Implementation of the Lean concept within Smart School Management

Sanja Puzović [1*], Vladan Paunović [1], Jasmina Vesić Vasović [1]
[1] University of Kragujevac, Faculty of Technical Sciences Čačak, Serbia
* sanja.puzovic@ftn.kg.ac.rs

Abstract: *Smart school represents a new educational concept that have dramatically changed education system, not only teaching and learning processes but the management process. In order to overcome the challenges that these changes bring, school managers must to adopt and implement advanced management concepts, such as Lean concept. The implementation of the Lean concept withih smart school management will ensure that all processes, required to support the teaching-learning function, are integrated into a rational entity that purposefully and effectively operates towards achieving objectives.The paper indicates the Lean principles whose implementation within smart school system management will enable improving of education processes.*

Keywords: *smart school concept; Lean concept; management*

1. INTRODUCTION

The social, economic and political prosperity of the nation depends on the intellectual potential of new generations, traditional educational systems are no longer capable to meet the resulting social need, so it has initiated the development of new forms of education systems that accompany technological development such as smart school platforms. Smart school is education institution that is based on digital education platform which brings a lot of benefits to learning-teaching processes, as it is pointed out by numerous studies [1], [2], [3], [4], [5] and [6].

Those new educational concepts have dramatically changed access to education, not only to teaching and learning processes but to the management process. In order to overcome today's challenges, school managers must to adopt and implement advanced management concepts, such as Lean concept, that will enable them to manage more efficiently and effectively of processes required to support the teaching-learning function in IT environment. Although the Lean concept was initially intended for the production environment, its application has expanded to non-production sector, as it is pointed out by numerous of studies in this area. The article [7] focuses on the applying Lean concept to non-profit organization. Lindenau-Stockfisch [8] introduces Lean management within hospital and indicates the principles and key factors for successful implementation, Di Pietro, Mugion & Renzi [9] presented integrated approach between Lean and customer feedback tool for public sector, Buavaraporn [10] investigates the importance of enablers of Lean implementation in financial services. This paper will indicate the key Lean principles whose implementation within smart school system will enables improving of education processes.

2. THE SMART SCHOOL CONCEPT

The smart school concept implies continuous implementation of the Information and Communication Technologies (ICT) through a comprehensive education system, not only within teaching and learning processes, but in implementing a more efficient education providing process. Smart schools are based on digital education platform which enables growing, adaptation and progress as important environments for learning in nowadays conditions.

To ensure the successful implementation of smart school concept it is necessary to use context and corresponding educational policies, which include continuously empowerment and flexibility of curriculum and upgrading of management and teaching staff's capacity and commitment through the integration of the ICT in strategic planning, teaching and learning methods.

The smart school is taken from the concept of the smart factories, which has given birth by a smart revolution. The Smart revolution or 4. industrial revolution is characterized by self-management, the concept of smart cybernetic-cyber-physical information system. The novelty brought by the industry 4.0 is the integration of the Internet of Things (IoT) into the production environment.

The IoT implies the advance concept of machine-machine interaction provided by network-based

remote sensors and actuators. The IoT system consists of smart devices managed by the user over the Internet. Wireless sensors generate data from different devices that can be stored and analyzed either on site or in the cloud.

The IoT concept can also be integrated into non-production systems, such as educational institutions, which provides the digital platform on which a smart school is based.

Utilization of the IoT technologies within educational institutions, increase student engagement and commitment, also it provide a safer learning environment. All students' activities can be monitored in real time by using online testing which helps to identify and analyse of student learning patterns and development of adaptive learning systems.

Some of the world's leading educational institutions that have adopted the smart schools concept are:Massachusetts Institute of Technology (MIT), Cambrige, Masachussetts; The California Institute of Technology (CALTECH), Pasadena, California and Eidgenossische Technische Hochschule (ETHZ), Zürich, Switzerland.

Smart school enables the best learning environments by providing the following benefits:

- It stimulates students engagement,
- It takes the benefits of learning in the mobile environment,
- It provides personalized education,
- It makes the learning process more efficiency,
- It achieves cost reduction,
- It improves the process of student success measurement,
- It enhances teacher`s responsiveness and commitment,
- It creates conditions for improving the curriculum,
- It introduces a creative approach in teaching and learning,
- It potentiates the development of adaptive learning systems,
- It fosters student collaboration and encourages creativity.

