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САДРЖАЈ / CONTENT

ОРИГИНАЛНИ НАУЧНИ РАДОВИ / ORIGINAL SCIENTIFIC PAPER

Nemanja Veselinović, Bojan Krstić, Martina Veselinović	
MEASURING THE EFFICIENCY OF HUMAN CAPITAL	1
МЕРЕЊЕ ЕФИКАСНОСТИ ХУМАНОГ КАПИТАЛА	1

ПРЕГЛЕДНИ РАДОВИ / SCIENTIFIC REVIEW PAPER

Ivana Janjić, Milica Jovanović, Zoran Simonović	
THE IMPORTANCE OF RESEARCH AND DEVELOPMENT FOR INNOVATIVE ACTIVITY: THE OVERVIEW OF THE TOP COUNTRIES IN EUROPE AND WORLDWIDE	19
ЗНАЧАЈ ИСТРАЖИВАЊА И РАЗВОЈА ЗА ИНОВАТИВНУ АКТИВНОСТ: ПРЕГЛЕД НАЈБОЉИХ ЗЕМАЉА У ЕВРОПИ И СВЕТУ	19
Milica Mladenović, Bojan Krstić	
TRENDS AND STRATEGIC APPROACH TO ESTABLISHING WORK/LIFE BALANCE OF MANAGERS AND OTHER EMPLOYEES	29
ТРЕНДОВИ И СТРАТЕШКИ ПРИСТУП УСКЛАЂИВАЊУ ПОСЛА И ПРИВАТНОГ ЖИВОТА МЕНАѢРА И ОСТАЛИХ ЗАПОСЛЕНИХ	29
Marija Rakić, Bojan Krstić, Tamara Radenović	
MEASURING ENERGY EFFICIENCY OF AN ENTERPRISE	37
МЕРЕЊЕ ЕНЕРГЕТСКЕ ЕФИКАСНОСТИ ПРЕДУЗЕЋА	37
Lazar Milenković, Tamara Radenović, Anđelija Baljošević	
THE IMPORTANCE OF WASTEWATER TREATMENT PLANTS FOR SUSTAINABLE DEVELOPMENT	49
ЗНАЧАЈ ПОСТРОЈЕЊА ЗА ПРЕЧИШЋАВАЊЕ ОТПАДНИХ ВОДА ЗА ОДРЖИВИ РАЗВОЈ	49

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P. 1-17

ORIGINAL SCIENTIFIC PAPER

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MEASURING THE EFFICIENCY OF HUMAN CAPITAL

Abstract

Increased efficiency is a necessity for any company in the knowledge-based economy, rather than an option, in the circumstances of constant change and global competition. The efficiency of using resources, especially intellectual resources, is a crucial factor in assessing the financial strength of an enterprise. Since intellectual resources are immaterial and mainly invisible, measuring and managing them is difficult. Measuring human capital efficiency provides relevant information for management, as human capital significantly affects a company's performance. The aim of the paper is to explain the importance of measuring human capital efficiency through selected conventional and contemporary indicators. This paper will show what managerial information we could get thanks to the quantification of human capital efficiency in using the specific indicators in the labour productivity analysis.

Key words: human capital, measurement, efficiency, performance

JEL classification: M21

МЕРЕЊЕ ЕФИКАСНОСТИ ХУМАНОГ КАПИТАЛА

Апстракт

У околностима сталних промена и глобалне конкуренције повећана ефикасност постаје неопходност за било коју компанију у економији заснованој на знању, а не опција. Ефикасност употребе ресурса, посебно интелектуалних ресурса, пресудан је фактор у процени економске снаге организације. Будући да су интелектуални ресурси нематеријални и, углавном, "невидљиви", мерење и управљање њима је тешко. Мерење ефикасности људског капитала пружа релевантне информације за менаџмент, јер људски капитал знатно утиче на перформансе компаније. Циљ овог рада је истраживање значаја мерења ефикасности људског капитала кроз одабране традиционалне и савремене показатеље. Овај рад ће показати које управљачке информације можемо добити захваљујући квантификацији ефикасности људског капитала приликом коришћења одређених показатеља у анализи продуктивности.

Кључне речи: људски капитал, мерење, ефикасност, перформансе

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Introduction

Productivity is a universal phenomenon of macro and microeconomic theory and practice. Productivity is an indicator of the efficiency of the use of human capital, i.e. work of people (employees) in the company. In the literature in the field of macroeconomics and microeconomics, there are different concepts of productivity: labour productivity, capital productivity, labour and capital productivity, human capital productivity. In further discussions of productivity management, the emphasis is mainly on the concept of labour productivity, i.e. productivity in the use of human and other intellectual resources.

Productivity as an economic principle is a requirement to achieve certain production volume with minimal labour costs (Krstić & Sekulić, 2020). One of the primary goals in the system of goals of a company is the achievement of optimal labour productivity. Success in achieving this goal is controlled and monitored based on labour productivity measures. Labour productivity, as a measure of performance, quantifies economic success in the production of human labour, i.e. human resources of the enterprise.

The essence of labour productivity is in the production, that is, economic activities of the company which are determined by the possibilities of meeting consumer needs. Following the realization of the basic economic principle (to achieve maximum economic results with the minimal usage of resources), it is of interest to achieve as extensive a range as possible between the volume production and the labour consumption (working hours). This labour productivity indicator has a non-financial character.

In the new circumstances introduced by the era of the knowledge economy, human and other intellectual resources are treated as a vital, even strategic resource of a company. Due to the increased importance of intellectual resources for the competitiveness of the contemporary enterprise, there is more and more talk about the need to increase the productivity of human and, especially, other intellectual resources.

These moments influence the change of traditional economic terminology and the spread of the concept of productivity in terms of methodological apparatus of labour efficiency measurement and control. In addition to non-financial productivity measurement, the emphasis is also on the financial productivity measurement. Namely, it is about the concept of efficiency of the use of human capital. In that sense, the point is to achieve as extensive a range as possible between the achieved results (human capital value added resulting from the use of human capital) and the value of invested human capital. In this way, a specific human capital productivity (efficiency) indicator was obtained.

Human capital is, in fact, human resources. In today's competitive environment and the information (digital) age, intellectual capital is an exceptional source of creating and maintaining the competitive advantage of companies (Krstić, 2007). Therefore, there is a managerial obligation to intensify time and energy in managing human and other intellectual resources, i.e. to manage productivity in the right way.

1. Human capital

Bontis and Fitz-enz classify intellectual capital into three categories: "human capital, structural capital and relational capital" (Bontis & Fitz-enz, 2002). As different views on defining human capital exist, Bontis and Fitz-enz (2002) state that human capital represents

the pure intelligence, knowledge, talent, experience of the employees and an essential constituent of the intellectual capital.

Chen and Lin (2004) identified three approaches to the definition of human capital. The first approach is the transaction cost economy theory, where companies can employ a new worker from inside or outside of the company. Since both options have their costs, companies will always choose the cheaper option, representing the most efficient way. The second approach is the resource-based view of the company, where the human competences that make up the essence of the business and build a competitive advantage must be developed within the company. The third approach is the human capital theory, where companies make decisions about investments in human capital by evaluating potential future benefits.

Fitz-enz (2010) describes human capital as a set of permanently and occasionally employed workers. The question is how much companies want to keep or lose certain employees. With the departure of employees from the company, the company itself loses part of the human capital in which it has invested a certain amount of money. Cascio (2010) states that talent is the potential of employees, who are currently part of an enterprise or who might come later. Furthermore, this potential of employees includes the realization of their capacities.

The investment in human capital can allow an enterprise to gain a competitive advantage and represent an input that companies transform into talents and technology (Porter & Stern, 2001). The capacities of employees represent the company's asset, and that is one of the reasons for investing in employees. Ruchala (1997) stated that by investing in human capital, a company would improve the efficiency and quality of products/services, and differentiation.

Human capital is described as a collection of basic characteristics and properties of workers and serve as a source of potential benefits and profits for both the employee and the company that employs this capital under certain conditions (Pocztowski, 2003, p. 45). Knowledge is the most valuable asset and knowledge management is critical to a firm's success (Oviedo-Garcia et al., 2014). Therefore, human capital investments could boost labour productivity and financial performances of an enterprise (Black & Lynch, 1996).

Durrani and Forbes (2003) state that investments in human resources and IT are strongly connected to business success. Nafukho et al. (2004) point out that investing in human assets results in increased employees' performance, productivity and economic development of an enterprise. Since human capital is the main strength (Sajkiewicz, 2002, p. 17) and affects business performance, human capital measurement and control are necessary. Since human capital is a complex phenomenon, this paper focuses on the following dimension – the measurement of human capital efficiency and indicators which allow managers to control the results of human capital.

2. Human capital measurement and reporting

The human capital of an enterprise is defined as individuals who are constantly bound to the enterprise and its mission, can collaborate and have creative attitudes and high-quality qualifications (Bagieńska, 2015). Unlike authors who have used the term investments in the employee, some authors have used the term human capital, obliquely suggesting that an employee with human capital is of some value for an organizational (business) unit within an enterprise or an enterprise as a whole (Campbell, Coff & Kryscynsky, 2012). People who are part of the enterprise are indeed one of the key drivers of attaining financial results. It is often stated that human capital is the key to the development of an enterprise and that employees

are vital assets in terms of competitiveness and business performance. Furthermore, human capital is described as a base for gaining the potential future profit (Koziańska, 2003).

Folloni and Vittadini (2010) see human capital as a complex phenomenon with numerous intangible dimensions. They find all these intangible dimensions very challenging to be observed and measured with precision. An enterprise can manage people, as one of its core resources, by measuring human capital. Some studies suggest that enterprises that do not deal with the measurement of their human capital may miss business opportunities to generate long-term and sustainable results.

Naden (2019) emphasized the relevance of human capital efficiency measurement because of the high percentage (up to 70%) of workforce costs in the total expenses. Enterprises must have a clear perception of the real power of their employees. The main benefits of human capital measurement are reflected in a better understanding and maximization of the employees' impact and contribution to long-lasting accomplishments. Additionally, enterprises should develop adequate competitiveness strategies based on the human capital indicators and implement them by data-driven decisions for their further improvement.

Human capital represents the economic value of workers' education and skills, and include resources such as education, training, intelligence, skills, talents, health, etc. Given that human capital can be expressed through all investments and costs for employees (salaries, benefits, education, training, etc.), the formula for human capital (Hc) is as follows (Krstić & Bonić, 2016):

$$(1) \quad Hc = Pe + Si,$$

where Pe stands for *personal expenses* and Si for the *total sum of stimulating incentives*. Generally, Pe includes expenses for employees or salaries of employees and managers (net salary + payroll taxes), plus investments in human resources development, such as education, training costs, etc.

By improving human capital management, we can expect an increase of over 20% of the market value of an enterprise (Marcinkowska, 2004). The study by Ocean Tomo LLC specified "that the share of intangible assets in the market value of the S&P 500 share index enlarged from 17% to 90% in the period from 1975 to 2020", suggesting that workers represent a key source of these intangible assets. According to ISO 30414, 4C Consulting Group emphasized four fields of major benefits of reporting on human capital (Mauterer & Wengel, 2019):

- 1) Reporting on human capital can contribute to the field of investors and the capital market through a precise assessment of a company and its upcoming sustainability;
- 2) Reporting on human capital can contribute to the field of politics through transparency on the labour market and attractiveness of economies;
- 3) Reporting on human capital can contribute to the field of enterprises through the identification of HR-related strengths and weaknesses, as well as the evaluation of costs and investments of development potentials of the employees;
- 4) Reporting on human capital can contribute to the area of potential applicants through insights into the dealing with workforce and evaluation of career opportunities.

Issues regarding the measurement approach were recognized by Abasilim and Agboola (2013) in: a) the form of leading financial or other retrospective indicators, b) inability to measure all contributory aspects to the human capital added value, c) inattentiveness about assets growth, d) a focus on short-term instead of long-term goals. Price (2011) noted that

workers are frequently not pleased with the performance measurement and performance management systems. Regarding their confrontational nature, managers are often unwilling to take part in the performance measurement process.

Baron (2017) identified three dimensions of the human capital measurement: 1) the measurement of efficiency of HR department, 2) the measurement of effectiveness of work processes, 3) the measurement of the return on investment in key work processes. Kucharčíková, Tokarčíková and Ďurišová (2015) stated that the human capital productivity measurement could lead to the level of attainment of a target (increase customer satisfaction or revenues, shorten the time for complaint handling, etc.), quantification of company gains, the amount of financial result per employee, etc.

K.E. Sveiby is the first author who introduced the intellectual capital measurement concept (Borowski, 2015). It consists of the introduction of the scorecard of an enterprise, classification of intangible assets (three categories), presentation of financial (fourth category) and other forms of indicators (non-financial), as well as indicators in a distinct addition and usage of constant traditional financial measurement methods.

There are two broad perspectives that Giménez, López-Pueyo and Sanaú (2015) used for the classification of human capital measurement: the quantitative and qualitative perspective. The quantitative perspective approach comprises studies based on measuring the level of formal education, the cost of human capital investment and differences in the salary regarding different educational levels. On the other hand, the qualitative perspective approach highlights the differences in the quality of the level of qualifications and training. To quantify the level of qualifications, this approach uses the criterion of educational inputs.

3. Measuring the economic efficiency of human capital usage

In this paper, the focus is on measuring human capital efficiency. Efficiency is defined as the ratio of achieved outputs and inputs, and their interpretation can be different (Kucharčíková, Tokarčíková & Ďurišová, 2015). Therefore, human capital efficiency is calculated as the quotient of the volume of output and the value of human capital.

Borowski (2015) defined human capital efficiency (HCE) as the efficiency rate in the use of human capital, which is an indicator of human capital importance in terms of the value added creation in the company:

$$(2) \quad HCE = \frac{VA}{HC},$$

where *VA* stands for *value added*, which is calculated by adding salaries to operating profit (Krstić & Sekulić, 2020) and *HC* stands for salaries and other expenditure incurred for the company's workforce.

Intending to measure human capital efficiency, Rahim, Atan and Kamaluddin (2017) conducted a study in which they applied Pulić's *Value Added Intellectual Coefficient (VAICTM)* methodology (Pulić, 2000). In this study, a significant and positive relationship between human capital efficiency and company performance was determined. VAICTM methodology has been used extensively by many researchers (Chen et al., 2005; Kamath, 2007; Chan, 2009; Ghosh & Mondal, 2012). According to them, the major benefit of using this methodology is the provision of quantifiable, unbiased and quantitative measurements. Also, there is no requirement for any subjective grading. The methodology is of great use for not only further calculation but also statistical analysis of a large sample size of data items gathered over time. Another benefit of using VAICTM methodology for the measurement

of human capital efficiency is the utilization of simple and straightforward procedures to compute required indexes and coefficients.

