BIBLIOMETRIC ANALYSIS ON THE CONTRIBUTION OF INTERNAL COMMUNICATION, MANAGERIAL ACCOUNTING AND CONTROL TOOLS IN THE MANAGEMENT OF PRODUCTION ACTIVITIES

ANALIZĂ BIBLIOMETRICĂ PRIVIND APORTUL COMUNICĂRII INTERNE, CONTABILITĂȚII MANAGERIALE ȘI INSTRUMENTELOR DE CONTROL ÎN GESTIONAREA ACTIVITĂȚII DE PRODUCȚIE

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Abstract. The image or overall performance of a company is determined by many internal and external factors that exert a more or less marked influence on it, depending on the specifics and characteristics of the activity carried out. This paper focuses on the importance of the interconnectivity of business functions related to internal communication, managerial accounting and control tools in the efficient and effective management of production activity. Bibliometric analysis of the literature was carried out using VosViewer and Bibliometrix software, and the determined variables were used for the analysis of the interconnectivity of the analyzed areas by means of the cluster method, statistical processing was carried out using SPSS v.26 software. The results demonstrate a significant positive correlation between the analyzed domains, as they play a significant role in the internal and external evaluation of a company, but they also require a more in-depth and updated approach to the concepts, appropriate to the new interests and trends existing in the economic environment.

Keywords: internal communication; managerial accouting; control instruments; interconnectivity;

JEL Classification: D83, L20, M41,

Introduction

The performance of any organisation is determined, among other things, by the proper functioning of departmental structures and internal functions that complement each other and together ensure the smooth running of the organisation towards the achievement of its objectives. We believe that in a company that carries out production activities, the most significant internal functions that can ensure efficient, optimal and timely management of available resources are internal communication, managerial accounting and production control management. This statement is based on the fact that the decision-making mechanism - which effectively represents the business management process - is based on intra- and inter-departmental communication and information transmitted through all hierarchical levels, with managerial accounting ensuring the accuracy and reality of the financial and cost data transmitted to the production department and used to optimise the control management represented by the tools used to monitor and evaluate production performance.

In this context, the *aim of* the present research is to demonstrate the complementarity of the roles of these functions of a manufacturing organisation in supporting its functionality and boosting its performance. In order to achieve this aim, the following *objectives* were pursued: $O_1 - t_0$

scientifically substantiate the concepts of internal communication, managerial accounting and production activity control tools; $O_2 - to$ carry out a bibliometric analysis using the cluster statistical method in order to identify the interconnectivity of the functions analysed. This approach ensures the relevance and significance of the research in the current economic context.

Research Methodology

To perform the bibliometric analysis, the Web of Science (WoS) platform was used, from which three databases were exported, totalling 10707 scientific papers, representing the result of searches according to the following conceptual structures: "internal communication" (2825 results), "managerial accounting" (7335 results) and "tools to control production activity" (547 results) and the application of filters to ensure the relevance of the scientific fields selected for integration into the database. The analysis took into account the first 1000 search results which were exported in Excel format in order of their relevance to the searched topic and then processed in VosViewer, resulting in a network of clusters showing the correlation between the concepts analysed. The variables thus obtained were used to build the econometric model to support the application of the cluster method in identifying the interconnectivity of the analysed domains. The econometric model formula is presented in the next section of the paper.

Literature Review

From a general perspective, communication is one of the basic functions of society, being indispensable for the development of any social structure, representing a transfer of information, ideas, attitudes and emotions from one person to another person or group, with the aim of modifying or influencing a certain behaviour (Tkalac Verčič et al., 2021). Particularly, internal communication creates and maintains communication systems between employers and employees, executive and management, and is identified as an increasingly important part of communication practice and as one of the core activities of management, vital for organizational success (Sincic Coric et al., 2020). In the same vein, Pace & Fauls argue that the internal communication process is the display and interpretation of messages and information between the communication units of an enterprise (Pace & Faules, 1994) between which there are hierarchical relationships established according to the organisational structure. Defining the concept of internal communication from the perspective of stakeholder theory again emphasises the existence of hierarchical relationships between the subjects involved in communication, and it is seen as "strategic management of interactions and relationships between stakeholders within organisations" in order to meet the information needs of each category of stakeholders, this communication also involves interrelated dimensions that include "internal line manager communication, internal team peer communication, internal project peer communication and internal corporate communication" (Welch & Jackson, 2007; Men, 2021). It can therefore be seen that there is a need for both horizontal communication between members of the same hierarchical level and vertical communication, communication that crosses one or more hierarchical levels until it reaches the final recipient of the information. All this intra- and inter-departmental communication and the exchange of information between different hierarchical levels is at the heart of building the development and investment strategies of organisations, and is essential for decision-making in all aspects of the organisation's work.

