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CREATING A UNIVERSITY MANAGEMENT MODEL USING LEAN MANAGEMENT INSTRUMENTS

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Purpose: The aim of the article is to analyze the impact of the Lean Management concept and its instruments on the modules of the university management model, taking into account the expectations and real impact of the concept.
Design/methodology/approach: The article proposes 16 modules of the university management model and analyses the impact of the Lean Management concept on university management. The analysis is based on the example of University of Bielsko-Biala.
Findings: The case study allowed us to assess the validity of the proposed university management model modules, as well as to verify the expected and real impact of Lean Management and improvement instruments on these modules. This was another step to increase the awareness of the customs management regarding the use of Lean Management concepts to improve processes and services.
Research limitations/implications: The limitations of the article concern the proposed university management model and its modules. The autonomy of each university causes certain obstacles in creating universal solutions. Therefore, for the purposes of the article, modules were adopted that constitute the basic functions implemented in the university.
Practical implications: The case study revealed that the expected impact of Lean Management and its instruments on the university management model modules is higher than the actual impact. This may indicate the need for a broader use of Lean instruments to improve processes and services at the university. This may also be the subject of further scientific research.
Originality/value: The added value of the article is the case analysis, which shows the importance of the Lean Management concept and its instruments in the management and improvement of university.
Keywords: university, management model, Lean Management.
Category of the paper: Case study.

1. Introduction

The concept of Lean Management has been known and used in the economy for several decades. The above conclusion cannot be applied to aspects of university management. One can notice the use of selected elements of the Lean improvement concept or instruments,

but there is no comprehensive use of the concept in the management and improvement of universities. This is confirmed by scientific research conducted for several years by researchers representing such research centers as: Jagiellonian University in Krakow, Gdansk University of Technology and University of Bielsko-Biala. Therefore, there is a need for further scientific research in this area to deepen the area of knowledge about the possibilities of using the subject concept and Lean improvement instruments in university management.

It should be noted that interest in the subject of the improvement concept, including Lean Management as a research area within higher education and university management, increased with the emergence of the New Public Management concept. The improvement of the quality of management in the broadly understood public sector was to occur through the absorption of market mechanisms and management methods, techniques and tools used on a large scale in the private sector (Kożuch, 2013; Emiliani, 2015; Balzer, 2010; Yorkstone, 2016).

This article addresses the issue of the impact of the Lean Management concept and its improvement instruments on the university management model. The issue of the model was treated with a great deal of awareness that this is a conventional issue in the case of universities. Each university is autonomous and has its own individual management model. However, it is possible to propose modules, which are elements of the model, occurring at universities and referring to the basic functions performed by universities. The article presents a fragment of a broader study that addressed the above issue. The empirical part presents the case of the author's alma mater - the University of Bielsko-Biala.

2. Lean Management and its relations with university management model

Managing a public academic university is possible using the Lean Management concept. The basis of this concept is sensitivity to changes in the environment and introducing changes, optimally using all available resources, eliminating waste by simplifying processes and analyzing effects on an organizational scale (Liker, Meier, 2011, pp. 27-28; Puvanasvaran, Megat, Tang, Muhamad, Hamouda, 2009, pp. 930-943).

Lean Management constitutes a management concept that has been successfully implemented by companies and organizations around the world. In Poland, an increasing number of organizations can boast successful implementations of this concept. The Lean Management concept originates from the Lean Thinking philosophy, implemented into the terminology of economics and management by J.P. Womack, D.T. Jones and D. Roos, scientists representing the Massachusetts Institute of Technology (Womack, Jones, Roos, 1990; Womack, Jones, 1996).

The concept of Lean Management is evolving, which results in the emergence of new terms and applications. There are varieties of Lean Management within organizations that refer to specific functional areas, e.g.: Lean Leadership, Lean Innovation, Lean Teams, Lean Product and Process Development. Variations of Lean Management are also emerging within industries, e.g.: Lean Public Services, Lean Education and Lean Universities (Torbjørn, Powell, 2016, pp. V-VIII).

Implementing the ideas and principles of Lean Management at a university means changing the philosophy and organizational culture. Long-term changes occur along the entire stream of activity, not just individual tasks. University employees create value, implement processes, use modern management methods and tools. Therefore, it is necessary to start by creating an appropriate culture and environment in which employees demonstrate commitment, think creatively and perform work that matters. The use of Lean Management requires maintaining consistency with the mission, vision and strategy of the university. A common problem that appears when implementing the principles of the Lean Management concept is the inability to look at the university as a system and the employees' understanding of their place in it and the impact on its functioning (Carvalho, 2020).