Kujansivu and others (2007, p. 159) define metrics and indicators as essential management tools that allow the control of multipart phenomena by summarizing the outcomes in the form of figures. By using metrics and indicators, these multipart phenomena could be controlled at certain levels or, on the other hand, their actions might be impossible to be directed. The measurement is necessary for various reasons and its usage depends on the need of the company. Indicators provide precise information about the company to the management. Therefore, they could be used to control the achievement of previously set goals. Additionally, Kujansivu and others (2007, p. 160) stated that a company could make the most of measurement by using metrics and indicators to back up the decision-making process, question modes of operations, set the compensation base, envision the business development, etc.

Efficiency in the use of human capital (Ehc) is an indicator of the productive use of human capital by the company. The human capital efficiency indicator is calculated as follows (Krstić & Bonić, 2016):

$$(3) \quad Ehc = \frac{ICVA}{HC}$$

Earnings before interest and taxes ($EBIT$) are adjusted to obtain this indicator. Intellectual capital value added ($ICVA$) represents the amount of newly created value per monetary unit invested in visible intellectual capital (Dženopoljac, 2013, p. 134). In essence, this indicator represents the return on intangible assets and goodwill. $ICVA$ is obtained as follows (Krstić & Bonić, 2016):

$$(4) \quad ICVA = EBIT + Dfa + Amia + Iml + P\epsilon,$$

or

$$(5) \quad ICVA = EBITDA + P\epsilon,$$

where Dfa refers to the depreciation of fixed or long-term assets, and $Amia$ refers to the amortization of intangible assets with an identified lifespan. Iml refers to a decrease in the value of intangible assets with an indefinite lifespan (goodwill). $EBITDA$ represents earnings before interest, taxes, depreciation and amortization.

4. Labour productivity and other human capital indicators

The methodological issue of measuring labour productivity is characterized by multidimensionality and complexity. It derives from the very essence of productivity, as well as from the information base for measuring productivity. Labour productivity (P) is measured as the quotient between the production volume (Q) and labour consumption (L) (Krstić & Sekulić, 2020):

$$(6) \quad P = \frac{Q}{L}$$

When determining the total labour consumption L (for a company or a narrower organizational unit, in which employees of different qualifications work), it is necessary to recalculate labour consumption (in working hours) of different qualification (L_i) based on 8 different coefficients of work complexity ($Cql_a, Cql_b, Cql_c, Cql_d, Cql_e, Cql_f, Cql_g, Cql_h$). This is usually the simplest work - work of the lowest degree of complexity, which we obtain by

multiplying the work of a certain complexity by the appropriate coefficient for that level of complexity (qualification) of work: $L_{ll} = L_l \times Cq_{l_a}$ where Cq_{l_a} denotes the equivalent of the simplest work (the first degree of complexity - a). By expressing the labour consumption of different qualifications of employees through the equivalent of the simplest work, we obtain the total labour consumption of employees of one organizational unit or company as a whole. More precisely, the basic labour productivity formula then takes the following form (Krstić & Sekulić, 2020):

$$(7) \quad P = \frac{Q}{Ll}.$$

Also, the production volume (Q) in the above-mentioned formula could be expressed in different categories – income, costs, cash flow. In addition to the basic productivity formula, other productivity formulas of financial nature could be obtained. With this in mind, we can discuss:

- Non-financial (natural) aspect of measuring labour productivity;
- Financial aspect of measuring labour productivity.

The basic labour productivity formula reflects the non-financial (natural) is used for measuring the productivity of a particular organizational unit (production plant, department, etc.), as well as the productivity of a company. It is especially suitable for measuring productivity in the production of different products.

When a company produces a range of products, the application of the basic formula has a limitation because the total production of products of different use-value or expressed in different measurement units cannot be aggregated. In that case, we use the special methodology of the conditional product, where the produced quantity of different products from the assortment is recalculated to the quantity of the product marked as conditional. Namely, this specific methodological procedure first leads to the production expressed in the conditional product units (Qu). Then it is placed in relation to the labour consumption in the production process (L) and determines labour productivity (Krstić & Sekulić, 2020):

$$(8) \quad P = \frac{Qu}{L},$$

that is, if the labour consumption ($L_1, L_2, L_3, \dots, L_x$) of different employees ($x = 1, \dots, n$) with differentiated degrees of qualification ($Cq_{l_a}, Cq_{l_b}, Cq_{l_c}, Cq_{l_d}, Cq_{l_e}, Cq_{l_f}, Cq_{l_g}, Cq_{l_h}$) is expressed through the same measure - the simplest work of the so-called first degree of work (Cq_{l_a}) complexity, the following formula is obtained (Krstić & Sekulić, 2020):

$$9) \quad P = \frac{Qu}{Ll}.$$

Ll denotes the labour consumption of employees of different levels of qualification, calculated and expressed in the equivalents of the simplest work, with the lowest level of complexity. It is a job for which only primary school has been completed by the employee. This kind of productivity measurement has a non-financial nature.

The financial aspect of measuring labour productivity implies that the measurement uses categories expressed in monetary terms, and the data from the balance sheet and income statement serve as an information basis. The reason for that is overcoming the information limitations of the non-financial aspect of labour productivity measurement. The financial aspect of measurement implies several different productivity indicators.

First, labour productivity is the ratio of total revenue (R) and labour consumption (L) (Krstić & Sekulić, 2020):

$$(10) \quad P = \frac{R}{L} \quad \text{or} \quad P = \frac{R}{Ll}$$

This formula overcomes the problem of expressing products of different use-value or expressed in different quantitative units of measure because the total production of the company is expressed in value – income.

Very often, in practice, by applying the financial concept, labour productivity is measured as operating revenue (Ro) per employee (Krstić & Sekulić, 2020), so we get the following productivity indicator:

$$(11) \quad P = \frac{Ro}{\text{Number of employees}},$$

or the productivity indicator - sales (S) per employee:

$$(12) \quad P = \frac{S}{\text{Number of employees}}.$$

This productivity indicator can also be designed as total expenses (E) per employee (Krstić & Sekulić, 2020):

$$(13) \quad P = \frac{E}{\text{Number of employees}},$$

which is also often encountered in practice.

The measuring expression of labour productivity which represents the quotient of profit (P) and labour consumption (L, i.e. Ll) (Krstić & Sekulić, 2020):

$$(14) \quad P = \frac{P}{L},$$

does not adequately measure productivity in terms of product expression and change. We should keep in mind the shortcomings of such a determined expression, which are a consequence of the presence of prices (products and consumption of production elements) in the realized profit, whose dynamics can otherwise deform the accurate picture of realized productivity in two consecutive periods. In other words, qualitative and quantitative changes in products are not adequately expressed through the profit size. In practice, on the other hand, by applying the financial concept, productivity is often measured as operating profit (Op) per employee (Krstić & Sekulić, 2020):

$$(15) \quad P = \frac{Po}{\text{Number of employees}}.$$

Then, productivity indicator as net profit (Pn) per employee (Krstić & Sekulić, 2020):

$$(16) \quad P = \frac{Pn}{\text{Number of employees}},$$

but also as economic profit, i.e. economic value added (EVA) per employee (*Human Economic Value Added - HEVA*) (Meszek, 2015; Krstić & Sekulić, 2020):

$$(17) \quad P = \frac{EVA}{\text{Number of employees}}.$$

In more modern literature, we also find a productivity measure with cash flow (Cf) in the numerator, so we get cash flow per employee. This kind of productivity measurement ensures that the measurement is less dependent on accounting principles relevant for determining accounting profit. The measure of cash flow per employee is important for productivity analyses because it is recalculated to determine the difference in the contribution

of labour (average employee) to the cash flow of the company or organizational (business) unit. Namely, this measure shows how much cash flow was generated by each employee. This indicator quantitatively results from the multiplication of the following indicators: cash flow margins and labour productivity in which the production is expressed in terms of sales revenue or, even more comprehensively, revenue (Buhner, 1997):

$$(18) \quad \frac{Cf}{\text{Average number of employees}} = \frac{Cf}{\text{Sales revenue}} \cdot \frac{\text{Sales revenue}}{\text{Average number of employees}},$$

or

$$(19) \quad \frac{Cf}{\text{Average number of employees}} = \frac{Cf}{\text{Revenue}} \cdot \frac{\text{Revenue}}{\text{Average number of employees}}.$$

Human capital cost factor (HCCF) reflects the total cost of human capital (Drábek et al., 2017). Fitz-enz (2000, p. 46-47) believes that this indicator is based on calculating four main types of human capital costs: salary and benefit costs for employees, contingencies, absence costs and turnover costs. Krstić & Bonić (2016) stated that human capital cost factor (HCCF) is equivalent to the category of human capital (Hc). This category includes salaries for managers and other employees, as well as the total sum of stimulating incentives for managers, so it is calculated as follows (Krstić & Bonić, 2016):

$$(20) \quad HCCF = Pe + Si = Hc$$

or HCCF per employee:

$$(21) \quad HCCF \text{ per employee} = \frac{Hc}{\text{Number of employees}},$$

or

$$(22) \quad HCCF \text{ per employee} = \frac{Pe + Si}{\text{Number of employees}}.$$

Human capital market value (HCMV) provides information on a company's net market value per employee (Drábek et al., 2017, p. 123). Human capital market value is calculated as follows (Drábek et al., 2017, p. 123):

$$(23) \quad HCMV = \frac{Mc : As}{\text{Number of employees}},$$

where *Mc* refers to market capitalization and *As* denotes total assets in the balance sheet. Human capital market value is also calculated as follows (Drábek et al., 2017, p. 123):

$$(24) \quad HCMV = \frac{\text{Tobin's Q}}{\text{Number of employees}},$$

where Tobin's Q is the ratio of the market value of a company's assets and replacement value of a company's assets (Lindenberg & Ross, 1981).

Human capital value added (HCVA) is an indicator for measuring human capital productivity that explains productivity from a profitability perspective (Fitz-enz, 2000, p. 50). This indicator reflects the economic efficiency of human capital in the enterprise through the full-time equivalent in value added (Drábek et al., 2017, p. 123). Human capital value added is calculated as follows (Fitz-enz, 2000, p. 50):

$$(25) \quad HCVA = \frac{\text{Revenue} - (\text{Expenses} - \text{Pay and benefits})}{\text{Full-time equivalent}},$$

or

$$(26) \quad HCVA = \frac{EBIT + Hc}{\text{Number of employees}}$$

Human capital return on investment (HCROI) is an indicator that shows the relationship between human capital and profitability (Drábek et al., 2017, p. 123). This indicator represents the return on investment in human capital in the form of profit for the money spent on employee salaries and benefits (Fitz-enz, 2000, p. 50). Human capital return on investment is calculated as follows (Fitz-enz, 2000, p. 50):

$$(27) \quad HCROI = \frac{\text{Revenue} - (\text{Expenses} - \text{Pay and benefits})}{\text{Pay and benefits}}$$

or

$$(28) \quad HCROI = \frac{EBIT + HC}{HC}$$

5. Measuring human efficiency: the case of UPS

This research includes the use of secondary financial data from annual reports and the case study method to apply human capital efficiency indicators to the same data. The UPS serves as an example for analysing the efficiency of human capital and using the obtained information to benefit the company's management. Although UPS is not a knowledge company, it was taken as an example because it operates successfully and is ranked as one of the most successful companies. The measurement and management of human capital are critical in all kinds of companies, whether they are knowledge companies or not. Also, UPS's financial statements fully provide the necessary data to conduct the analysis, so this company is considered an appropriate example.

The data are taken from the annual reports of the company UPS in 2017, 2018 and 2019. The necessary information for calculating human capital efficiency indicators can be found in the company's balance sheet and income statement. Information on the total amount of stimulating incentives is taken from the proxy statement of the company UPS in 2018, 2019 and 2020. The aim of the research is the possibility of practical use and control of human capital efficiency indicators in companies, primarily due to the great influence of human capital on the results of the company, the control of the efficiency of the use of human capital and the improvement of the results.

United Parcel Service (UPS) is an American multinational company headquartered in the American city of Sandy Springs, Georgia. UPS deals not only with package delivery and supply chain management but also with cargo airline, freight-based trucking operations, delivery drone airline, customs brokerage, mail and consulting services. It provides services in more than 175 countries and territories worldwide. Also, UPS was on the Best Global Brands 2019 Rankings and the 2019 Fortune 500 list of the largest United States corporations by total revenue.

To determine indicators of human capital efficiency, certain financial information from the annual reports is necessary. The consolidated balance sheet of UPS is presented in Table 1. UPS is not a knowledge enterprise, which can be explained by the ratio of intangible assets and goodwill (*Iag*) in the assets' value (*As*). Thanks to financial information presented on a consolidated balance sheet in 2019, this ratio is calculated and shows that only 10.34% of total assets are intangible assets.

Table 1. Consolidated Balance Sheet of UPS as of December 31, 2017, 2018 and 2019

ASSETS	2017 (In \$ million)	2018 (In \$ million)	2019 (In \$ million)	LIABILITIES	2017 (In \$ million)	2018 (In \$ million)	2019 (In \$ million)
<i>I Current assets</i>	15,718	16,210	17,103	<i>I Current liabilities</i>	12,886	14,087	15,413
Cash and cash equivalents	3,320	4,225	5,238	Current maturities of long-term debt and commercial paper	4,011	2,805	3,420
Marketable securities	749	810	503	Current maturities of operating leases	-	-	538
Accounts receivable, net	8,773	8,958	9,552	Accounts payable	3,934	5,188	5,555
Current income taxes receivable	1,573	940	382	Accrued wages and withholdings	2,608	3,047	2,552
Other current assets	1,303	1,277	1,428	Self-insurance reserves	705	810	914
				Accrued group welfare and retirement plan contributions	677	715	793
				Other current liabilities	951	1,522	1,641
<i>II Non-current assets</i>			40,754	<i>II Non-current liabilities</i>			39,161
Property, plant and equipment, net	22,118	26,576	30,482	Long-term debt and finance leases	20,278	19,931	21,818
Operating lease right-of-use assets	-	-	2,856	Non-current operating leases	-	-	2,391
Goodwill	3,872	3,811	3,813	Pension and postretirement benefit obligations	7,061	8,347	10,601
Intangible assets, net	1,964	2,075	2,167	Deferred income tax liabilities	756	1,619	1,632
Investments and restricted cash	483	170	24	Self-Insurance reserves	1,765	1,571	1,282
Deferred income tax assets	266	141	330	Other non-current liabilities	1,804	1,424	1,437
Other non-current assets	1,153	1,033	-				
				<i>III Shareholders' equity</i>	1,024	3,037	3,283
				Total equity for controlling interests	994	3,021	3,267

				Noncontrolling interests	30	16	16
Total	45,574	50,016	57,857	Total	45,574	50,016	57,857

Source: UPS, Annual Reports 2017, 2018, 2019

The consolidated income statement (Table 2) is used for obtaining financial information about key positions needed to calculate human capital efficiency indicators. UPS reported annual revenue of \$66,585 million in 2017, \$71,861 million in 2018 and \$74,094 million in 2019, and operating expenses of \$59,056 million in 2017, \$64,837 million in 2018 and \$66,296 million in 2019. Earnings before interest and taxes (EBIT) and earnings before interest, taxes, depreciation and amortization (EBITDA) are essential for this analysis since they are used for the calculation of human capital efficiency indicators. For the fiscal years 2017, 2018, 2019, UPS reported EBIT of \$7,529 million, \$7,024 million and \$7,798 million, while EBITDA had the value of \$9,811 million \$9,231 million and \$10,158 million. The fact is that human capital cannot be calculated without information about salaries of managers and other employees, which represent personal expenses in the consolidated income statement (Table 2).