To achieve smarts schools educational objectives, these teaching and learning concepts should be covered: curricular, pedagogy, assessment and teaching-learning materials [2]. The smart school concept is presented in Fig. 1.
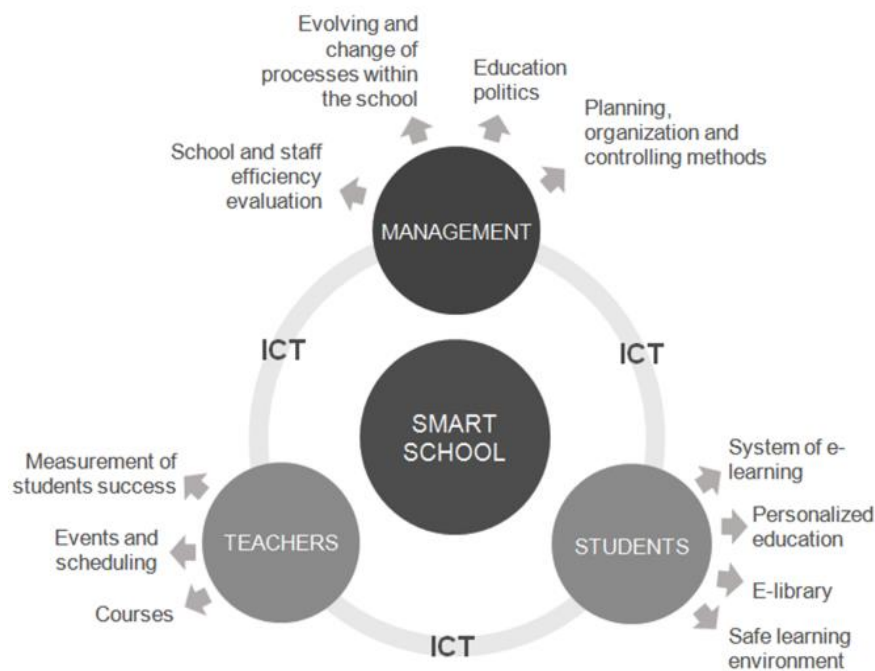
Figure 1. *The smart school concept*

As can be seen from Fig. 1, the inseparable component of the smart school concept, in addition to the teaching and learning process, is also a management that plays a key role in creating the conditions for achieving a more effective educational process.

As a main challenges for school management, in making effort to achieve a more effective educational process, are emphasized: developing

the concepts, the processes, structure and how to evolve and change the smart school, application of advanced planning, organization and controlling methods, assessment of the technology, the analysis of the potentials which must be incessant [2], introduction of efficient controlling systems…

In order to respond to these challenges, school managers must to adopt and implement modern management concepts that will enable them to

manage more efficiently and effectively of processes required to support the teaching-learning function in IT environment.

One of these management concepts is the Lean concept, whose implementation within smart school system will ensure that all processes, required to support the teaching-learning function, are integrated into a rational entity that purposefully and effectively operates towards achieving objectives.

More about the Lean concept and the possibilities of its implementation within the smart school system is given below.

3. LEAN MANAGEMENT CONCEPT

Lean concept was first introduced by Krafcik [11] and it has its origin in the main principle of the Japanese industry 'increasing output by reducing input'. The Lean concept can be defined as a systematic approach to overall business in the way of using as less resources as possible, in order to achieve the best possible performance and improve business processes. Lean needs to be viewed as a voyage necessitating a strong start and one that never concludes [12] and it is essential to decipher the current state; the current stated ideals and behaviours have to be contrasted with the Lean principles and behaviours [13].

The main elements of Lean concept are: Lean way of thinking, managing and changing of business processes and continuity of introducing improvements.

According to Koenigsaecker [14], Lean is more than a compilation of tools and that its ideology focuses upon a need to reduce three categories of waste, namely Muda (non-value adding work), Muri (overburden), and Mura (unevenness).

The Lean concept today has broader frames, and it is viewed as business improvement strategy that integrates concepts such as Just-in-Time Production (JIT), Total Productive Maintenance (TPM),Total Quality Management (TQM), Six Sigma and Human Resource Management (HRM) practices [15].

Although the Lean concept was initially intended for the production environment, its aim is to increase the efficiency and quality of the system, so Lean principles can easily transfer to non-productive institutions that share the same goals, such as health or financial institutions, service sector, government, as well as in education systems.

4. POSSIBILITIES OF IMPLEMENTATION OF THE LEAN CONCEPT WITHIN SMART SCHOOL SYSTEMS

Successful implementation of the LEAN concept in managing smart schools requires respect for some principles such as: optimize the whole, eliminate time and money waste, create knowledge, build quality in, deliver fast by managing flow and the last, but not the least important, respect people.

The Lean principles that can be implemented successfully in the smart school management process are: Lean way of thinking; continuity improvements and process optimization through the concentration on waste and values; improving personnel policy to increase productivity through employee satisfaction.

2.1 Implementation of Lean thinking within smart school concept

Lean thinking is a methodology which implementation will provide a new way to think about how to organize activities in order to offer more benefits to users through the elimination of waste (worthless activities and processes).

