Assessment of Company's Unused Production Capacity in the Context of Sustainability: The Case of Textile Industry in Lithuania

Kristina Rudzioniene
Kaunas faculty
Vilnius university
Kaunas, Lithuania
https://orcid.org/0000-0001-8111-5675

Ruta Klimaitiene
Kaunas Faculty
Vilnius University
Kaunas, Lithuania
ruta.klimaitiene@knf.vu.lt

Nora Dilyte
Kaunas Faculty
Vilnius University
Kaunas, Lithuania
https://orcid.org/0000-0002-5839-1441

Abstract—**Inefficiently managed resources in enterprises not only distort the financial results of the enterprise, statistical information of the state, but negatively affect the environment and contradict the concept of sustainable development. Research purpose was to investigate how are assessed the unused production capacity which affects the overall statistical indicators of the state in large Lithuanian textile enterprises. The determination of the capacity utilisation level in enterprises is quite superficial, which is influenced by the fact that there are no recommendations on how exactly the unused production capacity of enterprises can be identified. The performed research revealed that large textile Lithuanian companies do not have the methodology to assess the level of unused production capacity. Only 60 percent of surveyed enterprises use KPIs. The authors suggested to improve the form of the questionnaire of the Statistics Department in order to obtain more valuable information for the State.**

Keywords—capacity, company, sustainability, textile industry, Lithuania.

I. Introduction

The inefficient use of the available resources shows that business subjects are not exploiting their full potential. The essential goal of each business unit is the maximization of its profit, hence, the efficient use of the available resources is a very important factor contributing to increased profits and maximized operational efficiency. The available resources of enterprises indicate their ability to carry out activities and maintain their scale, and their effective management determines the maximum profit margin and top-level performance of the company. Inefficiently managed resources in enterprises not only distort the financial results of the enterprise and the statistical information of the state, but they also negatively affect the environment and contradict the concept of sustainable development.

In the light of the ever more globalized markets, efficient use of resources is an inseparable facet of every business not only due to the pursuit of superior results of the financial activity of the enterprise but also because of the increasing popularity and relevance of sustainable development. The identification of avoidable unused capacity as well as targeted and purposeful management at enterprises contributes to the increase of the efficiency of the enterprise, the social welfare of the state, the efficient and purposeful use of resources and the implementation of the objectives of sustainable development.

Unused capacity as a topic has been widely researched by many authors [1], [2], [3], [4], [5], [6]; however, capacity is usually divided by targeting specific segments while identifying their differences.

The effective use of capacity is a necessity for most organizations [7]. Organizations can no longer sustain profitability where there is a high proportion of unused capacity. This makes the subjects of unused/idle capacity to be of importance to managers at all levels and functions, and managers are being called on to take a closer look at capacity management [8]. The impact of efficient management of resources regarding the profitability and continuity of activities has mostly been dealt with in the following works: [8], [9], [10], [11]. The importance of unused capacity and its impact on the activity and results of enterprises has been extensively described previously: [2], [12-17]. Klimaitienė and Kundzelevičius [18] revealed the additional unused capacity in the weave service company; however, we couldn't find works highlighting the importance of exact identification of unused capacity in enterprises in the light of sustainability in economy.

Scientific problem – correct identification of the company's unused production capacity assessing the overall statistical indicators of the state implementing sustainability goals.

Research purpose – to investigate how are assessed the unused production capacity which affects the overall statistical indicators of the state in large Lithuanian textile enterprises.

Research methods. Various methods have been used in a complex manner to achieve the research purpose: comparative analysis of scientific literature, logical analysis and synthesis, structuring, abstraction, questionnaire survey, evaluation, statistical data analysis, deduction and calculations.