Table 2. Consolidated Income Statement of UPS as of December 31, 2017, 2018, 2019

Number	ELEMENTS	2017 (In \$ million)	2018 (In \$ million)	2019 (In \$ million)
1	Revenue	66,585	71,861	74,094
2	Operating expenses	59,056	64,837	66,296
	Salaries	34,577	37,235	38,908
	Repairs and maintenance	1,601	1,732	1,838
	Depreciation and amortization	2,282	2,207	2,360
	Purchased transportation	11,696	13,409	12,590
	Fuel	2,690	3,427	3,289
	Other occupancy	1,155	1,362	1,392
	Other expenses	5,055	5,465	5,919
3	Operating profit	7,529	7,024	7,798
4	Other income and (expense)	(392)	(1,005)	(2,146)
	Investment income (expense) and other	61	(400)	(1,493)
	Interest expense	(453)	(605)	(653)
5	Income before income taxes	7,137	6,019	5,652
6	Income tax expense	2,232	1,228	1,212
7	Net income	4,905	4,791	4,440
8	EBIT (Earnings before interest and taxes)	7,529	7,024	7,798
9	EBITDA (EBIT+ depreciation + amortization)	9,811	9,231	10,158

Source: UPS, Annual Reports 2017, 2018, 2019

To obtain indicators of human capital efficiency, it is necessary to gather additional information. To calculate HCMV, information about market capitalization is required. According to the financial information about the number of shares and market price per share of UPS, the market capitalization amounts \$105,498.75 million in 2017, \$84,459.60 million in 2018 and \$101,142.91 million in 2019 (Table 3). To present the

whole amount of human capital, the total sum of stimulatory incentives is added to the amount of personal expenses (Table 3). The value of human capital at UPS is \$34,607.98 million in 2017, \$37,271.20 million in 2018 and \$38,953.90 million in 2019. To calculate Ehc , the value of ICVA ($EBITDA + Hc$) is required, which amounts \$44,418.98 million in 2017, \$46,502.20 million and \$49,111.90 million in 2019.

Efficiency in the use of human capital (Ehc) shows us how many monetary units of ICVA are generated for each monetary unit of human capital. In our example, every dollar of human capital generates \$1.28349 of ICVA in 2017. A slight decline in the value of the indicator could be noticed in 2018, and in 2019 the value of the indicator increased slightly, but it is still at a lower level than in 2017.

Human capital cost factor ($HCCF$) shows the absolute sum of total costs related to employees and managers. Given that in our example this indicator is equal to the value of human capital, we will observe the indicator human capital cost factor per employee. For the period from 2017-2019, a slight increase in the total cost of human capital per employee could be noticed, from \$0.07623 in 2017 to \$0.07869 in 2019.

Table 3. Indicators of Human Capital Efficiency in UPS for 2017, 2018 and 2019

Number	ELEMENTS	2017	2018	2019
1	Number of shares	875	870	869
2	Market price per share	120.57	97.08	116.39
3	$Mc (1 \times 2)$	105,498.75	84,459.60	101,142.91
4	As	45,574	50,016	57,857
5	$E = As - L - Nci$	994	3,021	3,267
6	$\Delta IC (3-5)$	104,504.75	81,438.60	97,875.91
7	lag	5,836	5,886	5,980
8	$IC (6+7)$	110,340.75	87,324.60	103,855.91
9	Personal expenses	34,577	37,235	38,908
10	The total sum of stimulating incentives	30.98	36.20	45.90
11	$Hc (9+10)$	34,607.98	37,271.20	38,953.90
12	EBIT	7,529	7,024	7,798
13	EBITDA	9,811	9,231	10,158
14	Number of employees	454,000	481,000	495,000
15	$ICVA (11+13)$	44,418.98	46,502.20	49,111.90
16	Ehc	1.28349	1.24767	1.26077
17	$HCCF \text{ per employee}$	0.07623	0.07749	0.07869
18	$HCMV$	0.00001	0.00000	0.00000
19	$HCVA$	0.09281	0.09209	0.09445
20	$HCROI$	1.21755	1.18846	1.20019

Note: the data from Annual Reports 2017, 2018, 2019 and Proxy Statements 2018, 2019, 2020 of UPS is used for the calculation

Human capital market value ($HCMV$) shows how much each employee contributes to the formation of the value of the Mc / As indicator. In our case, it could be said that each employee contributes \$0.00001 to the formation of the value of the Mc / As indicator in 2017. Given that UPS has a large number of employees, we cannot ignore this indicator, although at first glance it seems that employees do not make a large contribution to the formation of the value of Tobin's Q.

Human capital value added (HCVA) shows how many dollars of value added (which is calculated as the sum of EBIT and Hc) each employee generates. In our example, this indicator shows that each employee generates \$0.09281 of value added in 2017. Although the value of the indicator fell slightly in 2018, we could notice an increase in the indicator in 2019 compared to both previous years.

Human capital return on investment (HCROI) shows the return on 1 dollar of investment in human capital. In our example, for every dollar invested in human capital, we have a return of \$1.21755 in 2017. We could notice a slight decline in the value of the indicator in 2018. Although the value of the indicator increases in 2019, it is still lower than in 2017.

Conclusion

The knowledge economy marks an era in which human and other intellectual resources play a key role in creating value. Unlike the knowledge era, in the industrial era physical and financial resources were the crucial value creators. As a result, human capital is crucial for the growth, productivity and overall efficiency of an enterprise. Human capital measurement is important for better management of employees' natural characteristics, capabilities and skills. Human capital's uniqueness is demonstrated by the fact that its components are one-of-a-kind and impossible for rivals to emulate. Due to specific features of human capital, the measurement of human capital can be challenging and complicated. Therefore, there is a need for developing a new framework of human capital measurement indicators, which makes a step forward comparing to traditional indicators of labour productivity. The new framework would contain a series of new indicators that will allow better control of efficiency in the use of human capital. Different and numerous metrics could be used when determining the efficiency of human capital. Connecting them is needed to depict the actual situation in the company and is thus critical to the successful evaluation of the whole entity. The human capital efficiency measurement with such a framework of new indicators allows managers to use more efficiently the capacities of human capital in their enterprises. The conclusion is that all managers should consider using a broader set of human capital efficiency indicators for better management of human capital.

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THE IMPORTANCE OF RESEARCH AND DEVELOPMENT FOR INNOVATIVE ACTIVITY: THE OVERVIEW OF THE TOP COUNTRIES IN EUROPE AND WORLDWIDE

Abstract

In the conditions of economic globalization and a dynamic business environment, companies need to continuously improve and innovate their business, in order to avoid complex and fierce competition and to achieve long-term and sustainable success. Due to the intensive effect of technical and technological progress, the survival and success of the company on the market depends on the introduction of innovative changes in the company and the undertaking of research and development activities. Research and development activities are a crucial factor in generating knowledge, creating patents and innovations, as well as in the increasing of profitability in the business of modern companies. Research and development (R&D) and innovations are considered to be a cornerstone of competitive advantage. The object of this paper is to point out the vital importance that R&D has for innovativeness, i.e. for performing innovative activities at the level of European countries and worldwide.

Keywords: *research and development, R&D expenditures, patents, innovativeness*

JEL classification: *O32*

ЗНАЧАЈ ИСТРАЖИВАЊА И РАЗВОЈА ЗА ИНОВАТИВНУ АКТИВНОСТ: ПРЕГЛЕД НАЈБОЉИХ ЗЕМАЉА У ЕВРОПИ И СВЕТУ

Апстракт

У условима економске глобализације и динамичког окружења, компаније морају континуирано да унапређују и иновирају своје пословање, како би избегле сложену и оштру конкуренцију и како би оствариле дугорочан успех. Услед интезивног дејства техничко-технолошког прогреса, од увођења иновативних промена у предузећу и предузимања активности истраживања и развоја, зависи опстанак и успех предузећа на тржишту. Активности истраживања и развоја представљају круцијалан фактор у генерисању

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знања, креирању патената и иновација, као и у расту рентабилности у пословању савремених предузећа. Стога, истраживање и развој и иновације представљају камен темељац конкурентске предности. Сврха овог рада је да укаже на виталан значај који истраживање и развој има за иновативност, тј. за обављање иновативних активности на нивоу земаља у Европи и у свету.

***Кључне речи:** истраживање и развој, трошкови истраживања и развоја, патенти, иновативност*

Introduction

The knowledge economy is a stage in the development of the world economy in which knowledge, i.e. intellectual resources, in particular, are marked as a key determinant for building and maintaining competitive advantages (Krstić, Rađenović, 2019, p. 11; Jovanović, Petrović, Janjić, 2021). In the era of fast technological advancement, characterized by an intensive process of globalization and the changing world, companies are facing the rise of new competitors and the heterogeneity of demand.

The creative potential of companies relies not only on their ability to establish operational strategies for innovation management, but also on their possibility to perform research and development (R&D) activities, as their internal competencies. In the information age of the 21st century and today's competitive landscape, timely and adequate firms' investments in R&D and innovative activities will provide a competitive advantage and their sustainability. In modern market conditions, harsh competition does not forgive mistakes, thus, innovation activities are seen as one of the most important factors in maintaining a competitive knowledge-based economy (Janjić, Rađenović, 2019).

R&D and innovations ensure the base of technical and scientific solutions, needed to overcome global societal challenges, contributing to a well-functioning knowledge-based economy. R&D investments stimulate creativity and innovations, resulting in the creation of new technology, knowledge, concepts, ideas and expertise. The higher amount of resources allocated to R&D (R&D input) has impacts on higher R&D output, measured by the number of patent applications (Chiesa, Masela, 1996), which ultimately affects the innovation activity.

1. The importance of R&D activities for the companies

In the conditions of the universal effect of technical-technological progress and increasingly fierce competition, to reach higher standards of performance and to overcome competition and risks, companies must invest in R&D activities. The key source to expand knowledge and to functionalize new technologies is R&D as a systematical concept (Tether, 2005). R&D entails increasing the knowledge base and applying that knowledge in developing new and enhancing existing products and processes.

Managing R&D activities represents a major strategic factor in generating future development that will ultimately benefit (material and intangible benefits) the company

and lead to sustainable profits. In generating future growth and development and long-term profits, managing R&D activities is a crucial strategic factor. Companies can obtain patents through the invention of new products by introducing and controlling R&D operations, establishing a competitive advantage and gaining a stronghold in the marketplace. By improving the process that is used, successful R&D can reduce the cost of producing products, thus ensuring companies to be more competitive than their competition and contributing to an increase in profit margins. The raising of funds to improve R&D operations is an excellent way to build a structure that enables companies to be innovative and to illustrate the vision of organizations to its investors. Companies will become more innovative if they attract, recruit and hire talented human resources, bearing in mind that internal R&D depends on the availability and quality of human capital.

Internal and external R&D activities are generally recognized as the drivers of technological development, while R&D investments are considered to be a reliable measure of innovative potential. In order to encourage their "absorptive capacity" as a source of productivity growth, companies have to implement internal R&D activities (Romer, 1990). Investing in internal R&D activities engages companies in a process of learning, encouraging and fostering the development of new products or processes, as well as, in many cases, the growth of new markets (Griffith et al. 2004). Investments in R&D within an enterprise create the integrative skills needed to deploy information resources. R&D is essential for gathering external information and expertise, ensuring that companies' proportion of high novelty products grows (Barton, 1992; Mathews, 2003). Companies may achieve synergies from their R&D mix when they use internal and external sources of R&D at the same time. It is crucial to point out that new products reflect the future commercial value of the R&D activities (Katila, Ahuja, 2002, p. 1183) of an organization and are predominantly affected by the decision of knowledge sourcing.

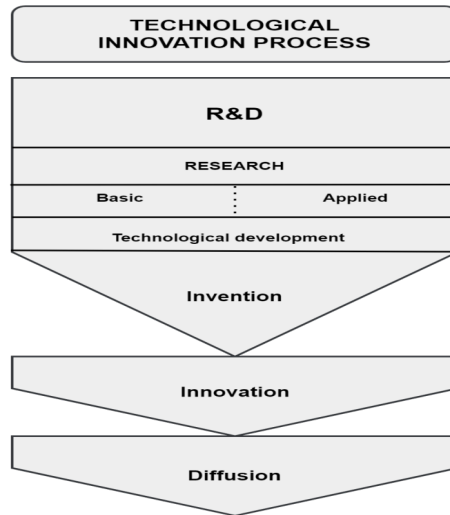
2. R&D as a determinant of innovativeness

Intense global competition, rapid technological change and increased sophistication of consumers, force companies to continuously invest in R&D and innovation, which are considered as the key strategic factor for the prosperity of companies (Marković, Krstić, Rađenović, 2020). For an effective innovation process, it is critical to have the capability of R&D, where it should be noted that research and technological development predate innovation as a preliminary step. Innovations are the result of proactive research and development in the company. R&D has long been regarded as a measure of innovation and strategic growth lever for companies, aiming to achieve "world-class" and market supremacy (Hendry, 1998).

According to Mansfield (1980) and Griliches (1986), R&D spending is positively related to a company's innovative potential, which is reflected in productivity growth. In order to achieve a radical innovation, Laursen and Salter (2006) proposed that an organization often needs to make a substantial investment in R&D, including a lower probability of success but higher performance. Since the current R&D investment is often the result of previous R&D spending, some researchers (Garcia, Navas, 2007) indicated that R&D may reflect on the company's creative potential and superior performance.

In this context, the most significant input for generating knowledge and creativity is R&D spending (Huergo, 2006), supposing that the greater investment in R&D affects the higher possibility of success in technological innovation. R&D is an important driver of technology diffusion since it reduces the likelihood of product innovations being rejected or unproductive innovations being implemented (Bolton, Harris, 1999). Technological innovation can be recognized as the process of “generation, application and diffusion of techno-scientific knowledge” (Nieto, 2001) and as a set of R&D activities related to the production of innovations. As a result of research and development, the invention is regarded as the first scientific knowledge emerging from technology or applied science (Nieto, 2001; Hill, Rothaermel, 2003).

Figure 1: Technological innovation process



Source: Adapted to Nieto (2001, p. 61)

Since a company’s ability to innovate is dependent on its R&D function and technological capabilities, efficient innovation is not guaranteed (Tsai, 2005). Great technological and inventive potential, does not always ensure the successful commercialization of products (Fleming, 2002, p. 1064).

