

Article

General Concept of Business Process Measures in the Circular Economy

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Abstract: The presented research has been embedded in a dynamically developing circular economy. Nowadays, it is more and more often referred to as an alternative economy model to the linear economy model. The principal aim of the research is to develop a general concept of business process measures. It was built on five key principles. They are (1) the principle of Institutional Determinants of Business Processes, (2) the principle of rational change of state, (3) the principle of incorrect definition of determinants, (4) the principle of rational determinants and (5) the principle of the intensity of the impact of determinants. The research mainly used the extensive literature on the subject, which was primarily aimed at showing the context of the circular economy. The concept itself mainly uses the methods and principles of process management. The rules of the Petri nets were used to define the key principles of the presented concept. Ultimately, it turned out that the proposed approach to business measurements can be helpful in managing environmental, social and governance factors also in small- and medium-sized enterprises. The most important result of the research can be presented in a specific theorem. The effective achievement of business process goals, in a circular economy, may depend on the adaptation and use of a wide stream of institutional determinants that make up a holistic environment for socio-economic phenomena taking place in the company. This may be possible thanks to the use of the general concept of business process metrics, which allows identifying and eliminating negative internal and external effects.

Keywords: circular economy; ecological economics; business process management; non-financial ecological reporting



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1. Introduction

Global socio-economic and ecological conditions have become prerequisites for the concept of a circular economy. Today, it is treated as a new economic model that is an alternative to the ineffective linear model. There is a dynamic development of this concept nowadays, both from the macroeconomic perspective and also from the perspective of enterprises and consumers. Today, the management of environmental, social and corporate governance factors is an element of the sustainable development of entire economies and individual enterprises. These phenomena determine alternative forms of management and force the creation of new tools that will contribute to the development of the efficiency of the economic system, e.g., by identifying and eliminating negative internal and external effects. These circumstances mean business processes carried out within the boundaries of a company often need to be redefined and adapted to contemporary challenges. Operational activities in enterprises, in order to be implemented effectively, should be related to a reflection on their effects, i.e., professional assessment [1].

In this context, the issues of the scientific research presented here are embedded. Two key research questions were posed. How can companies measure and analyze business processes in the principles of the circular economy? Can a holistic and institutional

approach to these measurements and analyzes support management in managing environmental, social and governance factors? The aim of the research was, however, an attempt to develop a general concept of business process measures under the principles of the circular economy. The presented issue is important for at least one reason. While large listed companies have developed mechanisms of this type of analyzes and reports, as evidenced by, e.g., ESG (environment, social and governance) reporting rules, small- and medium-sized enterprises still face serious barriers. They mainly concern the high complexity and multifaceted nature of issues arising from the principles of the circular economy. Enterprises are guided by the need to develop an appropriate added value, which should go hand in hand with an appropriate level of business profitability—regardless of how it is defined. Therefore, an attempt was made to develop such a tool that will allow the assessment of business processes carried out within the borders of small- and medium-sized enterprises.

The concept was based on a conjecture that became the thesis of the study. The effective achievement of business process objectives depends on how firms adapt to and exploit the broad stream of institutional determinants that make up the holistic environment of the firm's socio-economic phenomena. These determinants, clearly for this proposal of approach, were related to circular economy principles. This means that assessing the quality of business processes will address environmental, social and corporate governance issues. Thus, the general concept of business process measures can become a tool for developing the efficiency of the economic system by identifying and eliminating negative internal and external effects. This will be possible by defining business processes in such a way that they are optimally effective in terms of contemporary environmental and social management requirements.

It can be said that the most important scientific contribution of this publication is the attempt to create the concept of holistic business process metrics that can be used in the process of modern management. Sustainability principles do not only apply to large global companies and companies listed on stock exchanges. The concept presented here offers the opportunity to use the new social, environmental and corporate governance conditions to generate new added value also for small- and medium-sized enterprises.

2. Literature Review

The foundation of a circular economy is primarily resource efficiency, which becomes the basis for a new global economic model. It is a modern alternative to the linear economy [2]. The concept of the circular economy has clearly defined assumptions. These are mainly the maximization of added value through the optimal use of resources (including natural resources, raw materials, materials and semi-finished products) and the minimization of waste generation throughout the product life cycle. Although the concept has appeared in the scientific literature for several decades [3–5], its popularity has been growing since the early 21st century [6–8]. This is clear in a growing number of scientific papers, also in the fields of economics and management, as well as in papers at the national and international level. A good example is the activity of the European Commission in introducing legislative recommendations [9–11]. They should create a kind of 'road map' to facilitate the implementation of the principles of the closed-circle economy in European Union countries. These documents, both at the international level and at the level of individual countries, promote actions at all stages of the product life cycle, starting from product design, through obtaining raw materials, processing, production processes, consumption and ending with waste collection and management [12]. The Polish 'road map' for implementing the closed-circuit economy emphasizes that all elements of the production chain should remain in circulation as long as possible. Waste generation should be kept to a minimum.