The fundamental features of the Lean Management concept are the pursuit of improving broadly understood quality, minimizing costs and shortening the time of process implementation as a result of systematic elimination of waste within the framework of management based on a flat organizational structure. Lean Management means management focused on processes. Properly implemented in the university, the principles of process management can be a factor helping to adapt the Lean Management concept. Process management, focused on achieving the synergy effect to achieve the university's goals, has become the basis for "lean management" for comprehensive improvement of the management system. The key intention of process management and the Lean Management concept based on it is the elimination of rigid functional structures at the university. In place of this ineffective and inefficient model, the Lean Management concept introduces a flattened and horizontal organizational structure that is focused on processes and knowledge accumulation, while simultaneously decomposing the strategic goals of the university into the goals of processes and individual positions, along the value chain. Process management in the Lean Management concept concerns not only operational processes, but also auxiliary processes without which the proper functioning of the university would not be possible (Wiśniewska, Grudowski, 2014, pp. 34-38).

Implementing Lean Management at a university means implementing five fundamental principles:

1. Identifying the value stream.
2. Eliminating waste (Muda).
3. Ensuring the flow of activities in processes.
4. Controlling processes through a pull system.
5. Continuous pursuit of process perfection.

The implementation of Lean Management principles at the university can proceed according to the following stages (Krdžalicia, Brguljab, Duraković, 2020, p. 570):

1. Learning the assumptions of the Lean Management concept. The initial action starting the implementation of the LM concept should be to familiarize management staff and employees with the basic assumptions and goals of the concept, as well as the benefits of its application.
2. Assessment of the existing state and identification of opportunities. It is necessary to assess all the positives and negatives and development opportunities related to Lean Management (service, process) at a given moment, taking into account organizational, technical, economic and social aspects.
3. Analysis and modification of the existing state. This means determining deviations in the scope of efficiency parameters and determining the level of expected effects. At this stage, Lean Management instruments such as Kaizen, Value Stream Mapping, 5S and others can be included.
4. Design and implementation of a new service or process. Establishing a team, developing a plan and implementation.
5. Continuous improvement. Implemented by all employees at all organizational levels at the university.

The implementation of the Lean Management concept at a university leads to the identification and elimination of all activities that do not create value for the customer in the process of continuous improvement of processes and services. A university implementing the Lean Management principles adapts better to current market conditions through fundamental transformations of the management and functioning spheres. Lean Management attaches great importance to the human factor, changes the way of thinking and acting as well as the mentality of the management staff and other employees (Thomas, Antony, Francis, Fisher, 2015, pp. 982-996; Sunder, 2016, pp. 159-178; Kadarova, Demecko, 2016, pp. 11-16).

Materialization of the concept principles requires the use of various and appropriate Lean instruments (methods, techniques or tools) in given conditions. The table 1 presents the characteristics of selected Lean instruments, which were also included in the study presented later in the article.

Table 1.
Selected Lean instruments

Selected Lean instruments	Description
Failure Mode and Effect Analysis	The FMEA method concerns the analysis of potential types and effects of defects. A characteristic parameter is the risk indicator, which is the product of three components: the probability of occurrence of a defect, its detectability and the significance of the defect. The FMEA method constitutes a cause-effect analysis. It can be applied to a product or a process. The FMEA analysis can be carried out in three stages: preparation, subject analysis and supervision of preventive actions. An example of FMEA application in a university may be the modification or launch of a new course of study.

Cont. table 1.