3. R&D input and R&D output as preconditions of innovative activity

In theory, the existence of a causal association between R&D investment and innovation dates back to the 1980s. Many economists have begun to emphasize the importance of R&D expenditures (R&D input) and patents (R&D output) as measures in boosting innovations and economic growth (Geroski, Mazzucato, 2002). R&D expenditures are one of the most commonly used indicators of innovation input. The R&D intensity (R&D expenditures as a percentage of GDP) can be used to measure the relative degree of investment in generating new knowledge.

Table 1 shows the top 10 countries in Europe by R&D expenditures as a share of GDP, during the period from 2012 to 2019. The following countries are presented: Sweden, Austria, Germany, Denmark, Belgium, Finland, Norway, France, the Netherlands and Slovenia. During the eight years, the results showed that Sweden had the leading position from 2015 to 2019 (3.22% in 2015, 3.25% in 2016, 3.36% in 2017, 3.32% in 2018 and 3.39% in 2019) while only Finland had better results in 2012 (3.4%), in 2013 (3.27%) and 2014 (3.15%) than Sweden in the same years.

Table 1: The Top 10 countries in Europe by Research and Development Expenditures 2012-2019 (% GDP)

Country	Year							
	2012	2013	2014	2015	2016	2017	2018	2019
Sweden	3.23	3.26	3.1	3.22	3.25	3.36	3.32	3.39
Austria	2.91	2.95	3.08	3.05	3.12	3.06	3.14	3.19
Germany	2.88	2.84	2.88	2.93	2.94	3.05	3.12	3.17
Denmark	2.98	2.97	2.91	3.06	3.09	3.03	3.02	2.96
Belgium	2.28	2.33	2.37	2.43	2.52	2.67	2.67	2.89
Finland	3.4	3.27	3.15	2.87	2.72	2.73	2.76	2.79
Norway	1.63	1.65	1.78	1.94	2.04	2.1	2.06	2.22
France	2.23	2.24	2.23	2.27	2.22	2.2	2.2	2.19
Netherlands	1.19	2.16	2.17	2.15	2.15	2.18	2.14	2.16
Slovenia	2.56	2.56	2.37	2.2	2.01	1.87	1.96	2.04

Source: Prepared by the authors, based on the data from EUROSTAT

Observing the results from Table 1, it can be concluded that Sweden invests in R&D more than any other country, and the global trend in R&D expenditures is growing year after year. In 2019, the high R&D investments were recorded also in Austria (3.19%), followed by Germany (3.17%). All R&D expenditures above 3% of GDP in 2019 were ahead of Denmark (2.96%), Belgium (2.89%), Finland (2.79%), Norway (2.22%), France (2.19%), Netherlands (2.16%) and Slovenia (2.04%). The R&D expenditures below 2% of GDP, were registered: Norway (1.63% in 2012; 1.65% in 2013; 1.78% in 2014 and 1.94% in 2015), the Netherlands (1.19% in 2012) and Slovenia (1.87% in 2017 and 1.96% in 2018).

Innovative capacity on the national level may be improved by fostering investments in R&D. Table 2 and Figure 2, show the group of countries on the global level which invested most in R&D in 2020. The R&D intensity, i.e. R&D expenditure as a percentage of GDP, was much lower in the EU than in South Korea (4.35% in 2020), Israel (4.04% in 2020) and Japan (3.28% in 2020), while R&D intensity in Germany and the United States of America was at about the same level.

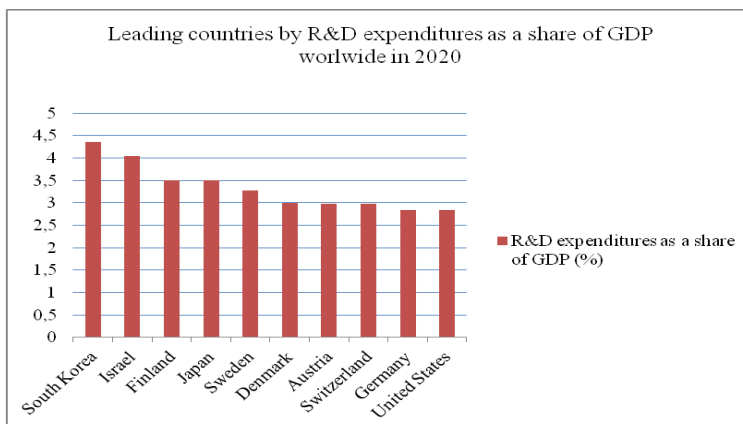
Table 2: The Top 10 countries Worldwide by Research and Development Expenditure in 2020 (%GDP)

Country	Year (2020)
South Korea	4.35
Israel	4.04
Finland	3.5
Japan	3.28
Sweden	3.0
Denmark	3.0
Austria	2.98
Switzerland	2.97
Germany	2.84
United States of America	2.84

Source: Prepared by the authors, based on the data from Statista, <https://www.statista.com/statistics/732269/worldwide-research-and-development-share-of-gdp-top-countries/>

The number of patent applications is regarded as a valuable indicator for assessing a company’s innovative capability (Wakasugi, Koyata, 1997), and serves as a way to protect intellectual property rights. Historically, the relationship between a company’s R&D investment and patenting activity has been at the core of many empirical analyses.

Figure 2: Graphical representation of the leading countries in R&D expenditures as a share of GDP worldwide in 2020



Source: Elaborated by the authors based on the data from Table 2

Some empirical research found a strong relationship between R&D spending and the number of patents (Pakes, Griliches, 1984; Bound et al. 1984; Hall et al. 1986). In the study of chemical and computer industries, some researchers (Ahuja, Katila, 2001; Hagedoorn, Duysters, 2002) proved a strong correlation between R&D investments and patents as an R&D output. Cardinal and Hatfield (2000) concluded that a greater focus on R&D spending was a key factor in generating productive inventions, measured by patents.

Table 3: The geographic origin of patent application

Country	2019 (%)
US	25%
Germany	15%
Japan	12%
China	7%
France	6%
Switzerland	5%
Republic of Korea	5%
Netherlands	4%
UK	3%
Sweden	2%

Source: European Patent Office – Patent index 2019

The data presented in Table 3 and Figure 3, show the number of patent applications, determined by the geographic origin at the world level. The results showed that more than half of all patent applications came from companies grounded in Europe. In 2019, the total number of patent applications in Europe (30%) was higher compared with the total number of patent applications in the US (25%), Japan (12%), China (7%), the Republic of Korea (5%) and the UK (3%).

Table 4: The most Innovative Economies in the World in 2020

Country	Score (0-100)	Rank	Rank change to previous year
Switzerland	66.08	1	+0
Sweden	62.47	2	+0
United States of America	60.56	3	+0
United Kingdom	59.78	4	+1
Netherlands	58.76	5	-1
Denmark	57.53	6	+1
Finland	57.02	7	-1
Singapore	56.61	8	+1
Germany	56.55	9	-1
Republic of Korea	56.11	10	+1

Source: WIPO - Global Innovation Index 2020

According to the World Intellectual Property Organization (WIPO), which released the Global Innovation Index 2020 (GII), Switzerland is an innovation leader, with a high rank (66.08/at the first place out of 131 countries). After Switzerland, the top-performing economies are: 1) Sweden with GII of 62.47 and at the second place out of 131 countries; 2) the United States of America with a GII of 60.56 and at the third place out of 131 countries; 3) the United Kingdom with GII 59.78 and at the fourth place out of 131 countries and 4) the Netherlands with GII 58.76 at the fifth place out of 131 countries ranked in 2020. In the top 10 global ranking economies, for their innovation

environments and outputs, the leading positions in 2020 also belonged to: Denmark (57.53/at the sixth place out of 131), Finland (57.02/at the seventh place out of 131), Singapore (56.61/at the eighth place out of 131), Germany (56.66/at the ninth place out of 131) and the Republic of Korea (56.11/at the tenth place out of 131).

Conclusion

In the past, tangible assets were the most valuable company resources. Nowadays, intellectual resources are the fundamental generator of a company's success (Petković, Krstić, Rađenović, 2020). The progress of new technologies, R&D and innovations are the engines of knowledge-based economies. At the firm, national and regional level, R&D investments and innovations are the main drivers of increased competitiveness. In highly competitive environments, companies' ability to build and retain market share, as well as increase firm profitability, is based on their R&D capabilities. R&D efforts can be viewed as a foundational activity that fosters creativity, as well as a valuable source of innovation for their manufacturing processes and strategic decisions.

R&D is deemed to create an organizational climate that favours developing new products and manufacturing process, and new core competencies through invention and innovation. The innovations and R&D are two different concepts, which complement each other. R&D is the method to achieve a target or outcome, while innovation refers to a new goal or result. Thus, R&D is the precondition of innovation activity, since it provides the necessary knowledge and experience for innovation.

In order to evaluate the productivity impact of inventions, the most commonly used proxy measures of creative activity and indices of firm technical capabilities are R&D expenses (R&D input) and patents (R&D output). R&D expenses can be observed as an indicator of the resources dedicated to the innovation process, needed to launch new technologies, products and processes to the market. Patent as an R&D output has long been considered as a key factor in fostering innovations by allowing inventors to profit from their inventions. The company ability to generate a higher number of patent applications depends on the realization of R&D activities, but does not depend on R&D spent by competitors.

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TRENDS AND STRATEGIC APPROACH TO ESTABLISHING WORK/LIFE BALANCE OF MANAGERS AND OTHER EMPLOYEES

Abstract

The purpose of the paper is presenting the most noticeable trends in establishing work/life balance of managers and other employees worldwide. Due to global changes, establishing work/life balance of employees is considered a strategic topic for human resource management (HRM). The research was conducted through a thorough analysis of various theoretical and empirical studies from the previous period, both domestically and abroad, with the aim of determining the extent to which companies have integrated employees' work/life balance programs into their HRM strategy and daily operations. Introducing training and the use of employees' work/life balance benefits leads to reduced stress and increased productivity, commitment and employee satisfaction. Consequently, this leads to improved company performance - reduced absenteeism and leaving of the company, lower recruiting and training costs, attracting and retaining top quality employees, as well as better company image. This way, employees' work/life balance programs provide benefits for both the employees and the company.

Key words: work/life balance, strategic approach, human resource management strategy

JEL classification: O15

ТРЕНДОВИ И СТРАТЕШКИ ПРИСТУП УСКЛАЂИВАЊУ ПОСЛА И ПРИВАТНОГ ЖИВОТА МЕНАџЕРА И ОСТАЛИХ ЗАПОСЛЕНИХ

Апстракт

Циљ овог рада јесте представљање најзначајнијих трендова у усклађивању посла и приватног живота запослених и менаџера широм света. Услед глобалних промена, усклађивање посла и приватног живота запослених сматра се стратешким питањем у управљању људским ресурсима. Истраживање је спроведено детаљном анализом многобројних теоријских и емпиријских студија реализованих у земљи и иностранству у претходном периоду, са циљем утврђивања у којој мери су предузећа интегрисала програме за усклађивање посла и приватног живота запослених у стратегију управљања људским ресурсима и своје свакодневно пословање. Увођење

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тренинга и коришћење погодности за усклађивање посла и приватног живота запослених доводи до смањења стреса и повећања продуктивности, посвећености и задовољства запослених. То последично доводи до побољшања перформанси предузећа - смањеног одсуствовања са посла и напуштања предузећа, нижих трошкова регрутовања и обуке, привлачења и задржавања најквалитетнијих запослених, те бољег имиџа предузећа. На тај начин програми за усклађивање посла и приватног живота запослених доносе погодности како за запослене тако и за предузеће.

Кључне речи: *усклађеност посла и приватног живота, стратешки приступ, стратегија управљања људским ресурсима*

Introduction

Establishing balance between work activities and private/home obligations represents work-life balance. (Friedman & Greenhaus, 2000). Achieving work/life balance is a current issue, the importance of which will only grow in the future. Given the frequent difficulties in setting priorities between work and private commitments, various programs and benefits that companies offer can help establish employee work/life balance. This allows managers and other employees to focus on work responsibilities when at work, and it also enables them to be efficient in performing home duties.

Therefore, the task of human resources sectors in companies is to provide superiors with guidelines for better employee management, with the purpose of improving their commitment and overall life satisfaction. The introduction of work/life balance training for employees and managers can lead to a significant improvement in the company's results, but also in the quality of life of its employees and managers (Postolov, Bardarova, Magdinčeva-Sopova, & Ristovska, 2019). This training can also provide each individual employee and manager with necessary skills to establish work/life balance, in accordance with their needs and desires. This is very important since more work/life balance research has tackled the organizational and less the individual level so far (Krasulja, Vasiljević-Bлагојевић & Radojević, 2015).

This paper will address some of the most significant trends in establishing work/life balance of managers and other employees. In addition, it will explain the importance of having a strategic approach when addressing work/life balance, with special emphasis on its individual aspects.

1. Trends in establishing work/life balance

The following trends can be observed in establishing work/life balance nowadays: elderly care, preoccupation with work obligations outside working hours, workaholism and overall life planning (Traynor, 1999).

A higher focus of employees and managers on *elderly care* represents a very noticeable trend nowadays. This claim is supported by predictions that by 2030, 20% of Americans (around 70 million) will be older than 65, followed by the fact that the fastest growing segment of the elderly population is the population over the age of 85, which has increased by an incredible 274% in the past 25 years (Society for Human Resource Management, 2002). Child care together with elderly care makes allocating time and

attention to work and private obligations even harder. Consequently, it can be concluded that caring for the elderly will become a major issue for employees and managers in the following years.

Although not yet as widespread as child care programs, an increasing number of companies offer various elderly care programs to their employees and managers, such as providing contact information on elderly care services and even subsidized elderly care costs (Society for Human Resource Management, 2002). Some companies also offer programs that include assistance with child care costs together with elderly care. The task of human resource management is to clearly and transparently present the work/life benefits and programs offered by the company to its employees and managers, in order for them to become aware of them and to start using them.

Employees and managers are often *preoccupied with work obligations outside working hours*. It is very common that even when they spend time with their families, employees and managers are not able to completely relax and mentally focus on the present situation and environment, but are still at work in their minds, thinking about tomorrow's obligations and potential issues. Their family members have the impression that they are constantly thinking about work, which results in greater work and life dissatisfaction, more frequent conflicts between work and private obligations, a lower sense of happiness and more frequent burnouts at work (Ezzedeen & Swiercz, 2002).

Research of employees in Serbia has shown that 78% of respondents think about tomorrow's work obligations at home and that 69% of respondents continue to perform work obligations at home, i.e. bring work home after working hours, resulting in chronic fatigue and dissatisfaction (Nosak & Zubanov, 2013). This research also showed that the assumption of the dominant influence of personality characteristics, gender, age and family status of employees on their work/life balance was inadequate. According to this research, organizational culture created and supported by superiors is what dominantly influences work/life balance. This discovery provides a new basis for better understanding this important issue and creating more adequate work/life benefits according the employees and managers' needs.