All this reveals the most important characteristic of the new global economic model. It is the designed renewability and reproducibility of widely understood resources used in production processes. This defines the principal goal of the circular economy. It is

maintaining an optimal level of value added and utility of goods, their components and materials [13]. The circular economy is thus based on three key principles. The first is to preserve and enhance natural capital. This is possible through processes for controlling scarce resources and equivalently natural resource streams. The second principal concerns the life cycles of products in an economy. It emphasizes the necessity of the optimal use of resources (including natural resources) by maintaining final goods in economic circulation with their highest utility [14]. The third principle concerns developing the efficiency of the economic system by identifying and eliminating negative externalities [15].

The development of sustainable business models very often deals with eco-design and reverse supply chains [16]. Eco-design refers to the design of goods that generate minimal waste in the production phase and environmental effects throughout their life cycle [17]. However, one should be cautious in assessing the potential negative impact of these goods on the environment, especially in a long-term perspective of their life cycle. For example, the use of raw materials that emit less pollution at the production stage may consequently lead to an increased environmental burden at the recycling or reuse stage of these products [18]. In contrast, reverse supply chain design boils down to managing the flow of goods in the opposite direction from standard logistics, i.e., from recycling to production [19,20].

The circular economy is very often equated with a sustainable development strategy at the macroeconomic level. In this sense, it aims to address national and global issues of increasing environmental degradation and depleting natural resources [21]. Various concepts and programs are therefore emerging to implement the three key principles of the circular economy at the macroeconomic level [22]. It is therefore possible to speak of a contemporary circular economy policy that will aim to implement programmes to encourage, promote and enable the implementation of circular economy principles by state institutions, enterprises and households [23,24]. In this context, newly emerging macroeconomic indicators, whose primary aim is to identify and implement circular economy principles at the national level, are also important tools [25–28]. A key feature of such indicators should be the ability to capture the entire sequence of behavioral changes of all socio-economic actors affected by the transition to a circular economy. They are the public sector, producers, consumers, scientific and research institutions or non-governmental organizations [29]. The theory of change is increasingly being used, where long-term goals are considered, which are adjusted by the conditions necessary to achieve the desired outcomes [30,31].

Research carried out using the aforementioned macroeconomic indicators already reveals certain benefits from implementing circular economy principles. The most common references in this context are the rise in resource efficiency and social welfare [32]. There are also many examples of the implementation and good practice of circular economy principles at the micro-level and in very specific operational areas. Recommendations on product packaging design can be mentioned in this context [33]. The aspect of the rapid growth in financing and investment in the circular economy is also interesting [34]. Yet, one of the most important issues in the circular economy is still climate change. In this context, it turns out that implementing circular economy principles makes it possible to create an economy that will develop dynamically while taking care of the natural environment [35]. There are many more issues and areas where circular economy principles can be implemented. Nevertheless, because of editorial limitations, not all of them have been cited here. Ultimately, that is not the purpose of this paper.

However, in the research's context presented here, non-financial ESG reporting is important [36]. It is directly related to the concept of the circular economy. ESG reporting is a response to the global challenges of sustainable development, which largely depends on proper management of environmental, social and corporate governance factors [37]. Reporting methods and principles have been developing since 2009 and are manifested in the so-called "ESG Disclosure Guidance". These are documents published mainly by global stock exchanges [38]. As of now, these documents have been pub-

lished in 60 countries around the world (Data from “ESG Disclosure Guidance Database”, <https://sseinitiative.org/esg-guidance-database/> (accessed on 8 September 2021)). The first of such document was the “Social Responsibility Instructions to Listed Companies” published in 2006 by the Shenzhen Stock Exchange in China. The Budapest Stock Exchange in Hungary, the Latin America Stock Exchange in Panama, the Warsaw Stock Exchange in Poland and the NYSE in the US will join this group in 2021. The purpose of ESG reporting is for companies to disclose non-financial information on the achievement of sustainability goals in environmental, social and corporate governance activities [39]. The companies should disclose whether they substantially contribute to at least one of the six environmental objectives, that they do not significantly harm any other and whether and to what extent they comply with the minimum safeguards [40]. The EU taxonomy is, of course, mainly concerned with companies listed on stock exchanges [41,42]. The trend towards a circular economy also applies to other businesses and is increasingly reinforced by conscious consumer choices. This phenomenon is the main background for the research conducted.