Quality Function Deployment	The main goal of this method is to translate the needs and expectations of customers into the characteristics of the service. Information about needs and expectations is collected using surveys, interviews, reports prepared by external organizations, etc. Linking the information obtained and linking it with actual expectations, and then creating the right service is difficult. The QFD method is to support these activities. The process of implementation using the QFD method can be reduced to the stages: planning (defining the area of activity), collecting requirements (based on quantitative methods, e.g., surveys) and analyzing the collected material in terms of improving a given service. An important tool used in the method is the "House of Quality". This is a matrix of relations in relation to: customer requirements, parameters characterizing the service of the university being studied and services of competing universities. The QFD method, similarly to the FMEA method, can be used to modify the course of study in order to determine the optimal subject grid.
Reengineering	The reengineering method refers to process management. It means a quick and thorough reconstruction (redesign) of the process in order to improve the effectiveness in achieving its goal and process indicators, also from the point of view of value for the customer. When doing this, it should be remembered that a given process is related to other processes and affects elements of the organizational structure of the university. Reengineering is a revolutionary approach to management, starting the organization and implementation of the process from scratch. Whether the actions taken within the framework of reengineering will be effective depends largely on the university management, understanding the university strategy, the structure of the implemented processes, etc. The aim of reengineering is to improve the analyzed process, reduce unnecessary activities, increase flexibility, efficiency of the process implementation and improve customer service. Reengineering can be used to analyze and change any process in the university. Its use should be dictated by the need for a quick change in the implementation of a given process.
Audit	It is a systematic, independent and documented process of obtaining objective evidence and its objective evaluation in order to determine the degree of fulfillment of audit criteria. The general classification of audits distinguishes internal audit, i.e., first-party audit, conducted by the organization itself. External audits are also distinguished, which are divided into second-party audits, i.e., audits conducted by parties interested in the organization, e.g., clients, and third-party audits, which are conducted by independent auditing organizations, such as certification bodies or government agencies. In the case of a university that does not have an implemented and certified quality management system, the audit process takes place, among others, as part of the management control system. It is used to review this system and improve it in all organizational units of the university.
Block diagram	A flowchart is one of the basic tools for quality management and improvement. It is most often used for graphical presentation of the course of a process, i.e., its individual stages. Graphical presentation of a process facilitates its analysis and allows for its improvement in relation to individual stages. A flowchart can also illustrate the flow of information and responsibility. Using a flowchart, you can present, for example, the stages of the recruitment process, which will undoubtedly make it easier for candidates to understand it or the circulation of documents related to a business trip. A flowchart can be found at a university in documents such as: procedures, instructions, orders or resolutions.
Checklist	A checklist is a simple tool used to assess the degree of implementation of a given undertaking or project. It consists of a series of questions related to the project or its environment. Such a list is prepared at the project planning stage and in the final control phase. From the university's point of view, the checklist is used when submitting scientific projects, including the analysis of the risks associated with the implementation of the project.
5Why	Solving a problem or irregularities is possible after determining the causes of their occurrence. This is important from the point of view of implementing preventive actions, not only corrective ones. Determining the causes is related to the use of specific solutions. One of them is the Ishikawa chart mentioned above. Another is the 5Why tool. Its essence is to ask the question why several times (usually five times) in order to determine the source of the problem. The 5Why analysis covers two aspects: why the problem occurred and why it could not be detected. Teamwork is recommended within this tool, and the tool itself is a useful support in solving everyday problems. The 5Why tool is widely used at universities. It can be used to analyze, for example, the reasons for losing a document or providing incorrect information in the process.

Cont. table 1.

Corrective actions	They are defined as actions taken to eliminate the cause of non-compliance and prevent its recurrence. Corrective actions are taken after a problem or irregularity has occurred. Their aim is to eliminate them or minimize the effects of their occurrence. If a problem occurs at the university in the form of an incorrectly completed document in internal circulation, the corrective action will be to correct it.
Preventive actions	They are defined as actions taken to eliminate the cause of a potential non-compliance and prevent its occurrence. Preventive actions, which are preventive in nature, are taken to prevent a given problem or irregularity from occurring. For example, a checklist can be used when submitting documentation in external scientific competitions, so that it is complete and no document or signature is omitted.

Source: Jakubiec, 2017; Jakubiec, 2021, pp. 111-115; Abdus Samad, Thiyagarajan, 2015, pp. 618-629; Aguirre, Pérez-Domínguez, Luviano-Cruz, Noriega, Gómez, Callejas-Cuervo, 2020, pp. 2-3; Klochkov, Gazizulina, Ostapenko, 2020, p. 2; Lock, 2002, pp. 356-357; ISO 9000:2015-10, p. 34; Höfer, Naeve, 2017, pp. 63-80; Slack, Chambers, Johnston, 2007.

The above catalogue of Lean instruments, as mentioned, is open and flexible. Each entity using the Lean Management concept can individually shape those Lean instruments that are useful at a given moment.

Moving on to the university management model, it is necessary to indicate a wide range of scientific publications in the field of higher education, management and quality improvement at the university, which was taken into account when defining the components of the model (modules) (Wawak, 2012a, 2012b, 2019b; Leja, 2013; Wiśniewska, Grudowski, 2019; Grudowski, Wiśniewska, 2019, pp. 49-61; Grudowski, 2020; Karpov, 2017, pp. 58-76; Teichler, 2016; Altbach, 2002; Tight, 2012; Meek, Teichler, Kearney, 2009; Barblan 2011, pp. 550-574; Scott 2008; Teixeira 2013, pp. 1-121; Clark, 2004; Lim, 2020; Barnett, Fulford, 2020).

