*European Research Studies Journal*
*Volume XXVI, Issue 4, 2023*

*pp. 44-61*

# Application of Lean Management Tools in a Circular Economy Model from the Perspective of Financial Security of SMEs

*Submitted 03/10/23, 1st revision 23/10/23, 2nd revision 27/10/23, accepted 10/11/23*

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***Abstract:***

***Purpose:*** *Presenting the possible application of lean management tools in SME service enterprises in a circular economy model. Demonstrate where lean philosophy can contribute to efficient resource management, waste reduction and financial security for SMEs.*
***Design/methodology/approach:*** *Critical analysis of scientific literature was employed. was conducted to assess the maturity level of applied management tools, including Lean tools, by SMEs, as well as their familiarity with the principles of the circular economy model in Poland and in entities affiliated to international organisations.*
***Findings:*** *The study highlights the validity of implementing Lean Management tools within the circular economy model and identifies the specific areas where Lean tools can be employed. It has been confirmed that environmental protection efforts and quality enhancement lead to increased operational efficiency, cost reduction, and improved company image, ultimately contributing to financial security.*
***Practical implications:*** *The practical use of lean management tools such as Kazizen costing, Design for Disassembly, One Piece Flow will accelerate the implementation of circular economy. Moreover these tools increase the company's financial security and resistance to market risks as well as optimize resources, help to reduce costs and improve quality.*
***Originality/value:*** *The added value of the article lies in enriching the knowledge about evaluating the maturity level of management tool utilization and familiarity with the circular economy assumptions in Polish SMEs from the service sector. The study also identifies areas requiring further work and development, as well as the benefits that companies can achieve by implementing Lean Management.*

***Keywords:*** *Lean management, circular economy, management tools, environmental protection, waste reduction, financial security.*

***JEL codes:*** *M2, Q56, O44.*

***Paper type:*** *Research article.*

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## 1. Introduction

With the growing interest in the circular economy model comes the need for effective management tools to help companies adapt to the new reality: keeping up with increasingly rapid market changes, meeting and often exceeding customer demands and, at the same time, the pressure to reduce costs without compromising quality. These are just some of the variables forcing us to search for ever more sophisticated, holistic management strategies (Norena-Chavez and Thalassinos, 2022a).

One such strategy is the relatively new concept of a circular economy — which aims to rationalise the use of resources and reduce the negative environmental impact of manufactured products. Both theory and practice indicate that lean management tools and techniques can be successfully used to realise the assumptions of a circular economy where the priority is to create value for products and processes, minimise the consumption of raw materials and reduce the waste generated (Toker and Görener, 2023; Genç, 2021; Kulczycka and Głuc, 2017; Matt and Rauch, 2013; Gnamm and Neuhaus, 2006; Womack and Jones, 2001; Cristea *et al.*, 2022).

The Lean management concept is appreciated worldwide, however, in Polish economic conditions, particularly in small and medium-sized enterprise sector companies, it is relatively rarely applied. In these entities, there is limited knowledge of the concept's tools and their potential benefits.

The aim of this article is to present the possible use of lean management tools in SMEs in a circular economy model and to show in which areas the lean philosophy can contribute to efficient resource management, waste reduction and financial security for the company (Havlícek *et al.*, 2013; Czainska *et al.*, 2021).

In order to achieve such a goal, a critical analysis of literature on the subject was carried out, a survey was conducted to indicate the level of maturity of the lean management tools used by SMEs and the knowledge of the assumptions of the circular economy model in Poland and entities affiliated with international organisations such as the International Association of Independent Accounting Firns (INAA).

Presenting the results of the survey will allow an assessment of the level of application of lean tools and knowledge of CE assumptions in Polish service companies and foreign companies, as well as identifying possible areas requiring further work and development.