II. Concept of Unused Capacity and its Impact on Sustainability

The United Nations (UN) encourages not only countries but also business subjects as well as all goodwill individuals to contribute to the implementation of its 17 objectives of sustainable development. UN highlights that these objectives will never be achieved if they will only be the objectives of the state – hence, businesses, along with the society, must adopt them as their duty. The twelfth objective of sustainable development is aimed at ensuring models of sustainable consumption and manufacturing in the entire world. It covers sustainable management of environmental resources and their efficient use, decrease of the production waste and promotion of its responsible disposal while

managing the available resources efficiently. According to Yang, Fukuyama and Song [19], the identification of the level of production capacity worldwide has been becoming ever more urgent due to the rapidly spreading idea of sustainability around the globe. As the society has already realized that sustainability is an indispensable part of the modern life and the natural as well as human resources are highly limited, the efficient consumption of all the resources is the fundamental responsibility of each business subject. Notably, the identification of the level of use of production capacity is one of the key means allowing to pinpoint the wasted potential in enterprise activity along with the opportunities of boosting productivity. This is also claimed by Turhan [20] who stated that the level of use of production capacity is an essential indicator of the manufacturing sector in each country. If the available resources are consumed inefficiently both at the level of the enterprise and the country, economy is suffering from major losses, major wastage of resources is observed, and the potential added value is getting lost. The insufficient use of resources can lead not only the lost profits but also economic crises [20]. Therefore, both at the macrolevel and at the microlevel it is essential to consider the efficient management of the available capacity more carefully and responsibly. According to Mugo [8], more advanced use of the capacity implies better use of the resources. It is essential that businesses should be oriented towards exact identification and decrease of their expenses.

However, the unused capacity is mostly defined at the level of the company. Tse and Gong [21] define unused capacity as the difference between the available resources and the consumed resources. Mugo [8] defines idle/unused capacity as the difference or variance between the available capacity and the applied capacity. Vaznonienė and Bendaravičienė [22] claim that the unused capacity is that part of time which is spent idle by the equipment and/or staff without doing any work (i.e., the non-productive part

of time). Gogoi [23] agrees that idle capacity is the remaining amount of capacity left in a company after productive capacity and protective capacity have been eliminated from consideration. Turkhan [20] agrees that capacity sets out the amount of output as a measure of ability for businesses. Bodar, Srinivasan, Shah, Kawal and Shunkla [24] define the potential unused capacity as the minutes that a system rests unused in an operating room.

Having conducted analysis of the definitions of unused capacity, we may claim that the definitions of 'unused capacity' are highly similar in all the analysed works and that this concept hardly changed at all during the past two decades. As the existing definitions do not include a sustainability aspect, we suggest to extend the definition stating that *unused capacity is the capacity of an enterprise for a certain period of time which is not used in business activities, does not create added value, and which requires certain costs and reduces the efficiency of enterprises in sustainable development issues.*

Nevertheless, the extent of unused capacity may even be explored at the level of the state. The importance of the use of the production potential at the level of the state ultimately reveals how enterprises themselves assess the market situation/conditions, informs about the potential for growth of a manufacturing sector and provides opportunities for assessing the unused capacity and the resulting wastage. According to Yu and Shen [25], the level of the use of production capacity in various countries not only shows the efficiency of production activities but also allows identifying the unused capacity – which is essentially wastage – and to adopt the corresponding solutions for dealing with environmental issues.

EU statistics service publishes quarterly levels of the production capacity utilization in its member states (Fig. 1 shows 2019 data).
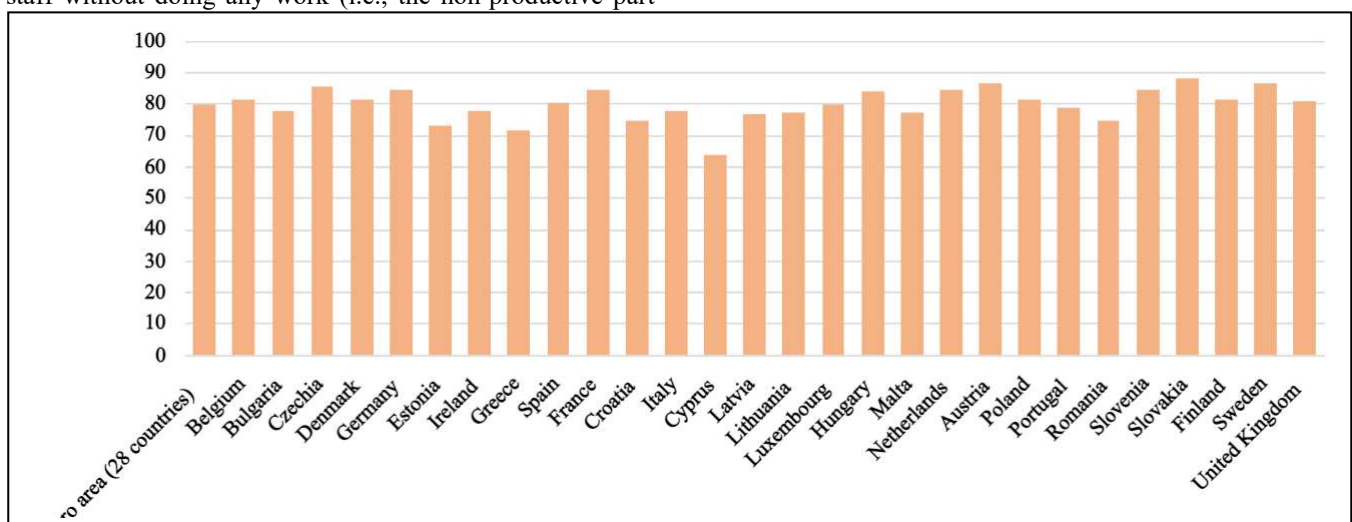