Bonebright, Clay & Ankenmann (2000) describe *workaholics* as a special group of employees and managers who have a high urge to work, high work engagement and a highly developed sense of responsibility and work commitment, differentiating only in the level of work enthusiasm. Research of these authors has shown work/life imbalance of workaholics, with a slight difference in the imbalance level - enthusiastic workaholics experienced higher life satisfaction and work/life balance compared to non-enthusiastic workaholics.

Overall life planning may be considered as a contemporary outlook on creating work/life balance programs that enables employees and managers to analyse and understand how these two aspects of their lives are interconnected. The goal of this approach is to encourage employees and managers to take a holistic view of their lives and to assess their relationships with other people, emotional stability, health, career and financial success. This enables employees and managers to evaluate available options to improve their work/life balance and develop their individual life plan, which this way becomes a goal for each individual, leading to an increase of energy, enthusiasm and productivity of employees and managers (Traynor, 1999).

Whether it is a new generation of employees increasingly valuing leisure activities, couples seeking to maintain a marriage while developing their careers, or single parents trying to earn a living and raise their children, human resources sectors in companies should create work/life balance programs for employees and managers in order to improve their productivity and reduce absenteeism.

2. Strategic approach to establishing work/life balance

Human resource management has become a strategic topic for today's companies. Unlike the previous view of human resources as only one aspect of the company, modern companies understand that, due to the specific nature of the human factor, human resources should be managed in accordance with the strategy of the entire company. Strategic human resource management enables companies that have human resource management (HRM) policies and programs aligned with the company's mission, strategy, goals and culture to achieve better performance (Delery & Doty, 1996).

Responsible human resource management, as an element of company's internal social responsibility, should be aimed at establishing work/life balance of its employees and managers (Stojanović-Aleksić & Bošković, 2017). Within strategic management of employees and managers' work/life balance, companies can apply one of the two approaches - one-sided (systemic) or two-sided (individual) approach.

Until recently, companies applied a *one-sided (systemic) approach* to creating work/life balance programs, which involved defining policies, procedures and benefits of these programs for managers and other employees, such as: flexible working hours, part-time work, compressed work week, division of work, work from home, paid days off and holidays, child care, elderly care, stress management programs, sports, health and wellness programs (Bird, 2006).

While a one-sided (systemic) approach regards creating work/life balance programs for employees and managers as mostly a company issue, a *two-sided (individual) approach* raises both the question "what can the company do to enable establishing work/life balance of an individual employee or manager?", as well as the question "what can an individual employee or manager do to establish the best work/life balance for themselves?" (Bird, 2006). Disregarding the second question can often lead to not achieving the desired work/life balance of employees and managers in companies, which is why it is imperative that work/life balance programs include both the creation of a healthier work environment by the company and the behaviour change of employees and managers themselves.

Involvement of employees and managers is essential here because work/life balance represents a different set of elements for each individual employee or manager. For example, for some employees, overtime work creates value and balance in their lives, while for others it reduces productivity and job satisfaction (Bailyn, Fletcher & Kolb, 1997). Also, the set of factors that establish work/life balance for every person can change in time, depending on whether they are starting their careers, preparing to leave their job or retire, as well as whether they are pursuing a career with no children or being a single parent.

Based on previous arguments, it can be concluded that the company alone cannot fully establish work/life balance of its employees and managers, but each individual employee and manager should discover and create a set of benefits that are most important to them in the present situation. It is necessary that the company help each individual employee and manager to develop skills that will enable them to not only understand the key factors that contribute to establishing work/life balance, but to also apply those skills both at work and in their private life (Byrne, 2005).

A two-sided (individual) approach to establishing work/life balance can be implemented by organizing *training* aimed at enabling employees and managers to better integrate their work and private lives in order to improve organizational efficiency (Bird, 2006). This training includes acquiring practical skills and tools that lead to increased work performance, satisfaction and work/life balance of employees and managers.

It has been observed that there is a great similarity between the skills needed for better interaction with family and friends and the skills necessary for better communication

in team-oriented companies (Nosak & Zubanov, 2013). Therefore, the skills of managing time, projects and interpersonal relationships, as well as the skills of providing more efficient services to consumers that are developed at work, are both transferred into the relationships of employees and managers with their family and friends, i.e. into their communication outside of work. The reverse is also true - the skills developed outside of work are transferred to the behaviour and communication of employees and managers at work. The ability of employees and managers to transfer the skills they have acquired in one role and apply them in the other role will lead to a significant improvement of the company's efficiency.

Training of the development of skills that employees and managers will use in their work and private lives should be part of the company's strategy due to its significance for everyone in the company. This training leads to greater retention, commitment and productivity, as well as to better behaviour and communication of employees and managers, which ultimately leads to greater satisfaction with both their work and private lives (Bird, 2006).

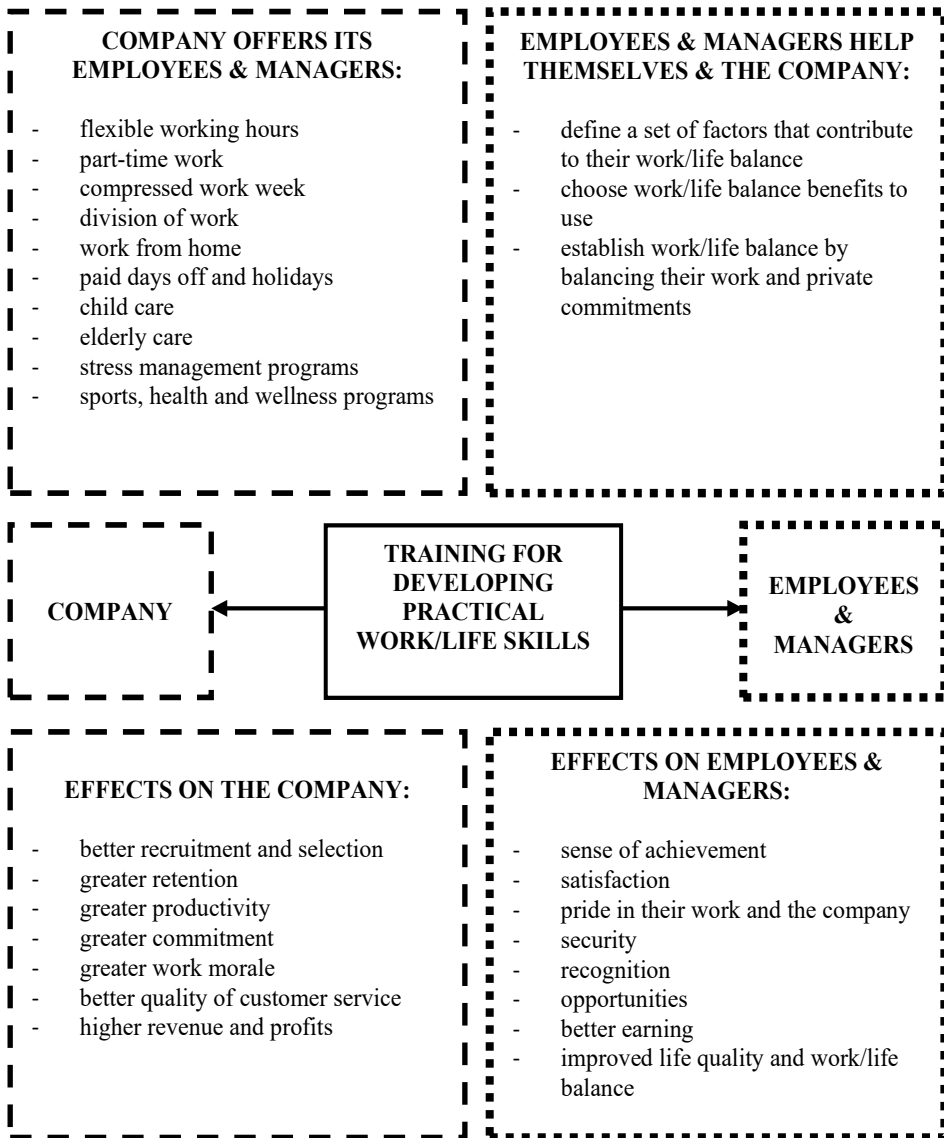
For the implementation of this training, it is necessary to have full support of the company's superiors, i.e. their participation in training, support and promotion. Superiors are actually the most common reason why employees and managers leave their companies, in most cases because of their disregard for private lives of employees and managers (Nosak & Zubanov, 2013). Therefore, it would be adequate to start the training precisely with superiors, because the development of their skills will most certainly have the greatest and fastest impact on employee and management satisfaction. Afterwards, employees and managers should develop the same skills in order to improve their work efficiency and communication both at work and in their private lives, which will ultimately contribute to the improvement of their work/life balance (Bird, 2006).

A two-sided (individual) approach to creating work/life balance programs for employees and managers connects both the company's and employees' goals, while at the same time offering specific training to develop skills that will improve behaviour and quality of life of employees and managers, both at work and outside of work (Figure 1).

When creating a strategy for establishing work/life balance of employees and managers, the *company* should be guided by the effects that it wants to achieve by implementing the created work/life programs and benefits - these effects include better recruitment and selection, greater retention, productivity, commitment and work morale, as well as better quality of customer service, all of which will lead to a higher company revenue and profits (Lazăr, Osoian & Rațiu, 2010).

On the other hand, *employees and managers* want to get a sense of achievement, satisfaction, pride in their work and the company, security, recognition, opportunity and better earning, which will ultimately lead to improved work/life balance and life quality (Lazăr, Osoian & Rațiu, 2010). In order to achieve the desired effects, employees should, based on their life goals, needs and interests, but also the company's business goals, choose certain programs and benefits that they will use to create a positive work environment, in which it is a pleasure to work. Companies offer these programs in order to support and enable their employees and managers to lead a balanced life. However, each individual employee and manager needs to define and create their own work/life balance, which implies successful balancing between their work and private obligations. It is important that the company encourage each individual employee and manager to accurately and honestly define and express their goals and priorities in both work and private lives.

Figure 1: Two-sided (individual) approach to creating work/life balance programs for employees and managers



Source: Authors - based on: Byrne, U. (2005). *Work/Life Balance: Why Are We Talking about it at all*. *Business Information Review*, 22, 53-59. & Lazăr, I., Osoian, C., & Rațiu, P. (2010). *The Role of Work/Life Balance Practices in Order to Improve Organizational Performance*. *European Research Studies*, 13(1), 201-214.

The company provides *training* to develop practical skills that will enable employees and managers to think and behave in a more productive way, both at work and in their private lives. By developing these skills, employees and managers will achieve

more and they will feel comfortable in their workplace, which will then be transferred into their private lives and it will contribute to increasing their life satisfaction and life quality (Bird, 2006).

Conclusion

Work/life balance includes a set of different factors for each individual employee and manager, and it can also change for each individual over time. Employees and managers should constantly search for a set of factors that help them achieve work/life balance in their present situation. These individual aspects are especially important in establishing a strategic approach to work/life balance. This balance implies the ability to perform most of the obligations and meet most of the expectations of employees and managers, both at work and in their private lives.

Establishing work/life balance of employees and managers while achieving the company's business goals requires training to develop practical skills that enable each individual employee and manager to establish their work/life balance. This paper has explained major trends in establishing work/life balance of employees and managers. This is a very important topic in strategic human resource management in companies nowadays. Companies have realized that the work/life balance of their employees provides benefits not only to them, but also to those companies, making it a strategic issue in today's business world (Mladenović, 2020). Therefore, establishing work/life balance of employees and managers has become one of the important topics in human resource management that requires strategic planning.

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P. 37-48

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MEASURING ENERGY EFFICIENCY OF AN ENTERPRISE

Abstract

Energy efficiency is gaining in importance as part of environmental efficiency within sustainable development. Many enterprises realize the need for the reduction of energy costs and improved control of energy consumption. This can be achieved by implementing the concept of energy efficiency. The subject of research in this paper is the analysis of the way in which energy efficiency can be measured within an enterprise. Therefore, the aim of the research is to define a set of indicators for measuring energy efficiency in an enterprise, as well as to point out cost advantages and competitiveness that are achieved by applying energy efficiency management.

Key words: *energy efficiency, measuring, energy costs, buildings, sustainable development.*

JEL classification: *M21, Q40, Q56*

МЕРЕЊЕ ЕНЕРГЕТСКЕ ЕФИКАСНОСТИ ПРЕДУЗЕЋА

Апстракт

Енергетска ефикасност добија све више на значају као део еколошке ефикасности у оквиру одрживог развоја. Велики број предузећа увиђа потребу за смањењем трошкова енергије и бољом контролом потрошње енергије. То се може постићи имплементацијом концепта енергетске ефикасности. Предмет истраживања у овом раду јесте анализа начина на који се енергетска ефикасност може измерити. Стога је циљ истраживања дефинисање сета индикатора за мерење енергетске ефикасности, као и указивање на трошковне предности и конкурентност које се остварују адекватним управљањем енергетском ефикасношћу.

Кључне речи: *енергетска ефикасност, мерење, трошкови енергије, зграде, одрживи развој.*

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Introduction

There are increased number of enterprises which within their mission, vision and strategy create a business policy that contributes to sustainable development. Due to the higher cost of fossil fuels, economic crises, new environmental and energy standards, enterprises should focus more and more attention to energy saving, the elimination of losses and inefficiency, and the control of energy consumption. The concept of energy efficiency has, therefore, become an integral part of operation of every enterprise which tends to maintain its competitiveness. The effects of an irrational use of natural resources are far-reaching, especially non-renewable resources. They can negatively affect the environment in which the enterprise operates, as well domestic economies of countries and the global image of the world. On the other hand, the application of the concept of social responsibility and energy efficiency contributes to economic development and sustainability.

Considering the significance of energy efficiency regarding sustainable development, it is necessary to efficiently manage the use of energy in enterprises. It is particularly important to consider the aspects of operation in which energy efficiency affects the total expenses and profitability. From a corporate perspective, the value which is gained by applying the concept of energy efficiency should be manifested through the environment in which an enterprise operates, as well as through the profit it achieves. In order to be clearly and precisely determined, the value should be visible and properly quantified or described. Due to this, an adequate set of quantitative and qualitative indicators is needed in order to provide energy efficiency measurement. By measuring energy efficiency, the difference in the way an enterprise operates before and after the use of this concept can be clearly pointed out, as well as the numerous advantages for the enterprise and its surroundings (living and natural environment and resources).

The aim of this paper is to determine the concept of energy efficiency, to point out the set of indicators for the energy efficiency measurement and the elements it consists of in order to gain insight into the effects of energy efficiency on the operation of a certain enterprise, as well as the numerous advantages for the enterprise and the environment in which it operates, which are achieved by an adequate and complete application of the concept of energy efficiency.