## 2. Circular Economy

The aim of circular economy (CE) is to increase the efficiency of primary resource use, especially of non-renewable and scarce resources, reduce waste generation and

move away from its storage altogether, in favour of recycling and a resource-efficient economy and preference for industrial symbiosis (Kronenberg and Bergier, 2010). The CE concept eliminates both the traditional notions of end-of-life and the category of waste, which takes on value by becoming a resource again (Tisserant *et al.* 2007; Park and Chertow, 2014; Kulczycka, 2019; Noja *et al.,* 2021).

The resource efficiency of the CE results not only from moving away from the destruction of resources discarded as waste, but also from increasing the useful life of products in the consumption phase, replacing parts, repairing and returning waste to the economy as high-quality secondary raw materials, switching to renewable resources, conscious consumption and more efficient use of resources.

Such behaviour directly affects companies' demand for and saving of primary raw materials and resource efficiency is one of the components affecting companies' competitiveness and the added value they produce (Godlewska-Majkowska *et al.*, 2016; Norena-Chavez and Thalassinos, 2022b).

The essence of CE is also a new outlook on the relationship between markets, customers and resources (Jastrzębska, 2017; Zhelyazkova, 2018).

Numerous countries treat CE as a strategy and even an economic system, adapting legislation and economic instruments to facilitate its implementation. The implementation of CE is a complex matter and is not a simple task (Michalski and Sitko, 2015).

It requires the involvement and cooperation of numerous actors, but above all the development of a unified line of thinking of the production, commercial and consumer spheres, effectively supported by law. Equally important is the role of both companies and eco-oriented attitudes of consumers in helping to "close" the economic circle (ISO 14063:2006).

At the level of business operations, the idea of CE is to design a cycle in which the stages (starting from raw material acquisition, through design, production, consumption, waste collection and waste management) are repeated numerous times. It is important that waste, if indeed generated, is treated as a secondary raw material that can be reused in an economically and environmentally appropriate manner.

Inherent in the implementation of CE is the concern to maximise the time of use of products or to replace them with other — also intangible — substitutes. These issues influence the development of innovation, the construction of new business models and a change in the environmental awareness of society.

The CE approach presented contrasts with the traditional model of linear economy. Although, according to its definition, the new development model is linked to approaches already in practice such as reusing, repairing, renewing and recycling

products in line with the well-known 3Rs principle (reduce, reuse, recycle) and extended to the 4Rs (reuse, repair, renew, recycle) or sustainable supply chain management, i.e., managing the economic, social and environmental impact of the supply chain throughout the product lifecycle to create value for all stakeholders involved in the process (Arnold, 2023).

The circular economy can undoubtedly bring major economic benefits, contributing to innovation, growth and job creation, as well as financial security for businesses. It will protect against resource scarcity and price volatility, providing more efficient ways of production and consumption and new business opportunities (Szczerbak, 2022).

From a company perspective, closing the circle can lead to cost reductions through more efficient use of raw materials and to increased revenues through the launch of new, attractive and innovative products or services. A broad perspective on the problem of economical and efficient use of resources and taking action to avoid and reduce waste and its impact on the environment is provided by the increasingly important concept of lean management.

A growing body of literature shows how lean management can be used to achieve the goals of circular economy (Hartini and Ciptomulyono, 2015; Atkinson and Nicholls, 2013).

## 3. Using Lean Management to Achieve Goals of Circular Economy

The term "lean" is multidimensional, used on several levels and includes: lean philosophy, lean thinking, lean management, lean manufacturing, lean accounting (Mann, 2005; Holweg, 2007; Stone, 2012). It is characterised by the pursuit of quality improvement, resource efficiency and, as a result, cost reduction through the consistent elimination of non-value-generating activities (Liker, 2018).

The basis of the lean concept was T. Ohno's identification of seven types of waste relating to: overproduction, excess inventory, unnecessary transportation, errors, shortages, waiting time and unnecessary motions (Liker and Meier, 2011), which result in inefficient work organisation, quality defects, loss of reputation and, consequently, financial instability of the company.