Fig. 1. The Level of Capacity Utilization in Manufacturing Industry in EU, 2019, %
Source: compiled by the authors on the Eurostat data [27].

13. At what capacity is your company currently operating?

less than 30 %	31-40 %	41-50 %	51-60 %	61-70 %	71-80 %	81-90 %	91-100 %	more than 100 %
☐	☐	☐	☐	☐	☐	☐	☐	☐

Fig. 2. The Questionnaire to Assess the Level of Used Capacity in Lithuania
Source: compiled by the authors on the Statistics Lithuania data [38].
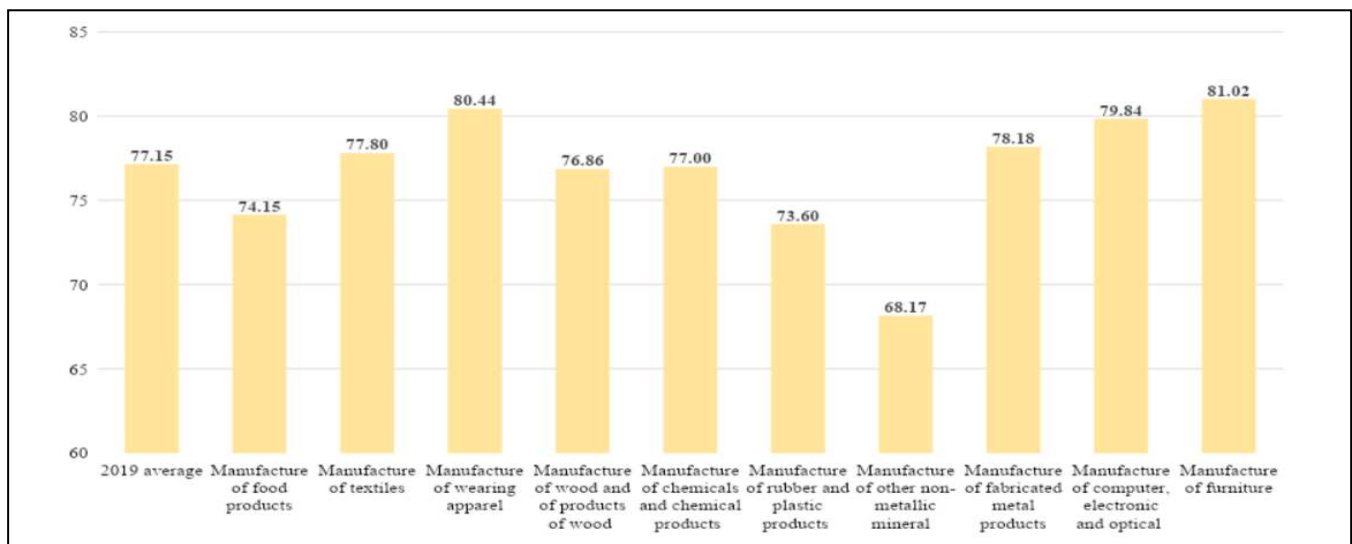
Fig. 3. The Level of Used Capacity in Different Sectors, 2019, %
Source: compiled by the authors on the Statistics Lithuania data [28].