Among the modules accepted for analysis:

1. Acts of internal and external law.
2. Single-person university bodies.
3. Collegiate bodies of universities.
4. Teams of employees.
5. Ensuring the quality of education.
6. Teaching process.
7. Scientific and research process.
8. Commercialization of research activities.
9. Human capital management.
10. Knowledge and intellectual property management.
11. Material capital management.
12. Financial management.
13. Investments.
14. Internal and external communication.
15. Risk and uncertainty management.
16. Improving processes and tasks.

The modules are flexible, so that the university can respond appropriately to changes in its environment. There are interactions between the university environment and the university. They result from legal regulations established by the government administration, influencing the shape and functioning of the university, from the market demand for educational and research services, which are determined by candidates for studies and organizations and enterprises from the business sphere and cooperating with universities.

In the characteristics of the model, it should be clearly emphasized that its components are of a conventional and debatable nature. Its adoption resulted from the implementation of the research process and verification of the impact and dependencies between Lean Management and the model modules. As emphasized in the introduction, each university has its own individual management model and it is on it that the use of the assumptions of the Lean Management concept and the practical application of its instruments actually depends.

3. The impact of Lean Management on the university management model – case study of University of Bielsko-Biala

The empirical part of this article refers to a selected fragment of scientific research that was conducted on the subject matter (the Lean Management concept and its functioning within the university) in the years 2021-2023 on the example of public academic universities in Poland. It was decided to present the case of University of Bielsko-Biala in the context of the impact of Lean Management and its instruments on the modules of the university management model. During the case study, the objectivity of the research was maintained. The Rector, together with other people from the university management selected to conduct the study, had the freedom to assess the importance of the model modules, as well as the impact of the Lean Management concept on these modules. The issue of the model was presented in the earlier part of the article. The Lean Management concept, described earlier as a set of improvement activities, can be implemented in practice by many improvement instruments. The full research included a number of Lean-specific instruments, which for organizational purposes are indicated below: Total Quality Management, quality management system according to ISO 9001, management through processes, standardization, Value Stream Mapping (graphical analysis and process improvement), Kaizen – continuous improvement, PDCA (continuous improvement cycle – Plan – Do – Check – Act), 5S (workplace improvement), FMEA method (identification of irregularities in the process and service - Failure Mode and Effect Analysis), QFD method (service improvement – Quality Function Deployment), benchmarking (comparison to patterns), reengineering (process redesign), audit, brainstorm, block diagram, Ishikawa chart (descriptive analysis of the causes of abnormalities), Pareto chart (quantitative analysis of the causes of irregularities), control charts, checklist, program chart of the decision process

(methodology of conduct in the event of irregularities), 5Why (searching for the causes of the problem), SWOT analysis, knowledge management, intellectual capital management, training system, employee suggestion system, motivational system, corrective actions, preventive actions.

The discussion about the belonging of the above-mentioned instruments to Lean seems justified and let this article also be a contribution to this discussion. It is worth remembering, however, that each scientific study is characterized by a certain subjectivity presented by the researcher. It is also necessary to emphasize the clear differences between the knowledge of instruments by university managers and the number of instruments actually used.

The main research objective was adopted as an analysis of the impact of the Lean Management concept and its instruments on the modules of the university management model. Further assumptions of the research present table 2.

Table 2.
Assumptions of the research

Items	Description
Research goal	Analysis of the impact of the Lean Management concept and its instruments on the modules of the university management model
Research method	Case study
The interviewees	The Rector and other managers of University of Bielsko-Biala
Date of realization	Period 2021-2023

Source: personal elaboration.

The table 3 shows the assessment by the university managers of the importance of the proposed modules of the university management model and the possible (desirable, preferred) and real (resulting from the current state of affairs) impact of Lean Management and Lean instruments on these modules. The assessment of the importance of the modules and the impact of Lean Management on these modules was made on a Likert scale from 1 to 5, where 1 indicates the lowest rating and 5 the highest rating. Out of 16 assessed modules, only one received an importance assessment of 5.0 (it was the module scientific and research process), the remaining 15 modules were important at the level of 4.0. The average value of the assessment of the importance of the modules was 4.06. The distinction of the module concerning the scientific and research process testifies to the general significance of scientific research conducted by universities. Scientific research builds the position of the university on the market, making it an attractive entity for cooperation with the economy. Public academic universities, among which the analyzed University of Bielsko-Biala is located, are universities that create trends in scientific research and determine their innovativeness.