Eliminating or at least reducing the occurrence of the indicated waste categories is not only a source of improvement for the organisation in terms of its efficiency, competitiveness and financial stability, but also underpins the implementation of the circular concept where the priority is to minimise the consumption of raw materials and reduce the waste generated (Kulczycka and Głuc, 2017; Cheng *et al.*, 2023).

Lean activities are focused on the use of a wide range of tools and techniques aimed at the continuous improvement of the company's processes through systemic

identification, reduction of non-value-generating activities, elimination of losses and deficiencies and all waste.

The basic tools and methods used in implementing lean concepts (Mann, 2005; Grudowski, 2007; Czerska, 2011; Graban, 2016; Liker and Meier, 2011; Chang and Chen, 2014; Sobańska, Kalinowski 2015; Ruben *et al.*, 2017; Cherrafi *et al.*, 2019) are:

a) Kaizen — a philosophy of continuously making changes and improvements through small steps. The recurring activities that make up the handling of a particular sphere of the organisation's activities are analysed;
b) Kanban — a method of controlling production by events occurring directly on production. It ensures short processing times, low inventory, timely delivery and quality control at all stages of production;
c) SMED (Single-Minute Exchange of Die) — sets a target of reducing changeover times to 10 minutes or less. It serves to reduce machine changeover times;
d) 5S — a tool to help analyse workplace processes. It results in an efficient organisation of the workplace, simplification of the working environment, elimination of losses due to shortages and breakdowns, improvement of quality and safety;
e) JIT (Just In Time) — a concept in production and delivery strategy based on synchronising inventory replenishment with demand in the system. This results in improved workflow and production efficiency which promotes liquidity and minimises risk;
f) TPM (Total Productive Maintenance) — comprehensive maintenance of productivity as a result of activating all employees working at different levels so as to maximise the total efficiency of resources;
g) VSA (Value Stream Analysis) — allows the visualisation of the information flow and manufacturing process for selected products. With its use, waste can be identified and a plan for transformation based on the suction system of production can be created;
h) OPF (One Piece Flow) — a production method where products are manufactured and transferred to the next stage of the process one at a time. Materials, semi-finished goods and products are transferred from one station to another in a structured, constant and uninterrupted manner — at a specific rate and without stoppages with maximum unit inventory between stations, processes or operations;
i) Heijunka — a tool for balancing production. It involves balancing the product range being produced so as to meet customer demands on the one hand and minimise inventory on the other;
j) Poka-Yoke — technical solutions to eliminate the possibility of employee error;

k) Jidoka — automatic detection of errors in the production process. It allows production to be quickly detected and stopped if errors or irregularities are detected;
l) Lean Design — an approach that incorporates lean principles at the design stage with a focus on minimal raw material consumption, simplicity of production and ease of maintenance;
m) DFMA (Design for Manufacture and Assembly) — an element of lean design. This tool involves designing new products so that they are low-cost and easy to manufacture;
n) Design for Disassembly — involves designing products in such a way that they can be easily dismantled and valuable materials recovered;
o) Value stream costing aimed at providing relevant and timely information on costs incurred within the lean concept supported by other sub-systems: target costing, continuous improvement costing, product lifecycle accounting or activity-based costing.

A number of researchers have categorised the positive effects and benefits of implemented lean tools in terms of effective inventory management, waste management, economical management of natural resources, raw materials, elimination of all waste (muda, mudi, mura), cost management, which have a special dimension in the aspect of the circular economy.

Vento distinguished between economic benefits and those related to human resources (Vento *et al.*, 2016). They included the following in the economic categories: delivering the right amount of products to customers on time, maximising profits, shortening steps in production processes, reducing machine and equipment breakdowns, reducing production costs, shortening operational and project cycles, increasing productivity, improving cash flow, reducing defective products, reducing material transport distances, reducing inventory waste, waiting times, material transport, reducing delivery times.

