %; to a large extent 75 respondents 58,59 %; to a very large extent 25 respondents 19,53 %.
Optimization	Interest for increasing attractiveness for monitoring the processes by using an informatic software	V31	highly unlikely 3 respondents 2.34 %; to a small extent 8 respondents 6.25 %; to a large extent 15 respondents 11.72 %; to a very large extent 102 respondents 79.69 %.
Optimization	The management decisions are based mainly on management accounting information	V32	highly unlikely 7 respondents 5.47 %; to a small extent 33 respondents 25.78 %; to a large extent 67 respondents 52.34 %; to a very large extent 21 respondents 16.41 %.
Optimization	The accounting information influence the decision-making process	V33	highly unlikely 12 respondents 9.38 %; to a small extent 51 respondents 39.84 %; to a large extent 45 respondents 35.16 %; to a very large extent 20 respondents 15.63 %.
Optimization	Overdue gathering of the information on the production cost has an impact on the decision-making process	V34	Yes 106 respondents 82.81 %; No 22 respondents 17.19 %.

Type of indicator/ Section	Description	Symbol	Versions of answers
Optimization	Overdue gathering of the information on the purchase cost has an impact on the decision-making process	V35	Yes 26 respondents 20.31 %; No 102 respondents 79.69 %.
Optimization	Overdue gathering of information regarding the waste proportion has an impact on the decision-making process	V36	Yes 116 respondents 90.63 %; No 12 respondents 9.38 %.
Optimization	Overdue gathering of data regarding several intelligence information has a negative impact on the decision-making process	V37	Yes 114 respondents 89.06 %; No 14 respondents 10.94 %.
Optimization	Information regarding the quantity of raw materials contributing to the efficiency of the activity and of the decision-making process	V38	Yes 113 respondents 88.28 %; No 15 respondents 11.72 %.
Optimization	Details about the amount of incomplete goods, which improves the activity's efficiency and the process of making decisions	V39	Yes 87 respondents 67.97 %; No 41 respondents 32.03 %.
Optimization	Information regarding the specific manufacturing processes contributing to the efficiency of the activity and the decision-making process	V40	Yes 117 respondents 91.41 %; No 11 respondents 8.59 %.
Optimization	The option to identify the activities/processes, which do not bring about added value to the activity itself	V41	No 101 respondents 78.91 %; I don’t know 8 respondents 6.25 %; Yes 19 respondents 14,84 %.
Optimization	The value of the production costs, which can be optimized are direct expenditures	V42	Yes 94 respondents 73.44 %; No 34 respondents 26.56 %.
Optimization	The optimization of the production costs based on overheads	V43	Yes 95 respondents 74.22 %; No 33 respondents 25.78 %.
Optimization	The optimization of the value of the production costs based on fixed expenditures	V44	Yes 53 respondents 41.41 %; No 75 respondents 58.59 %.
Optimization	The optimization of the value of the production costs based on variable expenditures	V45	Yes 52 respondents 40.63 %; No 76 respondents 59.38 %.
Optimization	The need for testing or purchasing a new software program to solve certain aspects related to the manufacturing processes	V46	Yes 19 respondents 14.84 %; Probably 24 respondents 18.75 %; Yes 85 respondents 66.41%.

Source: Author’s own elaboration

Annex 3

The Inventory’s Optimization Matrix

Programs	Functions’ typology	Functionality level	Actions taken to accomplish function	Variables projected	Weak points	Optimization gaps based on the neuronal models
TQM	Usefulness 81,25 %	Average	Prevention costs of the defects prior to manufacture	V1; V16; V17	The highest waste number can be found in the processing stage	Optimized

Programs	Functions' typology	Functionality level	Actions taken to accomplish function	Variables projected	Weak points	Optimization gaps based on the neuronal models
			Costs for eliminating the defective products prior to their shipment	V1; V4; V5; V18; V19	The highest number of wastes are in the polishing stage	-
	Quality ensurance 48,44 %	Maximum	Cost for eliminating the defective products prior to their shipment	V1, V19		-
	Risks' reduction 36,52 %	Average	-	V16; V17 V18	All the functions	-
	Efficiency 81,25 %	Maximum	-	V16; V17		-
	Efficacy 48,44 %	Average	-	-		-
	Performances' monitoring	Minimum	-	-		-
JIT	Usefulness 85,94 %	Maximum	Control of inventory and processes	V10, V11	Possible issues with the supply chains. The gaps may generate issues within their own processes.	
	Quality ensurance 50,00 %	Minimum	Offers information on both the inventory and processes for the managerial decision-making	V12–V15	Lack of operational influence the efficiency of the accounting information.	Optimized
	Risks' reduction 38,45 %	Average	Control of the inventory and of the processes	V9–V15; V30–35; V41–45	All functions	Optimized
	Efficiency 85,94 %					Optimized
	Effectiveness 50,00 %	Maximum	If accurately and coherently implemented, it generates minimum costs and maximum effectiveness.	V30–V35		Optimized
	Performance's monitoring	Minimum	-	-		Optimized
Lean Management	Usefulness 85,94 %	Maximum	Inventory's control Processes' control	V9–V15; V30–V33; V41–V45	Improper implementation may generate disturbances in the monitored activity. It requires an expertise, a pretty long-lasting training period.	Optimized
	Quality ensurance 60,16 %	Maximum	Inventory's control Processes' control It prevents errors It improves the distribution chains	V9–V15; V30–V33; V41–V45		Optimized
	Risks' reduction 38,45 %	Minimum	-	-	-	-
	Efficiency 85,94 %	Maximum	Inventory's control Processes' control It prevents errors It improves the distribution chains	V9–V15; V30–V33; V41–V45		Optimized
	Performance's monitoring 85,94 %		It further optimizes and monitors the optimizations in order	V40–V45		-

Programs	**Functions' typology**	**Functionality level**	**Actions taken to accomplish function**	**Variables projected**	**Weak points**	**Optimization gaps based on the neuronal models**
			to design an accurate future operational framework			
LSS	Usefulness 90,63 %	Maximum	Inventory's control Processes' control Waste control Possible price simulations for the new products Simulations for the optimizations of activities	V9–V45	A wrong implementation may generate disturbances within the monitorized activity It requires expertise It requires a pretty long-lasting training period	Optimized
	Quality ensurance 60,16 %		Inventory's control Processes' control Waste Control Possible price simulations for new prices Simulations for the optimization of activities	V9–V45	Incorrect implementation can lead to disruption of monitored activity Requires expertise Requires a fairly long training period	Optimized
	Risks' reduction 42,46 %	Maximum			-	Optimized
	Efficiency 90,63 %		Inventory's control Processes' control Waste control Possible price simulations for the new products Simulations for the optimization of activities	V9–V45	A wrongful implementation may generate disturbances within the monitorized activity It requires expertise It requires a pretty long-lasting training period	Optimized
	Effectiveness 90,63 %			V9–V45		Optimized
	Performances' monitoring 82,81 %		It further optimizes and monitors the optimizations to design an accurate future operational framework	V9–V45		Optimized

Source: Author's own elaboration

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