Given the complexity of internal communication, it can be viewed from several perspectives, with Kalla (2005) identifying four such approaches: *business communication* which refers to the communication skills of all employees, *management communication* which focuses on the development of managers' communication skills and capabilities, *corporate communication* which refers to the formal corporate communication function, and *organisational communication* which addresses more philosophical and theoretical aspects of internal communication. All these approaches are interlinked and it is impossible to separate them categorically, as each of them has its own

importance and role within the organisation, and together they contribute to the effectiveness of the consolidated communication system existing throughout the organisation.

In order to be clear about the significance of the areas under consideration, I believe it is important to define them clearly so that their role and importance in the context of a business environment is well understood. Thus, among the most common definitions of accounting can be found in the Accounting Terminology Bulletins issued by the American Institute of Accountants in which it is presented as "the art of recording, classifying, and summarizing in a meaningful way and in monetary terms, transactions and events which are at least in part financial in character, and of interpreting the results thereof" (American Institute of Accountants, 1953). We can see that this definition focuses more on the technical and practical aspects that accounting involves, leaving aside the underlying motivation and purpose behind these actions, which are however captured by Deegan in the *Financial Accounting* paper written in 2019, he presents accounting as that practice that is concerned with "providing information about aspects of an entity's performance to a particular group of people who have an interest or stake in the organization - these parties may be called stakeholders" (Deegan, 2019). A more recent definition however, and more appropriate to the current context dominated by the concept of sustainable business development, has been offered by Carnegie, et al., (2021), they consider accounting as "a technical, social and moral practice concerned with the sustainable use of resources and appropriate accountability to stakeholders to enable the development of organisations, people and nature." From this definition we can see the inclusion of social and moral, i.e. non-financial, aspects in the spectrum of interest and action of accounting, and there are relevant studies showing that a company's involvement in social actions can lead to increases in financial performance, an improvement in image and therefore an increase in market value.

As far as managerial accounting is concerned, we can appreciate that it has evolved over time from simple cost accounting methods (necessary for financial accounting), to complex methods, techniques and mechanisms (Chenhall & Moers, 2015), capable of providing management with real-time and accurate information related to any process or action involved in the production activity and beyond. Given this major change, we cannot overlook the fact that the role of the management accountant has also changed significantly, this fact is also captured by Fry, et. al., (1994) who points out that in this context, "the accountant must become an educator to the factory management in the proper use of alternative systems, but also a student of manufacturing to understand the production process, product requirements, and the company's production strategy." Therefore, a management accountant must have a thorough knowledge of the stages of the production process, as well as the resources involved in each of these stages, precisely in order to be able to propose and implement the most efficient and timely methods and techniques for managing and accounting for costs, resources and production results within a company.

Any enterprise carrying out economic activities of any kind needs to implement an effective control system in order to be able to know the progress made and the performance achieved, as well as the less good aspects that need improvement and corrective initiatives, these aspects being essential especially for enterprises with a production profile, since the dynamics of the activity carried out by them is particularly influenced by cost elements that must be well planned, managed and controlled in order to ensure the highest profitability of the production recorded. In the same vein, Reyes (2023) appreciates that production control is the process of supervising, managing and controlling the tasks involved in the production of goods, using different control techniques to meet production targets in a timely manner and in accordance with quality requirements and standards. The stages of this process of controlling production activity are discussed in various articles and papers in the literature, and according to Malsam (2023) they are as follows:

 \rightarrow *Planning: this involves* defining the production process from start to finish, including the type and quantity of materials required, the equipment to be used, the product to be produced and its quality, with the aim of identifying the most efficient method;

 \rightarrow Scheduling: the schedule of the production process is established taking into account the duration of each stage, their order, the date they will take place and the deadlines for completion;

 \rightarrow *Dispatching:* the actual start of the production process and material flows with the implementation of the planning and scheduling already carried out with their centralised or decentralised routing;

 \rightarrow *Monitoring:* following the production process to identify any problems and defects by measuring the variation between the planning and scheduling carried out and the actual progress made, this stage is dedicated to evaluating the efficiency of the production process and developing new ideas to improve it;

 \rightarrow *Inspection:* ensuring compliance with best practice in the production process and industry-specific safety and quality standards by conducting audits.