Among the benefits related to human resources, they included: increasing customer satisfaction, increasing employee responsibility and commitment, reducing accidents, improving ergonomic conditions, having employees focus their attention on high-impact issues, improving attitudes and skills of managers, in terms of continuous improvement, improving internal communication, better cooperation between employees, positive impact of change on employees, increasing motivation, co-creation of the new system by all employees, reducing the number of customers lost and employee turnover.

The benefits listed are closely linked to environmental benefits, which include: minimising the consumption of raw materials and energy, reducing waste generation, eliminating all forms of waste, which translates into a reduction in the use of resources, materials, raw materials, the production and transport of which

impose an increasing burden on society (Ford, 2007; Yang *et al.*, 2011; Singh *et al.*, 2018), improving the environmental awareness of employees.

Table 1 shows possible areas of use of lean tools that can promote the attainment of circular economy assumptions.

***Table 1.*** *Lean tools for attainment of circular economy (CE) assumptions*

| No. | **CE assumptions** | **Lean management tools** |
|---|---|---|
| 1. | Reducing the amount of waste generated | 5S, kaizen, Poka-Yoke, VSM, DFMA |
| 2. | Cost reduction (including production cost) | Kaizen costing, target costing, activity-based costing |
| 3. | Eliminating all waste (cost reduction) | Kaizen, 5S, Just-in-Time, Poka-Yoke, VSM |
| 4. | Increasing the efficiency of production processes | Kaizen, activity-based costing, 5S, VSM, OPF |
| 5. | Reuse of resources | DFMA, Design for Disassembly |
| 6. | Promoting savings | Kaizen |
| 7. | Resource recovery | VSM |
| 8. | Preserving the greatest possible value of resources, products, components | 5S, kaizen, Poka-Yoke, VSM |
| 9. | Creating a system to ensure long product life | TPM, SMED, Kanban, Heijunka |
| 10. | Maintenance, regeneration and recycling | TPM, SMED, 5S, ISO |
| 11. | Reduced consumption of raw materials | Lean Design, Kanban, Heijunka |
| 12. | Reuse, repair, replacement, upgrading, refurbishment | DFMA, Design for Disassembly, Lean Design |
| 13. | Activities to maximise the added value of raw materials/resources, materials and products | Heijunka, kaizen, activity-based costing |
| 14. | Development of innovation | Kaizen, VSM |
| | Promoting technological development | Kaizen, VSM |
| 15. | Extending product life cycles | LCA, Poka-Yoke, Jidoka |
| 16. | Improvement of the quality of the environment and nature conservation | Kaizen, 5S, VSM, LCA, Lean Design, Poka-Yoke, Jidoka |

***Source:*** *Own study based on literature on the subject.*

It can certainly be said that the identified areas of application of lean tools and the resulting benefits encourage consideration of implementing the concept. Its positive impact on the environment including CE assumptions is undeniable.

The analysis of the literature shows that it is possible to measure the implementation of the lean management concept in an organization, for example, by measuring the implementation of 14 principles of lean management, implemented in four categories: long-term philosophy; the right processes that produce the right results; in adding value to the organization through the development of employees and

partners; through continuous solving of source problems, which is the driving force of organizational learning (Yang *et al*., 2011; Czyż-Gwiazda, 2015; Åhlström *et al.*, 2021) and indicators measuring the impact of lean management on sustainable economic development. The results provide evidence of the positive impact of lean management on economic sustainability (Awad *et al.*, 2022, Kulczycka, 2020; Henao *et al.*, 2019).

## 4. Empirical Research to Assess the Level of Maturity of the CE Concept of Polish and Foreign Enterprises and the Management Tools they Use

As part of university research grant, a study was conducted to assess the level of maturity of the circular economy concept among small and medium-sized enterprises, both domestic and foreign, and the management tools they use, including lean tools. Among the companies surveyed, 50 were from Poland and 25 were members of the INAA. The companies represented the service sector. It is one of the fastest growing economic sectors not only in Poland but also worldwide.