Table 3.
Interactions between model modules and Lean Management

Model modules	Validity of modules	Possible impact	Real impact
Acts of internal and external law	4	3	1
Single-person university bodies	4	3	1
Collegiate bodies of universities	4	3	1
Teams of employees	4	4	3
Ensuring the quality of education	4	4	3
Teaching process	4	4	3
Scientific and research process	5	4	3
Commercialization of research activities	4	3	3
Human capital management	4	4	2
Knowledge and intellectual property management	4	4	2
Material capital management	4	4	2
Financial management	4	4	2
Investments	4	4	2
Internal and external communication	4	4	2
Risk and uncertainty management	4	4	3
Improving processes and tasks	4	5	3
	4,06	3,81	2,25

Source: personal elaboration.

The analysis of the possible and real impact of Lean Management and Lean instruments on the model modules clearly shows that the possible, and in fact desired impact is greater than the real one. The average impact values are as follows: possible impact 3,81 and real impact 2,25. In terms of the possible impact of Lean Management on the modules of the university management model, the highest assessment was given to the impact on the module improving processes and tasks. Among the impact assessments at level 4 were the modules: teams of employees, ensuring the quality of education, teaching process, scientific and research process, human capital management, knowledge and intellectual property management, material capital management, financial management, investments, internal and external communication and risk and uncertainty management. The lowest possible impact of Lean on the modules of the model concerns: acts of internal and external law, single-person university bodies, collegiate bodies of universities and commercialization of research activities.

The analysis of the real impact of Lean concepts and instruments on the modules of the university management model was rated from 1 to 3. The modules with the lowest ratings included: acts of internal and external law, single-person university bodies and collegiate bodies of universities. A rating of 2 was assigned to the modules: human capital management, knowledge and intellectual property management, material capital management, financial management, investments and internal and external communication. A rating of 3 was assigned to the modules: teams of employees, ensuring the quality of education, teaching process, scientific and research process, commercialization of research activities, risk and uncertainty management and improving processes and tasks.

The possibilities of further and broader use of Lean Management assumptions and its instruments at the universities studied depend on the awareness and need for broadly understood improvement of the university management system, processes and services. It is important to continuously verify emerging problems and barriers in university management that create waste, identify waste itself and make attempts at improvement in response to the above, using specific Lean Management instruments. It is also necessary to strive for greater implementation of Lean Management culture elements resulting from such assumptions as the process approach or appreciation of the role of human capital.

4. Summary

This article aims to show the usefulness of Lean Management concept in university management, referring to the conventional management model. The specificity of each university, included in the article, does not allow for a rigid adoption of a management model, but for proposing acceptable modules that can create this model as elements. The empirical part of the article shows the essence of the impact of the assumptions of the instruments for improving the concept on the model modules, indicating that the desired impact is greater than the real one. This indicates the need for further and broader education of university managers in the context of the possibility of using Lean Management at universities. The following can be indicated:

1. It is recommended that university managers be more involved in identifying barriers and waste in university management systems. This is the basis for launching improvement activities, as well as for a broader use of improvement instruments.
2. Lean Management instruments (e.g., brainstorming, Ishikawa chart, 5Why, etc.) can be used to solve everyday problems, and additionally engage employees in university matters, which builds their attachment to the workplace.
3. It is recommended that university managers strive more strongly to debureaucratize the functioning of universities. This is possible, among other things, by identifying the aforementioned waste at the source of its occurrence.
4. It is also recommended that more training for university management staff is provided in the scope of modern management and improvement concepts and systems, taking into account different levels of education, as well as the represented scientific disciplines. This will allow many people to raise awareness of the existence and possibilities of using concepts such as Lean Management.

The range of improvement guidelines, as well as improvement instruments, allows for their selection in accordance with the specificity of the university and the aspect of improvement. Selected examples of the implementation of Lean instruments at the university are included in

Table 1. The key to the successful application of Lean Management at the university is the involvement of management and employees in improvement and the conviction that implementing innovative solutions is right. The following can be indicated as prospects for the development of the undertaken subject matter and subsequent scientific works:

1. Development of case studies taking into account foreign universities, which will broaden the author's cognitive and empirical horizons, shaping further scientific research and scientific publications.
2. Expanding the study of the analysis of the management model of a public academic university and the modules that make up the model with an analysis of the impact of the university's environment (including: Polish and European law, government and local government administration, local and regional stakeholders, local and regional community, candidates for studies) on the analyzed modules and the functioning of the university.

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