Each member state runs surveys based on the joint and universally adopted program of the EU of May 15 [26]. Monthly, on the grounds of EU recommendations, more than 38,000 manufacturing enterprises are surveyed around the EU. The accrued data is systemized, and arithmetic averages of the criterion are announced.

In Lithuania, the level of used production capacity is calculated by the *Statistics Lithuania* [28]. The research is performed on the basis of the methodology of the statistical research of business trends which also describes the law acts regulating the statistical research of business trends and the methods used for the research. This statistical research is performed monthly by surveying managers of enterprises. The methodology of the statistical research of business trends stipulates that the research is based on the opinion of business enterprises on the former, current and future changes in the activity of the enterprise thus producing short-term economic analysis and forecasting.

Statistical research in Lithuania was conducted by employing selection, and the sample of the surveyed entities was derived by cut selection by considering the revenue of business entities and the numbers of staff. The entire pool of manufacturing enterprises was grouped in terms of the areas of economic activity and then listed for each activity by ranking in the decreasing order regarding the revenue and the staff numbers. Then, cut selection was employed from below, and, for each activity, enterprises were eliminated until the cumulative value of the revenue and staff of the remaining enterprises was equal or above the 50 percent level of the total of the sample. In 2019, 750 manufacturing enterprises were surveyed in Lithuania. The questionnaire is presented in Business and Consumer Surveys and its annexes. Specifically, Lithuanian manufacturing enterprises were sent the questionnaire of the statistical research of the trends of business enterprises A-01. The level of the use of production capacity is derived by using a single question (Fig. 2). When *Statistics Lithuania* receives the questionnaires filled by managers of manufacturing enterprises, the level of the use of production capacity at the national scale is derived as the arithmetic average of the values indicated by all the enterprises participating in the research.

Statistics Lithuania presents not only the general level of used production capacity, but also, since 2007, it has been presenting the production capacity levels in ten different segments of economic activity as it allows evaluating the economic advancement of each specific segment and yields insights into the trends of specific segment (Fig. 3). The levels of used capacity in each sector are calculated also on the data collected with this questionnaire.

The lowest level of the use of production capacity in Lithuania was identified in the sector of the manufacturing of other non-metal mineral products when it equaled 68.17%, whereas in the sector of manufacturing rubber and plastic items the determined value was 73.6%. The highest levels of used production capacity was determined in the sector of furniture manufacturing (at 81.02%) and in the sector of wearing apparel production at 80.44%.

The existing cannot easily be adjusted [29]. As the source of data collection is the one question in common questionnaire which has no recommendations how to identify the enterprise's level of used capacity precisely, we may conclude that enterprises determine this ratio quite superficially. Therefore, it can be claimed that the statistical data on the level of the use of the production capacity nationally is imprecise and that it hardly represents the real-life situation of the use of production capacity at the national level.

III. ASSESSMENT OF UNUSED CAPACITY IN ENTERPRISES

An important factor in the course of pursuit of the success of an enterprise, the efficiency of its activity and its adherence to the standards of sustainability is the definition of unambiguous objectives and the enumeration of a list of key performance indicators (KPI) identifying the implementation of objectives. Commonly, organizations accumulate and store extensive data which makes sense; yet, this sense is not derived as proper analysis is not conducted so that the right decisions could be taken. KPIs allow enterprises to gather information which can be converted to knowledge and correct decisions in simple ways. KPI

determines the objectives of an enterprise and suggests ways allowing the management of the enterprise and the introduction of upgrades so that the abovementioned objectives could be achieved. According to Graham, Goodall, Peng, Palmer, West, Conway, Mascolo and Derrmer [30], KPIs should be used as an ancillary means of the management of an enterprise which analyses the possibilities of improving the organization. According to Kaganski, Majak, Karjust and Toompalu [31], monitoring the KPIs will help companies identify progress toward sales, marketing and customer service goals. Enterprise activity analysis is at its optimal level when both qualitative and quantitative data is available. Most organizations give preference to qualitative data as it is easier to perceive and gather, and are better adapted to analysis. Still, it is fundamentally important that quantitative data is aligned with qualitative data as qualitative data is quintessential for highlighting issues encountered in activities along with the drawbacks of processes, the need for improvements and the opportunities to achieve progress.