On the basis of the study, it was proven that companies affiliated with international organisations are more aware of the concept of circular economy and responsibly implement management tools including lean management tools.

The first research area concerned the objectives of the companies surveyed. The analysis of the survey results shows that in both domestic and foreign companies, one of the main goals is entrepreneurship and the willingness to act. Respectively, 34% and 33% of the companies surveyed claimed so (Figure 1).

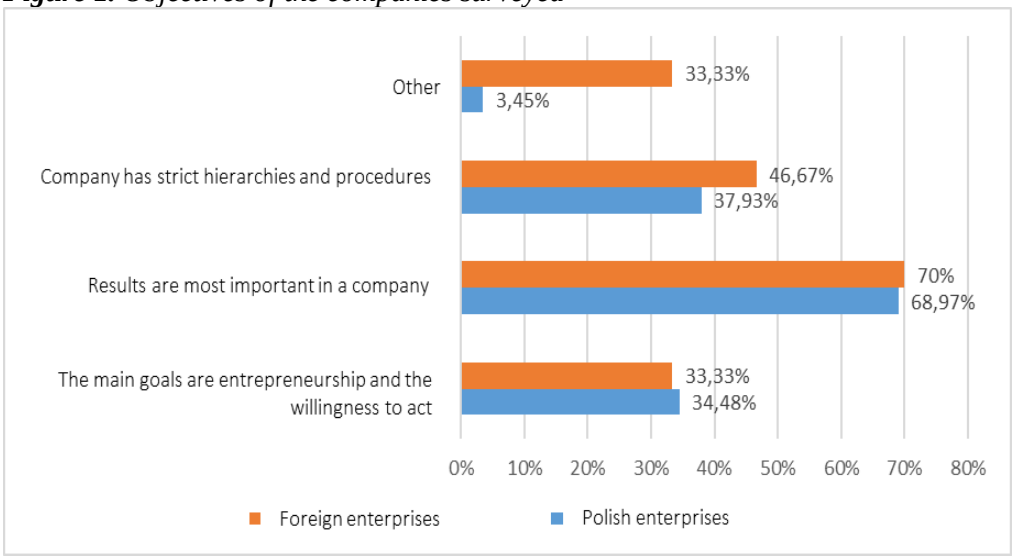
These results are very similar, suggesting that the motivation to be innovative and proactive is an important element in companies operating on the Polish as well as the international service market. Both Polish and foreign companies have a strong focus on achieving business goals, as 63% and 72% of respondents confirmed respectively. These results indicate the universality of results orientation in the business context, regardless of the company's country of origin.

The differences are in organisational structure. Among Polish companies, only 38% of respondents agree with the statement that their company has strict hierarchies and procedures. Meanwhile, among foreign companies, this is confirmed by 57% of respondents. This suggests that foreign companies may follow and adhere to more formalised structures and procedures.

Differences between Polish and foreign companies are also apparent in the "other" category. Among Polish companies, 13% of respondents indicated other main objectives, while in foreign companies this percentage is as high as 33%.

This may suggest that foreign companies have different goals and strategies or operate in a more diverse business context. Another question concerned *management tools/methods implemented, including cost management*.

***Figure 1.*** *Objectives of the companies surveyed*




***Source:*** *Original research.*

Analysis of the results shows differences in the use of various management tools and methods between Polish and foreign companies. Virtually all foreign companies (97%) use budgeting, compared to Polish companies (72%). Management control and internal audit are also more commonly used in foreign companies (57%) than Polish companies (41%). Financial auditing is used by 61% of foreign companies and only 23% of Polish companies.

A significant difference emerges in the case of risk management — this is a tool used by half of foreign companies, but only in 27% of Polish companies. In the case of quality management systems, the difference is also significant, with 34% of Polish companies and 73% of foreign companies using them.

Outsourcing is more popular with foreign companies (83%) than domestic companies (67%). In contrast, lean management tools such as kaizen, value stream mapping, target costing and target costing were only used in foreign companies (38% of indications). The 5S method is also rarely used in domestic companies.