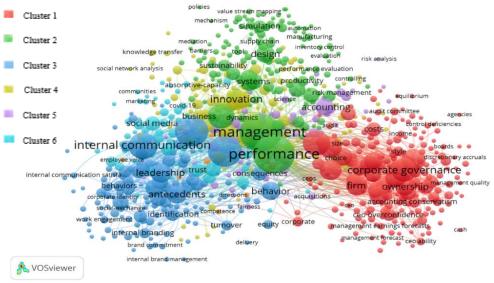
In a summarised form, we can say that the process of controlling the production activity includes planning, monitoring and evaluating it, which are also influenced by the customers' requirements, as products can be mass-produced according to certain standard characteristics in order to constitute the stock of goods or on demand, according to the specific characteristics of each individual customer, depending of course on the nature and destination of the goods manufactured. All these steps mentioned above are essential to maintain the efficiency, objectives and performance of the production process in any business, for which various monitoring and management tools are implemented.

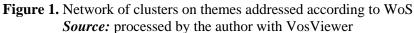
Results

According to the classification provided by Kalla (2005), corporate communication refers to the means of formal communication within an organisation and their importance and role in ensuring the functionality and efficiency of an organisation's activities of all kinds, and this paper focuses on the communication tools specific to this type of communication in the context of a manufacturing company (discussed at length in the second chapter), addressing of course the indispensable role of managerial accounting and manufacturing control tools and the interconnectedness of these areas of interest. In this context we can speak of production reporting or analysis (https://www.jaspersoft.com/articles/what-is-production-reporting) in various forms as the main tools of internal corporate communication - usually between two or more hierarchical levels - which make extensive use of managerial accounting information and principles and play an essential role in the ongoing and subsequent control of the production process through the key performance indicators (KPIs) they provide. Achieving optimal performance in each of the three areas mentioned (internal communication, management accounting and production control tools) is essential to ensure effective management of the production activity, which in turn has the ability to generate value creation and hence an upward trend in business performance and profitability. This statement also underlines the complementarity of the roles of the areas studied in ensuring the continuity of efficient and effective business activity. Thus, in this context, the interconnectivity between the areas studied is evident, although there are no papers in the literature with a detailed approach to this perspective, but there are many scientific papers that present an individual approach to the research areas mentioned, from both a managerial and economic perspective.

In order to identify the interconnectivity between the fields studied, three databases were exported from the Web of Science (WoS) platform, one for each scientific field analysed, and generated by the search engine using the following filters: "internal communication" (2825 results, on the domains Management, Economics, Business Finance), "managerial accounting" (7335 results, on the domains Management, Economics, Business Finance) and "tools to control production activity" (547 results, on the domains Engineering Manufacturing, Management, Economics, Business Finance, Industrial Engineering, Agricultural Engineering, Robotics, Operations Research Management Science), from

which the first 1000 results for the three searches were exported and processed, according to their relevance.





According to the cluster network shown in *Figure 1* above, a number of 6 clusters were formed based on 734 elements, and based on the keywords with the strongest links in each cluster, they were named as follows: first cluster - *corporate governance*, second cluster - *managerial accounting*, third cluster - *internal communication*, fourth cluster - *innovation and production development*, fifth cluster - *performance measurement and control*, sixth cluster - *corporate social responsibility*. Thus, themes of interest to the areas analysed can be observed, the figure above showing a strong interconnectivity between them.

Considering that the intensity of the interconnectedness of the scientific fields selected for analysis is determined by the links between the keywords collected, their frequency of occurrence (which was set to a minimum of 5 to strengthen the relevance of the terms considered) and the average number of citations for the papers included in the analysis, the following econometric model was developed in the form of a linear regression:

$$TLS = \alpha + \beta_1 \, cluster + \beta_2 \, L + \beta_3 \, FO + \beta_4 \, NC \tag{1}$$

where:

TLS - Total Link Strength; L - Links; FO - Frequency of Occurrence;

NC - Average Number of Citations.

The variables contained in the econometric model above were obtained by processing the data exported from WoS in the VosViewer program. Thus, the dependent variable TLS (*Total Links Strength*) represents the strength of connections between the keywords analyzed, and the independent variables L (Links) reflects the number of connections of a keyword with other members of the cluster network, FO (*Occurences*) shows the frequency of occurrence of a keyword in the cluster network, and NC (Average Citations Number) reflects the average number of citations of the paper of which the keyword is a part (Eck & Waltman, 2018). All these variables were entered into the SPSS v.26 program for statistical processing to substantiate the econometric model presented above.