1. The concept of energy efficiency and a general approach to the quantification of energy efficiency

The concept of sustainable development implies sustainable development in environmental, economic, social, cultural, and international aspects. Numerous studies indicate the disruption of the natural balance, and that consequences of the behaviour which neglects the long-term influence on the environment can be dangerous. Therefore, more and more enterprises tend to implement the concept of sustainable development into their mission, vision and strategy. The ecological sustainable development is measured through eco-efficiency, i.e. environmental efficiency. Environmental efficiency points out the use of natural resources and the negative aspects of that use. The essence of eco-efficiency also represents energy efficiency.

Energy efficiency is the focus of the management of enterprises which desire to continually improve their business activities. Numerous advantages which originate from the implementation of the concept of improving energy efficiency as business (as well as environmental) performances are the following: greater cost efficiency, better competitive position on the market, greater energy security, environmental benefits, etc.

Economic efficiency represents a quantitative relationship between outputs and inputs. If this efficiency coefficient is multiplied by 100%, the result represents the degree of efficiency (Krstić, Sekulić, 2020):

$$(1) \text{ Economic efficiency} = (\text{Outputs} / \text{Inputs}) \times 100\%$$

The efficiency measure structured in this way, provides an answer to the following question: how much input (resource) is needed to achieve a certain level of output? In other words, it shows how many units of output (results) are created by one unit of investment (input). This general formula can be used to determine the indicators of environmental efficiency and energy efficiency.

Environmental efficiency determines the success in the realisation of environmental activities, programs and initiatives. Namely, eco-efficiency means "to do something in the right way". This goes with a tendency, i.e. an aim to reduce negative influences on the environment. The essence is to use as small inputs as possible that are already invested into the realisation of environmental activities, in order to achieve as big (good) environmental effects as possible. Eco-efficiency is quantitatively measured as a relevant relation between certain categories of effects and inputs (Krstić, Sekulić, 2020):

$$(2) \text{ Eco-efficiency} = (\text{Realised environmental effects} / \text{Inputs for the realisation of environmental initiatives, activities and programs of an enterprise}) \times 100\%$$

Energy efficiency (Forsström et al., 2011, p. 13) is the quotient of the output (which is expressed as a certain volume of products/services) and the input (the energy which is needed for the production of the specific output):

$$(3) \text{ Energy efficiency} = (\text{Production volume i.e. Service volume} / \text{Energy consumption for the realisation of the output}) \times 100\%$$

The concept of energy efficiency specifically emphasises the following:

- the possibility of turning one form of energy into the other,
- ecological effects on the environment which are accomplished by its implementation,
- the use of a smaller amount of energy for the production of the same volume of products/services,
- the possibility of reducing the cost of energy, which is, perhaps, the most significant for enterprises which continually work on improving their business.

The application of the concept of improving energy efficiency implies numerous advantages for the enterprise which invests into the application of this concept. Besides energy saving, there are many other additional advantages which are reflected on the enterprise's business activities and lead to its prosperity, including the increase in productivity, product quality, efficiency, the improvement of work and life surroundings.

The productivity of production is increased, which is the result of lower processing costs. The satisfaction of buyers is higher because they receive a product/service of higher quality. The reliability and the production volume are also increased. Energy efficiency contributes to general efficiency, because its application leads to a better use of production capacities and equipment and it shortens the time which is needed for the implementation of production processes and operations. In this way, the total cost of production is reduced, as well as the overuse of machines and production equipment, the need for cooling, the need for workforce and control by an engineer (Pye, McKane, 2000). The application of energy efficiency leads to the reduction of waste which occurs during the production process, as well as the reduction of hazardous waste which reduces the costs of waste disposal. Also, water is used more efficiently. The amount of waste waters is reduced, as well as the loss of water (Finman, Laitner, 2001).

One of the advantages of the concept of energy efficiency is the improvement of work environment because the amount of noise during production processes is reduced, lighting is improved, temperature control is improved, air quality is better, etc. Safety during the production process is increased. The employees have a more comfortable workplace (Skumatz et al., 2000).

Energy efficiency has a positive effect on the environment and the health of people, due to the fact that the implementation of this concept implies the reduced emission of CO₂. A positive impact on the environment by a consistent application of the concept of energy efficiency within the enterprises' business practices implies reduced air pollution, improved local air quality in those areas where the production occurs, reduced emissions of harmful matters which affect the environment and the health of people (Worrel et al., 2003).

Other advantages of applying energy efficiency that should also be emphasised are increased motivation in employees, better reputation of enterprises, postponed or reduced capital expenses, spare spaces, improved competitiveness, reduced legal risks, risks of changes in the cost of energy and commercial risks, the increased value of shares, etc. (Cooremans, 2011).

2. Energy efficiency measurement

The indicators of energy efficiency measurement differ in regard to the aspect from which energy efficiency is observed (economic, environmental, social, etc.). Also, the level on which the concept is applied is also important (micro – an enterprise, or macro – a community).

Patterson (1996, p. 378) emphasises four groups of indicators of energy efficiency: "thermodynamic, physical-dynamic, economic-thermodynamic and economic". *Thermodynamic indicators* are based on the thermodynamic values of inputs and outputs (for example, thermal efficiency of heating). *Physical-thermodynamic indicators* measure energy inputs in thermodynamic values, whereas outputs are measured in physical units (for example, the energy consumption by a square meter in a building). *Economic-thermodynamic indicators* use the expression of outputs (merchandise, product and services) in market costs, and the energy (input) is expressed in thermodynamic

measuring units (e.g. the energy intensity of GDP⁴). *Economic indicators* are such indicators in which the inputs and outputs are expressed in a financial expression (e.g. the energy consumption per unit of GDP).

For the definition of a specific indicator of energy efficiency (provided by the relation No. 3), with the purpose of adequate and precise measurement, it is necessary to determine the input and the output. The question is what the output could be in this expression of energy efficiency, if the input is the quantifier of this indicator. During the expression of the input for energy efficiency measurement (Forsström et al., 2011, p. 20) the consumed energy within the life cycle of a product should be taken into consideration, as well as the energy which obtained its physical form in the materials (outcomes), and the energy from recycled materials. When it comes to the corporate measurement of energy efficiency, it is very important to have energy costs as an information input, based on the amount of consumed energy and the energy cost per unit of consumed amount. The output is usually the amount of product (production) or the scope of a provided service. Regarding the expression of the output for energy efficiency measurement, it should be noted that a simple measurement of the amount of production cannot take into account the quality of a service or a product (Forsström et al., 2011, p. 20).

The control of energy efficiency requires the use of a set of indicators; however, the focus are the two key, initial, indicators such as:

- *Energy natural productivity*,
- *Energy financial productivity*.

Energy natural productivity indicates the production volume per unit of consumed energy. In other words, it shows the amount of consumed energy (for example, expressed in kilowatt-hours). This indicator is calculated in the following way:

$$(4) \text{ Energy natural productivity} = (\text{Production Volume} / \text{Energy Consumption}) \times 100\%$$

Energy financial productivity shows the quotient of the production volume and total energy costs (Benedetti et al., 2015, p. 44) within a certain time period t :

$$(5) \text{ Energy financial productivity} = (\text{Production volume} / \text{Total energy costs}) \times 100\%$$

This ratio shows what amount of a production volume is achieved per 100 monetary units of total energy costs.

Besides the aforementioned two indicators, analytically speaking *energy cost efficiency* is a particularly important indicator. Essentially, this is not a new indicator in relation to the two indicators previously explained. From a mathematical perspective, *energy cost efficiency* is an inverse value of the indicator of energy financial productivity. The indicator of energy cost efficiency is, in essence, an indicator of financial energy efficiency, because it takes into account the costs of energy and not the consumption of energy (as a physical measure of consumed energy). *Energy cost efficiency* is calculated as a quotient of total energy costs and a production volume:

$$(6) \text{ Energy cost efficiency} = (\text{Total energy costs} / \text{Production volume}) \times 100\%$$

⁴ The energy intensity of GDP is calculated as a quotient of energy consumption and the GDP value (it represents an inverse value of energy productivity, which is calculated as a quotient of the GDP value and energy consumption). This indicator shows how much energy is spent for the production of one unit of GDP.

This indicator shows what amount of energy is spent on the production of one unit of products. In other words, this performance indicator shows how many monetary units of energy cost have been paid for the generated production (production volume) which is expressed in physical units of a specific product.

Energy cost efficiency can be disaggregated into two indicators. Namely, it can be calculated as a multiplication of two indicators (Benedetti et al., 2015, p. 44) such as: 1. *Cost of energy to energy consumption ratio* which represents the quotient of total energy costs and energy consumption (the amount of consumed energy) and 2. *Energy consumption to production volume ratio* which is calculated as a quotient of consumed energy and production volume.

Therefore, the energy cost efficiency can be expressed in the following way:

$$(7) \text{ Energy cost efficiency} = (\text{Cost of energy to energy consumption ratio} \times \text{Energy consumption to production volume ratio}) \times 100\%$$

i.e.

$$(8) \text{ Energy cost efficiency} = [(\text{Total energy costs} / \text{Energy consumption}) \times (\text{Energy Consumption} / \text{Production volume})] \times 100\%.$$

Building Assets are part of the fixed assets of enterprises. Buildings are also consumers of different energy, considering the characteristics and the purpose of building assets (production, selling, administrative, storage, etc.) It is interesting to supplement the previous set of indicators of energy efficiency of buildings (work spaces) as a significant asset of an enterprise. When it comes to buildings, the consumption of energy, and, at the same time, the potential for the implementation of the concept of improvement of energy efficiency, is very large. Buildings as consumers of energy imply direct consumption which is related to heating and cooling, and indirect consumption which refers to the consumption of electric energy for lights, appliances, office equipment, cooling devices, cooking and engines in pumps and ventilation systems.

The measurement of energy efficiency of buildings includes the selection of an appropriate set of indicators. However, making the right selection of indicators depends on the fact what data, for what purpose and who needs them (owners, lessees, contractors, etc.).

Energy Consumption per square meter is calculated in the following way (Forsström et al., 2011, p. 38):

$$(9) \text{ Energy Consumption per square meter} = \text{Energy Consumption} / \text{Building Surface},$$

Energy Consumption or the amount of consumed energy in kilowatt-hours is calculated for a one-year period; however, this period can be shorter, six or three months. The square footage of a building can include only the area which is heated or a total footage, and it is expressed in square metres.

Energy consumption adjusted for the utilization rate of a building is an indicator which refers to the degree (rate) of the utilisation of a space. This rate, logically, affects the energy efficiency. This indicator is calculated in the following way (Forsström et al., 2011, p. 39):

$$(10) \text{ Energy consumption adjusted for the utilization rate of a building} = \text{Energy consumption} / (\text{Utilization Rate of a building} \times \text{Building square footage})$$

Utilization rate of a building is calculated as the quotient of the number of hours of the actual use of space (building) during 24 hours of one day and the maximum number of hours of the use of the same space (building) during 24 hours of one day. Energy efficiency will be higher if the rate of the utilisation of space is higher. Namely, energy consumption in buildings implies some basic consumption of energy which occurs regardless of the use of a building (heating, minimum ventilation and other continual energy services) and the consumption of energy by the occupants of the building.

Intensity of energy consumption is an indicator which is used for the calculation of the amount of consumed energy depending on the number of hours which an individual spends in the building (Forsström et al., 2011, p. 40). It is calculated in the following way:

$$(11) \text{ Intensity of energy consumption} = \text{Energy Consumption} / \text{Number of hours a person or people spent in the building}$$

This indicator shows to what extent a certain space is used efficiently; however, it is not suitable for comparing different buildings or buildings with different purposes.

Economic Intensity of Energy consumption (Forsström et al., 2011, p. 41) is an indicator which is used for the calculation in leased buildings because they are not owned by enterprises. This is calculated in the following way:

$$(12) \text{ Economic Intensity of Energy consumption} = \text{Energy consumption} / \text{Rent for the particular business space, i.e. building}$$

The rent for a *specific space, i.e. building* is used for the calculation of this indicator as the amount which is paid for the period in which the amount of consumed energy is measured. The rent which is paid by the user of a certain building, implies a minimum benefit which the user expects from that space. If the user (lessee, the one who pays the rent) believes that the rent surpasses the usefulness which is achieved by the use of the building (space), most probably it will not be the user in the future. Taking this into consideration, this indicator shows the relation between the consumed energy and the usefulness which is achieved by a specific space for a specific time period. The lower value of this indicator points to higher energy efficiency.

Besides the aforementioned indicators, it is also important to use *Energy consumption - benchmark performance index*. It is calculated in the following way:

$$(13) \text{ Energy consumption - benchmark performance index} = \text{Energy consumption for a particular building} / \text{Energy consumption of a similar building that uses the best technology}$$

A higher value of this indicator implies a higher potential for energy saving, i.e. for the implementation of proper technology which will save energy in the future. The best possible technology with which a certain space (building) is equipped is the technology which is available on the market and represents a favourable investment for an enterprise (Forsström et al., 2011, p. 42).

3. Energy efficiency management

Energy costs are expressed in monetary units, the production volume is expressed in physical units of produced products, and the consumption of energy is expressed in kilowatts, for example. Energy costs are complex. They are directly connected with energy consumption, but they are also affected by different price tariffs and the flows of offers and demands on the energy market (the market of fuels). All this should be taken into consideration when defining a specific corporate strategy which adheres to the concept of energy efficiency with the aim of reducing total energy costs to the lowest level possible.

When it comes to the *Cost of energy to energy consumption ratio*, its value depends on the choice of a suitable tariff and the choice of suppliers, the respect of contract rules of ordering from a supplier, as well as the needed amount of energy (Benedetti et al., 2015). The selection of a suitable price tariff and the selection of suppliers implies that the enterprise should sign the most favourable contract regarding the purchase of energy with the suppliers of energy, i.e. the contract with the lowest price possible, while taking into consideration the corporate energy consumption and the fuel market. The factors which affect the selection of an appropriate price tariff and suppliers are: a) a total energy consumption, because the use of the effect of volume economy provides a certain benefit – the purchase of a larger amount of energy will provide lower costs per kilowatt hours, and b) the estimation of whether the demand for energy is small, balanced, or big, in order to provide it on time, etc.

Obeying the contract rules of purchase is necessary, in order to avoid penalties if there is a breach of contract. The required amount of energy implies that it should be taken into account how much energy is actually needed for production by a specific enterprise, and, according to this, a certain amount of energy should be arranged and purchased.

On the other hand, the value of *energy consumption to production volume ratio* is affected by the transformation, distribution and consumption of energy (Benedetti et al., 2015).

The process of energy transformation implies the shift of one form of energy into the other form, so that a certain source of energy can be used in the most efficient way, with the elimination of energy losses during the production process in a particular enterprise. *The process of energy distribution* implies a delivery of energy to the locations where it is needed, so it can be used in the most efficient way, with the elimination of energy losses. *The process of energy consumption* implies the use of energy in an efficient and effective way.