There were 17% indications. Instead, it is very popular in foreign companies. It is used by 64% of the companies surveyed. In the "other" category, significantly more foreign companies (27%) than Polish companies (10%) indicated the use of other management tools or methods. Among those mentioned were: project management tools, reporting systems and performance monitoring.

Another question was about *knowledge of tools to facilitate the implementation of circular economy***.** The analysis of the results shows the different attitudes of the surveyed companies to both the knowledge of the nature and importance of the CE concept and the tools that facilitate the implementation of this model. In both Polish and foreign companies, tools have emerged to help implement the CE concept, such as quality management systems, ISO environmental standards, internal auditing and cost management tools.

In foreign companies, the kaizen method, product cycle accounting and target costing have been added. The fundamental differences, however, relate to CE awareness and CE-oriented activities. Polish companies mainly focus on aspects related to environmental issues: the possibility to reduce the number of landfills and the amount of waste (56%), the use of renewable energy sources (43%) and general environmental improvement (44%).

In contrast, almost all foreign companies surveyed focused on aspects of waste management (92%), product life cycle (37%), information technology (80%), supplier cooperation (65%) and renewable energy sources (97%). The level of knowledge of CE in foreign companies was much higher: respectively, those who were unsure or had no knowledge of the CE concept were 15%, while Polish companies had twice as many indications of this. Among most of the answers provided by Polish companies, circular economy is identified with waste separation and general environmental issues.

Among CE measures, foreign entrepreneurs pointed to: reducing document printing, storing documents electronically, using energy-efficient lighting and renewable energy sources, applying the 3R principles (Reduce, Reuse, Recycle), environmental auditing, planning for raw materials management as well as reusing materials and energy. Foreign entrepreneurs pointed to the lack of sufficient education in this area and legislative preferences for companies applying CE.

Entrepreneurs from Poland also responded in different ways to the question asked. Among the CE model measures, they most often indicated environmental protection measures: segregation of waste, use of energy-efficient light sources, monitoring and reduction of $CO_2$ emissions, use of ecological means of transport and saving water.

When asked about the *benefits of implementing tools to facilitate the CE implementation process,* foreign entrepreneurs also provided varied answers. Some admitted that their companies had not yet introduced such tools, had no knowledge of them or did not provide specific information.

In contrast, others pointed to economic benefits, easier communication with customers, reduced paper consumption, reduced use of packaging materials and energy, increased access to new customers and business partners, reduced environmental impact and a greener and more environmentally friendly corporate

image. In other cases, the benefits of an environmental management system and waste segregation and the stimulation of innovation were mentioned. In some companies, CE has not yet been introduced.

Polish entrepreneurs did not provide such answers, which is due to a lack of knowledge on the matter. Some pointed to increased efficiency, improved quality and reduced waste generation.

When analysing the responses to the question on *activity-based costing as a tool to support the circular economy model*, one can see both similarities and differences. Both groups of entrepreneurs showed uncertainty or lack of knowledge about the role of activity-based costing in the CE process. However, foreign entrepreneurs were more likely to express the belief that activity-based costing was a tool to support the CE implementation process.

In contrast, Polish entrepreneurs differed in their responses. Some expressed confidence in the usefulness of activity-based costing, while others lacked a clear opinion on the matter. Thus, it can be concluded that foreign entrepreneurs showed a greater awareness and belief in the role of activity-based costing in the CE process compared to Polish entrepreneurs. Another question concerned *lean management tools* used. Among foreign companies, 80% of respondents indicated that lean management tools support the implementation of the circular economy model, while 20% disagreed with this statement.

In case of domestic companies, 54% of respondents agreed with this statement and 46% disagreed. Across the entire sample, 62% of respondents agree with the statement that lean management tools can support the implementation of the circular economy model, while 38% hold the opposite view.

A chi-square test of independence was used for this question. Table 2 shows the results obtained. Based on these, Chi2(1)=4.78; p=0.03 were calculated.