		Cluster	Links	Frequency of occurrence	Average number of citations	Total link strength
Cluster	Pearson Correlation	1	-,080*	-,075*	-,112**	-,094**
	Mr (1-tailed)		,015	,020	,001	,006
	N	734	734	734	734	734
Links (L)	Pearson Correlation	-,080*	1	,936**	,045	,955**
	Mr (1-tailed)	,015		,000	,112	,000
	N	734	734	734	734	734
Frequency of occurrence (FO)	Pearson Correlation	-,075*	,936**	1	,010	,983**
	Mr (1-tailed)	,020	,000		,392	,000
	N	734	734	734	734	734
Average numberPearson Correlation		-,112**	,045	,010	1	,030
of citations (NC) Mr (1-tailed)		,001	,112	,392		,210
	N	734	734	734	734	734
Total link strength (TLS)	Pearson Correlation	-,094**	,955**	,983**	,030	1
	Mr (1-tailed)	,006	,000	,000	,210	
	N	734	734	734	734	734

Table 1 Pearson correlation between the variables of the econometric model

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

Source: processed by the author with SPSS v.26

According to Table no. 1 above, a significant correlation can be observed between the variables forming the econometric model, except for the NC variable which shows a significant negative correlation only with the *Cluster* variable, suggesting that an increase in the number of clusters in the exported database would lead to a decrease in the average number of citations per scientific paper, and a decrease in the number of clusters would lead to an increase in the average number of citations, since an increase in the number of clusters suggests an increase in the volume of scientific output, which means that the number of citations per paper should be related to a higher number of citations of papers published in a single year, thus decreasing the value of this variable. It can be seen that *the* NC no longer shows significant correlations with any of the other variables, but although the correlation is weak, it is a positive one, which tells us that they influence each other in the same direction. We can see that the strongest positive correlations of 0.983, 0.955 and 0.936 are between the variables FO, L and TLS, which means that the higher the frequency of occurrence of a keyword (themes), the more links are formed and the stronger the significance of the links between them, thus generating a more homogeneous cluster network. Therefore, according to the Pearson correlation shown in the table above, there are significant correlations between the variables taken in the analysis, which underlines their interconnectivity and importance in determining the cluster network.

Table	2.	Model	summary
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Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,988ª	,977	,977	23,333

a. Predictors: (Constant), Average number of citations, Frequency of appearance, Links, Cluster

b. Dependent Variable: Total link strength

Source: processed by the author with SPSS v.26

Table 2 above shows a strong correlation of 0.988 between the variables considered in the analysis, the value of R square being 0.977, which means that the variation of the independent variables

explains 97% of the variation of the dependent variable, thus validating the econometric model developed.

		Unstandardized Coefficients		Standardized Coefficients		
Model		В	Std. Error	Beta	t	Mr
1	(Constant)	-14,534	2,277		-6,383	,000
	Cluster	-1,505	,536	-,016	-2,805	,005
	Links	,786	,045	,279	17,487	,000
	Frequency of occurrence	4,466	,099	,721	45,169	,000
	Average number of citations	,050	,034	,008	1,449	,148

Table 3. ^a regression coefficients

a. Dependent Variable: Total link strength

Source: processed by the author with SPSS v.26

Table 3 above shows the regression coefficients that will be used to complete the econometric model as follows:

TLS = -14,534 - 1,505 * cluster + 0,786 * L + 4,466 * FO + 0,05 * NC (2) According to the regression coefficients table, only the *Cluster* variable shows a negative correlation with the dependent variable, which means that as the number of clusters increases, the overall strength of the links decreases, as the network becomes more dispersed due to new concepts and results being updated in the literature, thus forming new research clusters. As for the impact of the variable *Average number of citations* on the dependent variable, it is small as indicated by the related regression coefficient (0.05), with the Sig indicator far exceeding the 0.05 threshold set for showing correlation significance. The most significant correlations with the dependent variable can be found in the *Frequency of occurrence* (4.466) and *Links* (0.786) variables, which is understandable, since when the frequency of occurrence of a keyword or its links with other members of the cluster network increases, the interconnectivity of the whole network also increases, thus leading to a greater homogeneity of the network.

Although it has not been possible to identify scientific works in the literature that deal extensively and together with all three areas referred to in the analysis, it is possible to see a close interconnectivity between the keywords and the areas addressed, thus highlighting the interdependence and importance of their role in the good management of a company's production activity. It was also found that an increase in the volume of scientific production, and therefore in the number of research clusters, has a negative impact on the strength of the links between network members. Therefore, given that the literature is very fluid in terms of the themes presented, it has the capacity to highlight or distract researchers' attention from certain themes, thus leading to the creation of new research clusters, reinforcing the importance of others based on their topicality or showing a decline in interest in others. Therefore, in order to identify the trend and evolution of the different themes addressed in the word network, the same database exported from WoS was imported and processed in the Bibliometrix software, and based on the results of this processing, it was possible to observe the evolution of the integration of the themes in the literature, as well as their importance in the scientific environment.