When deciding on the set of programs which will be used for the implementation of the concept of energy efficiency, the effects which will influence the energy demands should also be taken into consideration, as well as the energy consumption management. There are three main categories of the effects of applying the program of energy efficiency, and they are (Benedetti et al., 2015):

- Change in the necessary amount of energy,
- Change of the profile of energy demand, and
- Partial or complete isolation from energy supply network.

1. *The change in the needed amount of energy* implies that the amount of energy which is needed for the functioning of the production system at a desired level is smaller in relation to the amount of energy which was needed before the implementation of the program of energy efficiency (Benedetti et al., 2015). The programs (measures) which enable this effect are implemented in the following areas: transition to a more energy-efficient production and other equipment which has the influence on the appropriate selection of suppliers and price tariffs, as well as the adherence to the contract rules regarding the purchase of energy which affect the value of *cost of energy to energy consumption ratio*; the selection of the appropriate production technology, the selection of techniques which affect the transformation, distribution and consumption of energy, which also affect the value of the indicator *energy consumption to production volume ratio*.

2. *The change in the profile of energy demand* implies that after the introduction of the program (measures) for achieving desired energy efficiency of the production system, the use of energy in different periods is required (throughout the day, as well as throughout the year) (Benedetti et al., 2015).

Measures which can provide this effect are applied in the following areas: the total consumption of energy, the highest demand for energy, a response to the demand and the appropriate flexible systems of energy costs which affect the proper selection of an energy supplier and the price tariff, the adherence to the contract rules of the purchase and the needed amount of energy for the production process at a certain location and at a certain time, which affect the value of the indicator *cost of energy to energy consumption ratio*.

Besides these measures, the following measures which affect the value of *energy consumption to production volume ratio*, are also relevant: a) the selection of a modulation technique and dimensioning, which affect the transformation, distribution and consumption of energy during the design stage, b) the best practices, c) monitoring and controlling which affect the transformation, distribution and consumption of energy during the stages of production and maintenance.

3. *Partial or total isolation from the supply network* implies that after the application of measures for achieving desired energy efficiency of a production system there is no need for energy from the supply network, or that, only occasionally, there is the need to use the supply network (Benedetti et al., 2015). Measures which can provide this effect have an influence on the needed amount of energy which affects the value of the indicator *cost of energy to energy consumption ratio*.

Every effective program of energy efficiency management includes certain stages, and they are: a) the stage of management commitment, b) the stage of control (revision) and analysis, c) the stage of implementation (Goswami, Kreith, 2007).

The stage of management commitment implies the inclusion of the corporate management team and the assignment of specific tasks whose fulfilment leads to the implementation of the program of energy efficiency. Afterward, it is important to select a manager who will be the program coordinator, and to form the board for the implementation of the program, as well as to name representatives for organisational segments of an enterprise, who are the board members and who are directly involved in the realisation of the program.

The stage of control (revision) and analysis of the implementation of the program of energy efficiency implies, first of all, the review of energy efficiency indicators, a preliminary analysis of the records of indicators from the previous period, and the specification of necessary resources. It is also necessary to perform a comparative analysis of data from different years. After that, it is necessary to analyse different options of the program of energy efficiency management from an economic aspect.

The implementation stage implies setting goals for the enterprise and for every organisational part, determining the funds needed for the investment into a certain program and setting priorities in the realisation of different defined projects. It is also necessary to establish a quality system of measuring energy efficiency indicators and reporting on energy efficiency performance, continual monitoring and control. It is particularly important to promote the program throughout the organisation and to talk about its importance with the employees, and, in that way, influence their awareness and engagement regarding the implementation. Finally, it is important to periodically perform an evaluation of the program of energy efficiency management and, if necessary, to conduct proper corrections in the program, in order to overcome perceived issues and limitations identified during the program implementation.

When it comes to energy efficiency management, it is important to say that there are certain stimuli for enterprises in order for them to decide about the implementation of this concept. In this sense, the importance of financing the program of energy efficiency by the state should be pointed out, as well as the significance of external pressures such as the increase in energy costs and the introduction or the increase in fees for the used resources and for the emission of pollutants.

However, despite the importance of the implementation of the concept of energy efficiency, there are barriers which slow down or disable its application. One of them is certainly a high investment into these programs. The lack of capital slows down the adoption of measures of energy efficiency. Subventions or affordable loans can help in speeding up the spread of measures of energy efficiency. Also, the quality of the control of energy consumption influences the application of the program (measures) for the achievement of a higher level of energy efficiency. Therefore, it is necessary for the efficient regulation to include quality standards for the control of energy consumption (Fleiter et al., 2012).

Studies also show that enterprises have a favourable attitude towards energy-efficient technologies which are able to provide long-term benefits, which proves their willingness to adopt solutions if they can improve their long-term competitiveness. Other initiators which are viewed as strategic for the improvement of energy efficiency are business initiatives in the enterprise and the management team who is dedicated to a successful application of the concept of energy efficiency (Cagno, Trianni, 2013).

Conclusion

There are increased number of enterprises which understand the significance of the implementation of the concept of improving energy efficiency for the profitability of their business, as well as numerous benefits of this concept for the environment. In

order for the enterprises to properly utilise all the advantages of the implementation of this important concept for the entire economic efficiency, it is necessary that they formulate and implement the strategy of energy efficiency and programs for the energy efficiency management which will support the implementation of the aforementioned strategy. Taking into account numerous advantages which are provided to enterprises by the implementation of the concept of energy efficiency and to the environment in which they operate, it is necessary to emphasise its significance. The significance of energy efficiency can be understood through the quantification of the effects reached by its implementation. That is why it is important to establish an appropriate system of energy efficiency measurement which should be an informational input for efficient energy efficiency management.

The efficiency of the use of energy is different in different industries because they imply different products and processes. Taking into account that particular diversity, the programs of energy efficiency management are specific for different industries, as well as different enterprises within one industry. Many large enterprises have succeeded in accomplishing great savings in the consumption of fuels and electric power by applying different programs of energy efficiency management. Smaller enterprises, however, can face certain difficulties during the implementation of these programs, due to the lack of knowledge, competencies, technical staff and equipment which are necessary for an effective realisation of the program of energy efficiency. One of the possible solutions of the aforementioned limitations can be to hire external consultants and experts. Besides a high-quality strategy of energy efficiency, it is also necessary to have a good organisation for a successful implementation of the program of energy efficiency, and it is important to provide motivation and dedication of employees and the support of corporate management.

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THE IMPORTANCE OF WASTEWATER TREATMENT PLANTS FOR SUSTAINABLE DEVELOPMENT

Abstract

The concept of sustainable development has gained in its importance with the attempt to align the goals of economic development with the goals of preserving the quality of living environment. This paper explains the concept of sustainable development and its dimensions, emphasizing its connection with the communal activity of purification and drainage of atmospheric and wastewater. The evidence from the Republic of Serbia regarding wastewater treatment plants and environmental protection costs raises concerns about sustainability issues. Therefore, the aim of the paper is to point out the importance of increasing wastewater treatment plants' capacity and improving their operability, as well as to emphasize the necessity for structural changes of public utility companies to address the identified problems.

Key words: wastewater treatment plants, sustainable development, environmental protection costs

JEL classification: Q25, Q53, Q56

ЗНАЧАЈ ПОСТРОЈЕЊА ЗА ПРЕЧИШЋАВАЊЕ ОТПАДНИХ ВОДА ЗА ОДРЖИВИ РАЗВОЈ

Апстракт

Концепт одрживог развоја добија на значају са покушајем да се ускладе циљеви привредног развоја са циљевима очувања квалитета животне средине. Овај рад објашњава концепт одрживог развоја и његових димензија, наглашавајући његову повезаност са комуналном делатношћу пречишћавања и одвођења атмосферских и отпадних вода. Подаци за Републику Србију у погледу постројења за пречишћавање отпадних вода и трошкова заштите животне средине подижу забринутост за питања одрживости. У том смислу, циљ рада је да укаже на значај повећања капацитета постројења за пречишћавање отпадних вода и унапређења њиховог пословања, као и да

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истакне неопходност структурних промена јавних комуналних предузећа како би се решили идентификовани проблеми.

Кључне речи: *постројења за пречишћавање отпадних вода, одрживи развој, трошкови заштите животне средине*

Introduction

With the growing concerns regarding the environmental issues and survival of the human society, the concept of sustainable development has gained in its significance. It "has emerged as a need to align the goals of technological progress and economic growth and development, with the goal of preserving the quality of the living environment" (Marković et al., 2020, p. 3). Increasing pollution and rapid degradation of living environment, due to excessive production and consumption, has emphasized the need to seriously raise the question regarding the mere survival of the planet and all its inhabitants.

The concept of sustainable development implies satisfying the needs of current generations without endangering the natural systems and environment and jeopardizing the needs of future generations. It has served as a base for the rise of new philosophy and strategy of social development. Hence, starting from 1994, the World Bank has begun convening annual conferences on sustainable development to raise awareness of the importance of this concept and environmental concerns among other institutions and spread it to all parts of society.

As regards the Republic of Serbia, the vision of its sustainable development is focused towards becoming a country with stable macroeconomic environment, developed infrastructure and institutions that meet EU requirements, highly educated population; in which available natural and knowledge-based resources are used in a productive and efficient manner with considerable environmental protection; a state in which entities from private, public and civil sector mutually interact, and where all citizens have identical possibilities (Government of the Republic of Serbia, 2008).

In the combat against environmental pollution, the central role is devoted to wastewater treatment (Qu et al., 2019). Namely, water represents the essence of life and without this natural resource the survival of human society is seriously threatened. As a result of inadequate care for water resources, half of world population does not have sufficient and sustainable water resources, while 20% does not have access to clean water (Moghaddam et al., 2017, p. 463). The good water quality is a prerequisite for a healthy life. In order to get adequate water quality, it is necessary to perform several levels of purification in the wastewater treatment plants (WWTPs). Wastewater is polluted water produced by various industrial activities and community (Padrón-Páez et al., 2020). WWTPs represent the technology through which the treated water is discharged into the recipients. The technology of these plants is improved by technical and technological achievements. All countries of the world, including the Republic of Serbia, are striving for the most advanced technologies for wastewater treatment, which will reduce the degradation of the environment as much as possible. Hence, wastewater management is an important issue especially for undeveloped and developing countries. Inadequate and

inefficient wastewater management could cause the serious ecological, environmental and social consequences (Qu et al., 2019).

Considering all this, in the first chapter of the paper, the importance of sustainable development as theoretical concept is pointed out. The second chapter provides an analysis of wastewater in the Republic of Serbia, the third chapter presents a comparative analysis of environmental costs in the Republic of Serbia for the period from 2013-2019. The next chapter connects sustainable development with wastewater treatment plants, after which the wastewater treatment plant of the city of Kruševac is presented as an example of good practice.

1. The concept of sustainable development

The concept of sustainable development, or sustainability, is one of the basic concepts of economics of natural resources and the environment. Many different interpretations of this concept can be found in literature, and it is increasingly given importance, which gives it a central place in considering the long-term perspective of the survival and progress of civilization.

Although great environmental debates took place in the 1960s, the very concept of sustainable development was first mentioned almost a decade after the first United Nations Conference on the Environment in Stockholm in 1972, which marked the formation of the United Nations Environmental Program (UNEP). Many organizations, encouraged by the results of the conference, began to deal more actively with the environmental issues, and in that period the idea of sustainable development was born.

The World Commission on Environment and Development was formed by the UN General Assembly in 1983. After 4 years of work, the report "Our Common Future" was published, in which the concept of "sustainable development" gained a broader meaning by the fact that environmental issues of nature conservation were related to social aspects of development, which has become an unavoidable and generally accepted concept.

The World Summit on Sustainable Development was held in Johannesburg in 2002 under the auspices of the UN, at which it was defined that sustainability had three pillars: environmental, economic, and social. With the further development of the concept, in many countries there was a need for additional pillars - institutional and/or cultural, without which the basic three were not applicable in practice.

The economic dimension of sustainable development is based on the effort to increase economic growth, which would increase real wages, and hence reduce poverty in society. A useful definition of unsustainable development could be that it is development after which environmental damage punishes economic growth (Cvetanović & Mladenović, 2015). Sustainable development strives for economic development, understood in the traditional sense - as an increase in per capita welfare, aligned with the requirements to reduce poverty and injustice, and that the "resource base" of national economies and the world economy must be preserved (Gavrilović & Jovanović, 1998). The economic dimension of sustainable development increases the production capacities of underdeveloped and transition countries, while imposing rational consumption of natural resources for the developed countries, and hence increasing the efficiency of their use. This dimension also requires internalization of costs, including social and environmental costs (Milutinović, 2004).

The first development goal, and at the same time the basic precondition for an acceptable quality of life, is equality and understanding of the interdependence of people within the community, which is a postulate of the social dimension of sustainability. Providing education and opportunity to citizens to contribute to the progress of society through their own work represents social equality. The social dimension of sustainable development requires the active political participation of all sectors of society, and the responsibilities of the competent authorities in defining social policy, including solving the problem of social equality and population size. The implementation of the above can be achieved through the education of the local population and social groups in order to independently come with a solution, and thus contribute to a higher standard of living at the national level.

Actions of key importance for achieving the social dimension of sustainable development are achieving equality in income distribution, gender equality, providing basic social goods for all, stabilizing population growth, political responsibility, and participation.

A healthy environment and life on the planet in general are the results of a productive system and infrastructure, which represent a component of the environment in sustainable development. In order to achieve a healthy environment, large investments in the infrastructure are needed, because in that way the necessary quality of goods and services is achieved. The quality of life also depends on the achieved quality of goods and services. The degree of quality that is necessary to achieve allows nature to self-reproduce. The activities that need to be implemented in order to achieve the dimension of environmental protection are: sustainable use of resources, limitation of all forms of pollution, provision and preservation of natural capital, and avoidance of activities and actions that may have a negative impact on the environment, which occur due to insufficient knowledge to anticipate such situations (Milutinović, 2004).

The fourth dimension of sustainable development is the institutional dimension, on the basis of which the "sustainability prism" model was created. The explanation of this model is that the role of the institutional dimension is to provide support and assistance in carrying out activities that belong to other dimensions of sustainable development. This leads us to the conclusion that mutual coordination between all dimensions is necessary, but also the establishment of a balance between them, because in that way the most efficient results are achieved and their policies are realized.

Culture is one of the most important aspects that influences the understanding of values and patterns of behaviour that directly affect the openness, inclusion and cohesion of society, i.e. the quality of life of people generally. When it comes to the connection between culture and the environment, it is pointed out that cultural factors have an extremely large impact on the lifestyle of citizens of a country, their individual behaviour, the attitude towards consumption, as well as values and attitudes related to environmental protection. In the last few years, since culture has been included in the sustainable development goals, a lot of effort has been made to make it the most important dimension of sustainable development. Culture is an indispensable part of both global and development policies of individual countries and therefore it is a significant factor in sustainable development (Cvejić, 2015).