***Table 2.*** *Do Lean management tools support the implementation of the circular economy model vs. the company's country of origin*

| **Variable** | | **Yes** | **No** | **Total** |
|---|---|---|---|---|
| | Population size | 20.00 | 5.00 | 25.00 |
| Foreign | % per line | 80.00% | 20.00% | 100.00% |
| | % of total | 26.00% | 7.00% | 33.00% |
| | Population size | 27.00 | 23.00 | 50.00 |
| Domestic | % per line | 54.00% | 46.00% | 100.00% |
| | % of total | 63.00% | 30.00% | 67.00% |
| Total | **Population size** | **47.00** | **28.00** | **75.00** |

| Variable | Yes | No | Total |
|---|---|---|---|
| % per line | 62.00% | 38.00% | 100.00% |
| % of total | 62.00% | 38.00% | 100.00% |

***Source:*** *Original research.*

The chi-square test showed a statistically significant difference between foreign and domestic companies in assessing whether lean management tools can support the implementation of the circular economy model. When analysing the responses of foreign entrepreneurs to the next question on the reasons for *not using tools/methods to facilitate the CE implementation process,* it can be seen that some respondents did not consider the lack of awareness of these tools as the main reason.

In contrast, other respondents acknowledged that lack of awareness may be one of the reasons for not using these tools. Some entrepreneurs also pointed to the specifics of their business as the main reason for not using these tools.

When analysing the responses of Polish entrepreneurs, it can be seen that some respondents agreed with this hypothesis. They felt that lack of awareness was the main reason for not implementing these tools. Other entrepreneurs also indicated a fear of using these tools and a belief that they would not bring the expected benefits. Another question addressed the *challenges of implementing CE by companies.*

Responses from both foreign and domestic entrepreneurs were similar. Foreign companies indicated: switching to renewable materials and energy sources, extending the life cycle of products, increased durability, using recycled materials instead of new resources, increasing resource efficiency, reducing or even eliminating waste in the production and supply chain, reusing products or components, recycling, upcycling, using new technologies and lean management tools.

Polish companies emphasised electromobility, $CO_2$ reduction, switching to renewable materials and energy sources, extending the life cycle of products, creating a system for reuse and repair and high quality of services provided. In the conclusion, both Polish and foreign entrepreneurs indicated the *factors influencing the threat to the market stability of their companies*.

In both groups, factors such as competition, inflation, legal changes and external factors, the country's economic situation or political considerations emerged. Both groups of entrepreneurs also emphasised the importance of economic factors for market stability.

However, there were also some differences in the responses. Foreign entrepreneurs were more likely to mention: retention of skilled employees, technological change or competition from companies offering lower prices for their services. Polish

entrepreneurs, on the other hand, were more likely to point to: employee turnover, automation and digitalisation, changing legislation and regulations, social and political-legal factors.

When asked about *the factors that influence the development and competitiveness of companies* the similarities between the answers of foreign and Polish entrepreneurs concerned: the importance of the human factor, especially the attraction and retention of qualified employees and their development. Both groups referred to external factors: political, economic and health factors and competition.

Differences were also present. Foreign entrepreneurs were more focused on innovation, technology, management tools and competition, while Polish entrepreneurs were more likely to point to factors related to legal regulations and the economic situation of the country. Foreign entrepreneurs were more likely to emphasise the importance of the management strategy adopted, the quality of customer service and the development of the company's uniqueness, while Polish entrepreneurs focused more on financial factors and local conditions.

## 5. Conclusion

Due to its huge potential for change, Poland can lead the way in implementing the circular economy concept. At this level, it is very important to understand and spread awareness of benefits of implementing circular economy principles. Government actions play a huge role, as it should assist in transcending regulatory barriers and creating suitable conditions conducive to the transition to circular economy. A multifaceted effort to remodel the current system into a set of coherent economic and legal instruments may prove to be the key to Poland's great success in this area.