According to Thakur, Beck, Mostaghim and Großmann [32], the selection of the right indicators of efficiency is the key step in the process of enterprise activity when implementing the KPI system. The properly selected KPIs generate a number of advantages for enterprises and affect the increase of the efficiency of activities; on the other hand, the faulty choice of KPIs produces an obstacle for the improvement of activities. Gackowiec, Podobińska-Staniec, Brzychczy, Kühlbach, Őzver [33] highlight that a comprehensive list of indicators applicable at different management levels should take into account the main perspectives of processes and consider such process-impacting factors as the work environment, machinery, and the human factor. According to Bishop [37], setting the right KPIs allows businesses to achieve strategic objectives, to deal with the challenges arising in activity processes and to boost the efficiency of the daily activities.

On the grounds of works [34-36] we highlight the main KPIs in manufacturing enterprises which have impact on the efficiency of the consumption of resources in terms of sustainability and present their definitions (Table 1).

TABLE 1. Main KPI in Manufacturing Enterprises Having Impact on Sustainable Management of Resources

KPI	Definition
Efficiency of the staff	Time during which the staff are performing their direct functions
Efficiency of the equipment	Ratio between the duration of product manufacturing and the maximum duration of the operation of the equipment
Duration of production	Time during which manufacturing processes take place
Amount of entry	Amount of materials consumed in the course of production
Spoilage/ rejected items	Inappropriately produced items
Wastage	Result of production which cannot be sold, including waste/scrap of the manufacturing process
Unused capacity	Capacity of an enterprise off a certain period which is not employed in the course of business activity, does not generate any added value yet requires specific expenses and decreases the efficiency of the enterprise activity in terms of sustainable development

Source: created by the authors

Previous literature indicates choosing the right KPIs leads to improved assessment of the level of unused capacity of the company. Bishop [37] claims that KPIs should be used by all the subjects of the business process as KPIs provide major competitive advantages.

IV. RESULTS OF RESEARCH AND DISCUSSION

The sector of Lithuanian textile production was selected for the research for several reasons: 1) the technological progress and development of this industry branch (the investment into machinery, equipment, vehicles and inventory in the textile manufacturing sector grew by 42.69% in 2015–2019 [38]); 2) consistent growth in the sector (in 2009–2019, the revenue from sales of the textile item manufacturing sector more than doubled [38]); 3) unused capacity and waste generation during the production process is highly relevant in this sector [18]; 4) attractiveness to foreign investors (direct foreign investment between 2010 and 2020 grew by 47.58% [38]); 5) very high level of production exports (in 2018 and 2019, the export share of the textile sector was 73.1% and 69.44% of the entirety of the output, respectively [38]); 6) one of the lowest capacity utilization levels in 2019–2020 (out of the 10 manufacturing sectors targeted in this research, in terms of the average level of used capacity between the years 2007 and 2019, the textile sector took the lowly position 8 [38]).

In order to find out how textile item manufacturing enterprises identify the unused capacity in their activity, a questionnaire was developed whose digital version was submitted to the thirty largest (in terms of the revenue and the staff numbers) textile enterprises of Lithuania. 5 responses of the textile industry leaders were received: two enterprises are currently filling in the survey of *Statistics Lithuania* regarding the statistical research of the business trends of the production enterprise. Meanwhile, three enterprises are not currently filling in this survey, but used to do it in the past. Research results are shown in Table 2.

TABLE 2. Research Results

Question	Answers
How precisely is enterprise capable of pinpointing the unused capacity in the activity (in the scale from 1 to 5, where *1* stands for *very imprecisely* and *5* represents *very precisely*)?	3 companies indicated that their ability to identify the unused capacity is 3 points; 2 companies indicated that their ability to identify the unused capacity is fairly high and assessed themselves by giving 4 points.
Do the enterprises use KPIs?	3 companies use KPIs in their activities.
How often do the enterprises using KPIs actually observe them?	2 companies are tracking KPIs on a daily basis; 1 company is applying weekly observation of KPIs; 2 companies are not using KPIs at all.
Which KPIs are most commonly used?	Efficiency of the staff (3 companies); efficiency of the equipment (3 companies); spoilage/number of deficient (substandard) items produced (3 companies); timely implementation of orders (2 companies); technological progress (1 company); wastage (1 company).