2. The analysis of wastewater in the Republic of Serbia

Wastewater management represents a compound process comprising of wastewater generation, followed by the wastewater collection through the sewerage systems, the wastewater treatment in WWTPs, and the reintegration of by-products into the environment (Cossio et al. 2020, p. 2). Inefficient wastewater management could lead to the serious environmental issues. The reintegration and re-usage of wastewater by-products are crucial for sustainability.

Wastewater is generally collected through the sewerage system. A comparative analysis of European countries with the Republic of Serbia at the level and quality of construction of sewerage systems shows a significant lag of our country behind the European standards. Also, when analysing the application and scope of legislative regulations, the backlog of the Republic of Serbia appears. However, this backlog has been worked on in recent years, as evidenced by the growing percentage of implementation of the European legislation in the field of sewerage systems. As for the amount of investments, based on the conducted analysis, it is expected that they will reach more than 4 billion euros in the next twenty years. It is very important to emphasize the need for a detailed consideration of the interests of economic, environmental and socio-political nature, to determine the priorities for the construction of sewerage infrastructure, the dynamics of their implementation and to define optimal financial programs given that these are funds of great importance.

Based on statistical data of the wastewater analysis, it is determined that the biggest water pollutants are municipal and industrial wastewater, which is discharged directly into the recipients, without any treatment. According to the UNEP estimates, the 90% of developing world is discharging wastewater directly into environment without any treatment (Malik et al., 2015, p. 173). In the Republic of Serbia, through the primary treatment, about 8% of municipal wastewater is treated before discharge. The reason for this situation is the small number of wastewater treatment plants that are in operation and that provide an appropriate degree of treatment. Also, an additional problem is the use of outdated technologies, given that the plants in which they are used were built decades ago. Consequently, the WWTPs may discharge partially or completely untreated wastewater into the environment (Malik et al., 2015).

The wastewater treatment comprises of three stages. It is possible to use primary (wastewater moves very slowly through large tanks - primary sedimentation tanks, where 30-50% of particulate organic matter is deposited on the bottom, fatty and oily substances float to the surface, where they are removed), secondary (reflected through the biochemical process, which takes place under the influence of microorganisms and is used to further remove suspended particles and reduce biochemical oxygen demand - BOD), and tertiary treatment (includes filtration of wastewater on sand filters, elimination of phosphorus by chemical treatment and disinfection).

The percentage of the population covered by the wastewater treatment, according to the Statistical Yearbook from 2020, for 2017 was 13.9%, while in 2018 that percentage was 14.1%, and in 2019 14.4%. Out of these, only 12.6% of the population in 2017 was at least connected to secondary treatment, 12.9% in 2018, and 13.1% in 2019 (see Table 1) (SORS, 2020, p. 269). The tertiary treatment covers only 1.9%, and those are residents connected to the sewage system which drains wastewater to the wastewater treatment plant in Subotica.

In order for wastewater treatment to be possible, there must be an adequately built wastewater and atmospheric water collection system. However, there is a problem of insufficiently constructed sewerage network, which results in a low level of municipal wastewater collection (Table 1). There is a tendency to increase the coverage of sewage systems. However, that is still insufficient. The amendment of the Law on Public Property gave greater authorization to the units of the autonomous provinces, as well as to the local self-government units (LGUs) in the provision of communal services. As a result, the coverage of the sewerage network has drastically increased, but there is a problem of inadequate wastewater treatment.

Table 1. Indicators of treated wastewater in the Republic of Serbia

Indicators	2017	2018	2019
Wastewater treated, mil. m ³	131	132	94
Primary treatment	75	76	23
Secondary treatment	43	42	39
Tertiary treatment	13	14	32
The length of the public water supply network, km	43,497	44,361	46,444
Number of households connected to the water supply	2,119,103	2,130,462	2,157,004
Percentage of population connected to water supply	86.9	87.9	89.4
The length of the public sewer network, km	16,725	16,851	17,435
Number of households connected to the sewerage network	1,515,790	1,528,161	1,572,314
Percentage of population connected to the sewerage network	62.2	63.0	65.2
Percentage of population covered by wastewater treatment	13.9	14.1	14.4
Of these associated at least on the secondary treatment	12.6	12.9	13.1

Source: SORS (2020, p. 269)

Existing systems are burdened with wastewater from households to a greater extent than from economic entities. In already built wastewater treatment systems, the problem is system maintenance, improvement of work and quality of treated water. Hence, the environmental problems in the Republic of Serbia are immense, as existing WWTPs do not have capacity to treat the collected wastewater, whereas cities lack funds to adequately maintain and upgrade the existing facilities. With an estimated investment of over several billion euros, the wastewater sector can become one of the development opportunities of our economy that can provide the conditions for job creation.

3. The analysis of environmental protection costs

Environmental protection costs are costs incurred in order to prevent, reduce, and eliminate pollution or any other environmental degradation due to the process of production or use of goods and services. Comparative analysis includes costs for air protection, costs of wastewater management, waste management, costs for protection and rehabilitation of land, groundwater and surface water, costs of protection against noise

and vibration, costs for nature protection and other activities related to environmental protection (Table 2).

Air protection costs in 2015 showed a significant increase compared to other years. For the municipal activity of wastewater management in 2019, significantly higher costs were recorded compared to the observed period from 2013-2019. In relation to the observed costs, the costs of waste management recorded the highest values, and in the observed period, the largest amount was recorded in 2019. Other activities related to environmental protection, which include protection and rehabilitation of land, groundwater and surface water, protection against noise and vibration, nature protection and other activities recorded the highest growth in 2017.

Table 2. Environmental protection costs by activities in the Republic of Serbia in mil. RSD

	2013	2014	2015	2016	2017	2018	2019
Environmental protection costs	31,306.4	30,509.7	34,826.0	35,349.4	34,402.3	38,266.7	42,367.8
Air protection	3,571.2	4,098.7	8,517.1	5,704.2	2,000.5	3,077.5	4,584.2
Wastewater management	4,865.1	4,978.7	4,348.3	4,420.7	4,465.9	4,681.8	5,817.1
Waste management	15,827.5	14,349.6	15,309.8	19,390.4	20,236.9	24,434.6	26,307.4
Other activities related to environmental protection	7,042.6	7,082.7	6,650.9	5,834.1	7,699.0	6,072.7	5,659.2
Environmental investments	11,707.3	10,041.8	12,292.3	12,805.0	6,592.7	7,437.7	11,606.4
Current environmental expenditures	19,599.1	20,467.9	22,533.7	22,544.4	27,809.6	30,828.9	30,761.5

Source: Authors calculated based on various SORS reports - Environmental protection costs in the Republic of Serbia (2013, 2014, 2015, 2016, 2017, 2018, 2019)

Observing the total costs, this analysis determined that their highest amount was recorded in 2019. When we talk about investments for environmental protection, whose structure is the same as the costs, the largest amount of funds for investment in this area was invested in 2016. Current expenditures for environmental protection have shown increasing growth from year to year, and the highest is recorded in 2018.

4. Linking sustainable development with wastewater treatment plants

One of the biggest challenges to the concept of sustainable development is the pressure on anthropogenic activities on natural resources, which results in the separation of three crisis areas: providing sufficient food, energy supply, and environmental protection. Water is a renewable resource and its inadequate protection and excessive use cause problems in all these areas. One of the modern technical-technological solutions to this problem is the construction of WWTPs, which drastically reduces the concentration

of undesirable substances released into the recipients. The result of this process results in the achievement of the sixth global goal of sustainable development - clean water and sanitation, and thus connects all three dimensions of sustainable development with WWTPs. These goals are in effect from 2015-2030 and are promoted by the UN.

The criteria for the assessment of sustainable management of the wastewater treatment system include the ecological, social, and economic aspects of the communal infrastructure. Through these aspects, a satisfactory level of services is provided to all citizens without disrupting the natural, built, and social systems on which the provision of these services depend.

Atmospheric and wastewater treatment and drainage, as one of the communal activities of general interest, must provide basic services that enable economic and social development and at the same time have an impact on the way society treats water as a development resource.

Sustainable development planning implies the establishment of links between land use and resources, air, water and land pollution and waste generation as a consequence of social and economic impacts in the development of urban areas and wider spatial artificial and natural ecosystem units. Urban development is part of the global concept of sustainable development and implies the application of environmental policy with the focus on projects that contribute to reducing resource consumption and minimizing the impact of the industrial and communal sectors on the environment.

5. The wastewater treatment plant in the city of Kruševac - an example of good practice

Bearing in mind that water as a natural resource is limited, one of the main goals of conservation and protection of watercourses is the treatment of wastewater from industries and households that are discharged into recipients. The creation of the WWTP project aims to protect and preserve the environment, as well as reduce the negative impact on human health.

Based on research conducted by the Association for Water Technology and Sanitary Engineering (AWTSE), it was found that thirty-three local governments have WWTPs. Seven local governments are with the primary, 21 with the secondary, while 5 units of local governments are with the tertiary treatment. Of all the existing structures and those that are under construction, only 8 of them are in operation, two plants are being reconstructed, five are in trial operation, while eight plants are not working (AWTSE, 2020).

The construction of the WWTP is underway in 13 LGUs. Among those plants are the ones located in Leskovac, Žitiste, Kanjiža, Priboj, Rača, Senjača, Žagubica, Rekovac, Opovo, Vranje, Zrenjanin, Mali Idoš, and Zlatibor. Some of these plants have reached the final construction stage (AWTSE, 2020).

Improvements in technique and technology, which the process of globalization brings with it, have brought many plants into bankruptcy and liquidation. These plants include: Bačka Topola, Vlasotince, Alibunar, Boljevac, Kanjiža, Sokobanja, and Surdulica. There is a specific example of a WWTP in Medveđa that is currently out of order due to poor location. By changing the location, this plant could be operational (AWTSE, 2020).

Almost 60 LGUs do not have these facilities, but their construction is planned. As an example of future construction of new plants, there are constructions on the territory of Kuršumljia, the construction of 4 plants is planned, also in Kanjiža, where the construction of two is planned, in addition to two already existing ones, out of which only one is in function. Since the tender documentation for the WWTPs is also necessary, it is being prepared in 6 LGUs, the preparation of planning documentation is in progress in 36 LGUs, and 12 units are in the planning phase (AWTSE, 2020).

In 2019, the Ministry of Environment conducted a study, the results of which determined that in addition to the WWTPs mentioned in the AWTSE Survey, there are 14 WWTPs, out of which 8 are in operation, a new plant in Plandište is in the final phase of construction, and 5 plants are not operational: Bela Palanka, Velika Plana, Despotovac, Kladovo, and Ruma (AWTSE, 2020).

In order to increase the efficiency of water resources, ensure the appropriate quality and quantity of drinking water for the population and the economy, as well as wastewater management, the German Development Bank (KfW) has established a program "Program for water supply, wastewater treatment and sewerage in medium-sized cities in Serbia", through which it provides significant financial assistance for the implementation of EU standards in the field of water protection. One of the larger projects financed by this bank is the Kruševac WWTP Project (Ministry of Construction, Transport and Infrastructure, 2019).

The holder of the "Kruševac Wastewater Treatment Plant" Project is the Ministry of Construction, Transport and Infrastructure. This project represents the most significant capital investment in the Rasina district, whose total value amounts to € 23,846,000 including the construction of a city collector network over 40 km long. The project is financed for the period of 12 years, where 95% of the loan is repaid by the Government of the Republic of Serbia, while the remaining 5% is repaid by the public utility company (PUC) "Vodovod-Kruševac". The project started on April 25, 2018 and lasted until February 02, 2020, when the trial operation of the plant was completed, and regular activities began. The project consisted of two main activities: (PUC Vodovod-Kruševac, 2020)

- construction and reconstruction of the sewerage network of the city of Kruševac,
- construction of a WWTP for 90,000 population equivalents.

After the completion of the trial operation of the plant on the accounts of the users of the city water supply system in Kruševac, in addition to water consumption and payment of sewage costs, another item was added - wastewater treatment. PUC "Vodovod-Kruševac" announced the introduction of the price of this service immediately after the beginning of the construction of the WWTP. The price of the service is 18.6 RSD/m³ without VAT, while 20.46 RSD/m³ with VAT. Taking into account that a household with an average water consumption consumes about 15m³, there is an increase in bills for water services in the amount of about 300 RSD (PUC Vodovod-Kruševac, 2020).

The recommendation of the Gauf Institute, a consulting company that worked on the project construction, was that the price of the service should be 29.37 RSD/m³, while PUC "Vodovod-Kruševac" planned to charge 24.72 RSD/m³. However, it was decided to reduce the operating costs of the plant, so that the price of services would be socially acceptable for the citizens and at the same time cover the minimum operating costs of the plant (PUC Vodovod-Kruševac, 2020)

After the implementation of the Project, the pollution of the surface, groundwater and land with wastewater contaminated with organic waste has been minimized, which is a significant step towards preserving the environment and human health. With strict respect for the conditions and consent of the competent authorities, organizations and companies, holders of public authorizations, legal regulations, prevention measures, this project has been sustainable and environmentally friendly for the location where it is located and for the city of Kruševac.

Conclusion

The sustainable development model focuses on satisfying the human needs and overcoming the conflict between economy and ecology (Štrbac et al., 2012). The rapid urbanization has led to the severe pollution and degradation of ecosystems and human health (Cossio et al., 2020), thus emphasizing the need for the adequate wastewater management. Inefficient wastewater management, as a complex process, can lead to the serious environmental issues. This is especially emphasized in developing countries, in which as the consequence of limited financial resources WWTPs with sufficient capacities to adequately treat collected wastewater are lacking.

In the Republic of Serbia, the alignment with the EU legislation in the field of environment and climate change brings great challenges for the state, local governments, public companies, the economy, but also for the citizens themselves. According to the estimates of the National Environmental Protection Program (NEPP), activities and projects aimed at achieving goals in the field of environmental protection could cost the Republic of Serbia between 4 and 4.5 billion euros in the next 15 years. The planned funds are distributed in the areas of: energy (29%), waste management (24%), water and wastewater management (21%), and environmental protection in the transport sector (12.5%) (Business Association of Communal Enterprises KOMDEL, 2004).

The major problem in municipal wastewater management is lack of experts of various profiles necessary for a quality and long-term sustainable approach to this problem. To overcome this problem, support for wastewater management is needed as a very important part of environmental protection.

There is a clear need for modernization of PUCs and the need to stop hiring incompetent staff. It is necessary to adjust the prices of communal services, including water, in order for the PUCs to become self-sustaining. Otherwise, financing PUCs becomes a very difficult task for most LGUs. Instead of borrowing from foreign financial institutions, LGUs should strive to use IPA funds, because they represent the most favourable option. However, in order to be able to apply for these funds, it is necessary to submit complex documentation which is a problem for most PUCs and LGUs, due to lack of financial and human resources.

Considering all the above mentioned, the Republic of Serbia will face serious environmental issues in the future regarding water resources. Therefore, determined actions should be taken towards the improvement of the wastewater management process, especially towards the increase of sewerage system coverage and wastewater treatment.

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