As *Figure 2* below illustrates, over time, the themes addressed evolve and progressively integrate into different newly created clusters. Thus, as can be seen, the following clusters have made a significant contribution to the foundation of the clusters illustrated in the period 2011-2020: for the first cluster *information*, the *communication*, *information* and *firm* clusters have contributed, as they represent the indispensable elements of an efficient communication process: the information to be transmitted, the means of communicating it and the environment in which it is transmitted (the firm); for the second cluster *performance* clusters have contributed: *design* and *performance evaluation*, which were

subsequently integrated into the *model* cluster, demonstrating a growing interest in the development of models and techniques for evaluating company performance, together with the *knowledge* cluster, which is in turn an essential element for correct and optimal performance evaluation; for the third cluster management, the clusters contributed: *perceptions* and *incentives* later integrated into *performance*, the *united-states* cluster later integrated into the *time* cluster (this is particularly due to the fact that modern management theories originated in the United States of America (USA), these being promoted by Peter Drucker, known as the father of management) (TSoM Team, 2018), together with the *accountability* cluster.

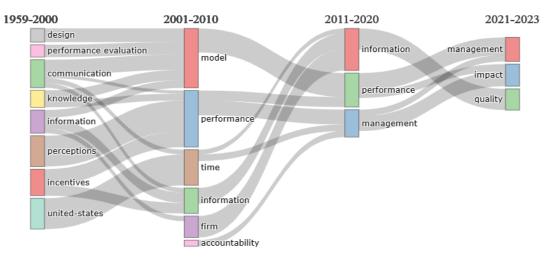


Figure 2. Evolution of the integration of themes between 1959 and 2023 *Source:* processed by the author with Bibliometrix

According to the elements that contributed to the foundation of the clusters presented in the period 2011-2020, we can assess that the first cluster includes elements related to the communication process within an enterprise, the second cluster refers to tools for controlling and evaluating the performance of an enterprise, and the third cluster includes elements of managerial accounting and enterprise management.

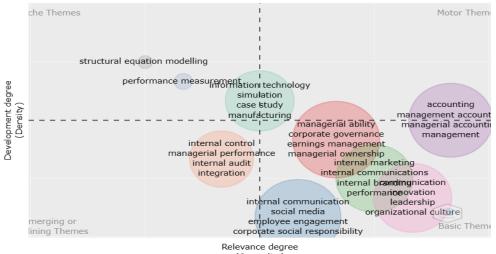


Figure 3. Thematic mapping of keywords in the literature according to WoS *Source:* processed by the author with Bibliometrix

In order to also capture the importance and positioning of the themes of interest in the literature, the exported data was also processed to obtain Figure 3 above which groups the themes into four quadrants according to their topicality. Thus they are organized on two axes of the Callon matrix, namely according to centrality which demonstrates the importance of the theme in the field of analysis and according to density which illustrates its level of development in the literature (Della Corte et al., 2022). The top right quadrant shows the themes with the highest level of centrality and density, and among these we can see that accounting and management accounting are included. The top left quadrant shows the niche themes, those that are strongly developed but are relatively isolated, not having a significant number of external links that increase its importance and relevance in the field, and we can see that among the main such themes are concepts such as *performance measurement* and structural equation modelling. In the left-left quadrant are represented emerging or declining themes, which do not have a significant current representation in the literature, being more marginal and having a low level of centrality and density. Therefore, we can see that themes with potential for development would be concepts such as internal control, managerial performance, internal audit and integration. As for the lower-right quadrant, it shows themes with high centrality but low density, this being the quadrant most represented in the figure. So, here are represented themes that are particularly important but not sufficiently developed, which means that concepts such as managerial accounting, internal communications, corporate social responsibility and earnings management still need to be addressed and developed so that their level is in line with the existing needs.

Conclusions

Therefore, we can assess that the areas of study that are of interest in the present research have a high relevance in the broader field of internal and external analysis of a company from the point of view of the economic or financial side. Although they are of high importance, they are not sufficiently developed and substantiated, requiring a more in-depth and updated approach to the concepts, in line with new interests and trends in the economic environment. As regards the interconnectivity of the areas selected for analysis, a high level of it is demonstrated in the correlation obtained between the variables in the econometric modelling related to the exported keywords, showing a complementarity of their roles in ensuring a good functioning and management of a business.

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