Source: compiled by the authors.

The companies participating in the survey (Table 2) assessed their ability to identify unused capacity on a 5-point scale, and they ranked themselves at the solid average of 3.4 points in their responses. From this, it can be concluded that setting the capacity utilization level is not accurate from the point of view of the companies and further from the point of the State.

The other results of the questionnaire showed that about 60 % companies use KPIs in their activities. Therefore, we may conclude that the use of KPIs is not a universal and widespread device of business management in Lithuania, especially if we consider the fact that the leaders by the output of textile production were surveyed. The KPIs they are applying (efficiency of the staff and the equipment, spoilage and wastage, timely processing of orders, technological progress) are observed in a fairly regular manner. Moreover, the survey was performed in large companies, but it is very likely small companies use less KPIs or do not determine them at all.

In order to achieve the maximum economic result while taking into consideration the implementation of the UN Sustainable Development Goals, governments must pay due attention to determining the level of capacity utilization in their countries as accurately as possible by developing recommendations so that to enable enterprises to accurately assess the untapped production capacity in the activity and thus enable businesses to properly fill in the statistical department's questionnaires aimed at determining the utilization level of the country's production capacity. Besides, governments should demand at least moderately detailed data (KPIs) which should be supported with detailed calculation and real data, for instance, by the efficiency of the use of materials, work of staff and operation of equipment, the amount of waste and the share of spoilage/substandard output.

V. Conclusions and limitations

After analyzing the concept of 'unused capacity' in terms of sustainability, it should be noted that, in the scientific literature, the authors are not inclined to define it through the prism of sustainability; as the existing definitions do not include a sustainability aspect, we suggest to extend the definition stating that *unused capacity is the capacity of an enterprise for a certain period of time which is not used in business activities, does not create added value, and which requires certain costs and reduces the efficiency of enterprises in sustainable development issues*.

In 2019, Lithuania was in the 22nd place in terms of the level of used capacity in the EU. In Lithuania, the level of used production capacity is calculated by the Statistics Lithuania. This statistical research is performed monthly by surveying managers of enterprises regardless of the manner in which enterprises determine the level of used capacity (subjectively or objectively). But the assessment of the capacity utilisation level in enterprises is quite superficial, which is influenced by the fact that there are no recommendations on how exactly the unused production capacity of enterprises can be identified.

The sector of Lithuanian textile production was selected for the research. The results of performed questionnaire of large companies in textile sector indicate the current approach of companies to the assessment of unused

capacity. The companies assessed their ability to identify unused capacity on a 5-point scale, with an average of 3.4 points of responses, which can be concluded that setting the capacity utilisation level is not accurate from the point of view of both the companies and further the state. Although about 60 % companies use KPIs in their activities. The KPIs they are applying (efficiency of the staff and the equipment, spoilage and wastage, timely processing of orders, technological progress) are observed in a fairly regular manner. Therefore, we suggest to improve the form of the questionnaire of the Statistics Lithuania in order to obtain more valuable information from enterprises and to make the aggregated state data more accurately and more reasonable. The improvement can be made by inserting additional KPIs in the questionnaire, which were analysed in this survey and/or specific to every sector of manufacture.

The digital version of prepared questionnaire was submitted to the thirty largest (in terms of the revenue and the staff numbers) textile enterprises, but only 5 responses were received. The sample must be sufficient so that valid results of the research could be obtained. Statistical research requires a higher number of results than the data which we have at our disposal so that we could ensure the representativeness of the results; in our case, the results of the questionnaire survey are restricted by the quantity as well as the quality of the assembled data. The sample size is not big because enterprises tend to hide confidential management accounting information; private companies making their research also hardly gain the representative results in this context. Despite this limitation, such as the size of the sample surveyed, the authors argue that the results show the main tendencies in large manufacturing enterprises. Moreover, the authors assume that the situation in smaller companies should be worse. Therefore, the data for the Statistics' needs are very approximate.

However, depending on the scope of this research topic, there is very little or no prior research on a specific topic, in this case, discovering a limitation can be considered an important opportunity to present the need for further development in the area of assessment of company's unused production capacity in the context of sustainability, including other sectors of manufacturing, other KPIs.

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