According to [16] there are several postulates of Lean way of thinking: **Purpose**: the Lean concept is based on considering the purpose in a way to ask questions what values for the stakeholders we can create. **Process**: How will the organization analyze each step in order to consider whether the new value for stakeholders are created in every steps, whether there are useless steps, and to consider their interdependence. **People**: It is necessary to ensure that people in organization can create an organization that can produce value and that important process has someone responsible for continually evaluating that value stream in terms of business purpose and lean process. The Lean thinking model is presented in Fig. 2.
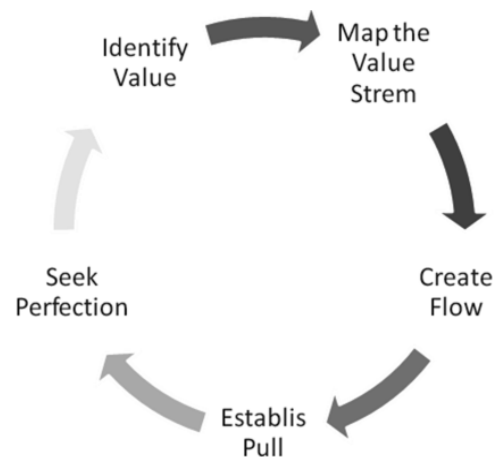

Figure 2. *Lean thinking model [16]*

The Lean way of thinking includes a several principles:

Identify Value: Define value from the user's perspective, and express that value in appropriate terms.

Map the Value Stream: Map all of the steps, values, activities and processes which will lead to customer satisfaction.

Create Flow: It is necessary to be sure the remaining steps flow smoothly with no interruptions, delays, or bottlenecks.

Establish Pull: Pull the value from the next upstream activity.

Seek Perfection: Finally, it is necessary to make Lean thinking and process improvement part of your corporate culture.

If this way of thinking would be implemented in the smart school management process, it will bring the following benefits:

- Improvement of employee morale and involvement
- Increasing efficiency,
- Gaining satisfied stakeholders,
- Facilitating the process of change,,
- Improvement of productivity,
- Reducing the risk and increasing achievability of the plans.

'Lean Transformation' is often used to describe the process of moving from an old way of thinking to Lean thinking model. This transformation requires a long term perspective and perseverance that will result in an all-encompassing revolution in managing educational processes.

2.2 Continuity improvements and process optimization through the concentration on waste and values

Lean management concept concentrates on process optimization, waste and value. Therefore, managers in smart schools must involve some Lean tools for waste and value identification and improving, within their practice. Some of them are Kanban, Kaizen, Value Stream Mapping (VSM).

The main purpose of Kanbans is to show which work has to be done at what time to ensure optimal flow, this applies both to teaching and to the learning processes. Also it includes implementation of the Pull concept (does not produce anything until it is needed by the end user), in education system this implies - map market needs for specific professions and accordingly, conceive how many students of which profile will be educated.

A smart school, within the framework of smart education, with the help of a lean concept, will enable students to take the initiative themselves and create their own jobs, in a way to foster self-contemplation, which is contrary to the molded approaches to education that have been countless times proven to be wrong.

Kaizen, or the concept of continual improvement, is aimed at reducing waste. Every day spent in the education system should contribute to creating value for students. Unfortunately, a significant part of the time at faculties is spent on activities that do not contribute to creating values relevant to students. Kaizen concept will enables eliminating non-value adding activities from education process through continuous improvements.

Value-stream mapping (VSM) is a technique to analyse and measure the flow of information and to value how much each activity or operation, that is part of the value stream, contributes to outcome and total quality. Implementation of this technique within smart school education processes can improve the process of student success measurement, which is of particular importance for monitoring the quality of the entire educational process.

2.3 Improving personnel policy to increase productivity through employee satisfaction

The ideology and concept of Lean is largely successful when pertained to a whole organization, even though the Lean concept has been largely associated with manufacturing and production processes, its principles embrace the entire business, ie to all aspects of the organization both on processes and on human resources.

Within smart schools, by the Lean concept must be covered not only educational processes and activities that relate to providing knowledge to users, but also to employees, as a vital part of these systems.

To achieve main Lean principle - higher outputs while streamlining inputs it is necessary to set the appropriate personnel policy. Lean management includes a reflected interaction with employees, also through employee satisfaction and motivation the Lean contributes to a sound and proper basis for smooth implementation of education processes.

Lean also represents a drastic transformation of the current way of working and thinking, it often creates resistance to employees, in order to eliminate these issues, it is necessary to motivate employees to completely accept and implement Lean way of thinking and operating.

Lean approach to human resources management is especially important in the context of smarts school, as this concept requires the teacher to adopt new knowledge concerning the intensive application of ITC technology in teaching processes.

5. CONCLUSION

The paper indicates that it is possible to continuously improve educational institutions through an understanding and applying Lean and smart principles. Smart schools concept provides digital education platform which enables improvement, adaptation and progress as important environments for education processes in nowadays conditions. Also, by integration of smart school concept and Lean principles such as: Lean way of thinking, continuity improvements and process optimization through the concentration on

waste and values and improving personnel policy to increase productivity through employee satisfaction, it is possible to create the conditions for achieving a more effective educational process.

By implementing Lean way of thinking within smart school concept, a new way to think about how to organize activities in order to offer more benefits to users through the elimination of waste will be provide. Also it will bring a lot of benefits for educational processes.

Integration of the Lean concept within smart school management will provide continuity improvements and process optimization through the concentration on waste and values.

To achieve main Lean principle - higher outputs while streamlining inputs it is necessary to set the appropriate personnel policy.

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