Circular economy can provide society with high-quality, functional and safe products that are more efficient and affordable, more durable and designed for reuse, repair and recycle. A whole new range of sustainable services, product-as-a-service models and digital solutions will provide a better quality of life, innovative jobs and higher levels of knowledge and skills.

The survey provided information on the awareness of Polish service companies in the SME sector of the principles of circular economy and the lean management tools used to implement them.

Based on the survey results, the following conclusions were formulated:

1. Despite the undeniable benefits of lean management tools in Polish service enterprises, they are not very popular compared to foreign enterprises. Such methods as: kaizen, value stream mapping, target costing were used only in foreign companies (38% of responses). The 5S method is very popular in

foreign companies. It is used by 64% of the surveyed companies. Domestic companies recorded 17% of indications.

2. The level of knowledge about circular economy in foreign companies is much higher than in domestic companies. 15% of the surveyed foreign companies had no knowledge of the circular economy concept, while in Polish companies there were twice as many such answers.
3. Polish companies identify the circular economy with waste segregation and general environmental issues.
4. Lack of awareness is the main reason for not implementing lean management tools, fear of their use, belief that they will not bring the expected benefits, and external economic and political factors of the country.
5. In order for SMEs to implement lean management and the circular economy model, it is important to take appropriate measures, such as education and training, presenting SMEs with specific benefits that may result from the implementation of lean management and the circular economy model.
6. Identifying cost savings, increasing operational efficiency, reducing waste, improving quality and sustainability can encourage entrepreneurs to take actions.
7. Conducting a detailed process analysis in SMEs and identifying areas where lean management principles can be applied.
8. The implementation of lean management and the circular economy model should be gradual, with an initial focus on key areas and a gradual development of activities. A pilot approach in one area of activity can help to understand and achieve first successes, which can serve as motivation for further action.
9. SMEs often have limited financial, technical and human resources, which makes it difficult to implement lean management tools. In most small and medium-sized enterprises, the main goal is to generate profits in the short term. The introduction of changes related to circular economy may require an investment of time and resources, which will not always bring immediate financial benefits. In some regions, especially where there is a lack of appropriate regulations and incentives for the implementation of circular economy, enterprises do not see the motivation to take action in this direction.
10. Participation of enterprises from the SME sector in international organizations not only opens the door to the market and knowledge exchange, but also increases awareness of new management tools and concepts such as circular economy.

There is a need to understand what changes and adjustments has to be made to streamline operations, reduce waste and increase efficiency and ensure SMEs have access to the right tools and technical support. This can include the provision of process management software, training in specific lean tools, as well as advice from lean management experts, organising industry meetings, business networks or

entrepreneurial clubs can enable the sharing of best practices, ideas and challenges related to the implementation of lean management and CE.

Both the literature on the subject and business practice indicate that by continuously improving processes, using lean management tools, it is possible to achieve the circular economy assumptions and, as a consequence, as a result of significant cost reduction, efficient use of resources, increased quality of products and services provided — to ensure the enterprise's stability and financial security (Jagusiak, 2018; Cherrafi *et al.,* 2017; Alves *et al.,* 2015).

The lean philosophy, methods and tools enrich the set of management tools with a perspective that is based on an in-depth recognition of the context and causes that generate problems in the organisation. Lean management teaches us to notice, spot and see waste. However, the biggest challenge in implementing the lean concept is the stereotypes about the concept (e.g., predatory change aimed at reducing the number of employees). They are mainly due to a misunderstanding of its essence and, above all, of its principles: continuous improvement and respect for people.

Both circular economy and lean management cannot be seen merely as concepts consisting of a set of methods and tools to implement rapid change in technical, organisational or environmental terms. These concepts have great potential to change organisational culture towards continuous improvement.

This change is realised by changing people's attitudes and their working culture. The prerequisite for this change is a good understanding of the fundamental principles of the circular economy and lean concepts, organisational, technical, administrative, legal support and education.

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