The approach presented here is an attempt to develop a general mechanism for measuring business processes in line with the circular economy concept. In this context, the primary research question was posed: How can companies implement business process measurement and analysis in a circular economy concept? So, can a holistic and institutional approach to business process measurement be a concept to support executives in managing environmental, social, and governance factors? Clearly, these questions apply to companies not listed on stock exchanges. At the heart of the approach presented here is an assumption: The optimally effective achievement of business process objectives depends on the adaptation and use of a broad stream of institutional determinants that make up the holistic environment of socio-economic phenomena occurring in the company. Considering the circular economy context described above, the holistic stream of institutional determinants can also apply to environmental, social and corporate governance issues.

3. The Concept of Institutional Measures of Business Processes

Any action taken within the boundaries of a company is done under the influence of many determinants [43]. Whether we are dealing with fully automated technological processes or with human activity within the boundaries of business processes, these activities are influenced by internal and external factors. Some of these will be endogenous, while others will be exogenous. Some of them will be essential, while others will be sub-essential for the activity carried out within the company’s boundaries [44]. The typologies for the division of business process determinants can still be listed at length. However, for this study, a typology of their division was adopted from the perspective of business processes occurring within the boundaries of the company. It should be clearly emphasized that the concept presented in this section is very general. This is in line with the purpose of this paper, which is to attempt to develop a general concept of business process metrics. Thus, it can be expected that the presented concept of metrics will be subjected to scientific discussion in the context of its use in a closed loop economy.

3.1. The Principle of Institutional Determinants of Business Processes

The first group of determinants to be mentioned will be any Supply Factors Business Process (SFBP). These will be all those factors that represent supply versus demand from business processes. From a company’s perspective, these will be different factors of production. In this context, natural, capital and human resources are most often mentioned. This set of factors that feed business processes can be written in the following form:

$$P_S(T) = \sum_{m=1}^{\infty} p_{sm} \quad (1)$$

where $P_S(T)$ —the set of supply factors the process T ; p_{sm} factors of the business process T . This is to be understood in such a way that the supply factors a business process are a set of m factors p_S for the relevant process T .

The institutional perspective on the concept of measures adopted here suggests that there is a group of so-called Institutional Determinants of Business Processes (IDBP). From the point of view of business process efficiency, they form a group of business environment factors. They have a certain characteristic in common. Each of the determinants in this group is an expected factor. This means that their impact is captured in the definition and programming of business processes occurring within the boundaries of the company. Each of these factors, while their source may vary, remains focused on business processes. Using set theory, the IDBP group can be written as follows:

$$P_D(T) = P_P \cup P_O \cup P_E \quad (2)$$

where $P_D(T)$ are the Institutional Determinants of Business Processes (IDBP); P_P expected process determinants; P_O expected determinants of the organization; and P_E expected determinants of the environment.

The first subgroup of IDBPs is the expected determinants of business processes (P_P). These factors have their sources within the boundaries of the company. They are tied directly to the business processes that they affect. Thus, these are the determinants that form the immediate environment of the operating business processes. A subset of these factors is defined as follows:

$$P_P = \sum_{n=1}^{\infty} p_{Pn} \quad (3)$$

This should be understood in such a way that the determinants of business processes are a set of n factors p_P characteristic of a given immediate environment of the operating business processes.

The second subgroup of IDBPs are the expected determinants of organization (P_O). It includes those factors which have their sources within the company but are not part of the immediate environment of business processes. Thus, they will make up a broader organizational environment that may affect the implementation of these processes in different ways. It can be said that the organizational determinants defined in this way are the source of constraints and opportunities resulting from joint action within the boundaries of the company [45]. This subgroup of IDBPs can be written in the following form:

$$P_O = \sum_{n=1}^{\infty} p_{On} \quad (4)$$

This notation implies that the expected organizational determinants are a set of n factors p_O influencing business processes that have their sources within the boundaries of the company, although they are not the immediate environment of the business processes.

The last subgroup of IDBPs are the expected determinants of the environment (P_E). This subgroup includes all those determinants that have their sources outside the company. However, their impact on business processes is significant, if only from the perspective of their effectiveness. This group of determinants is referred to as the institutions that influence the way any organization operates. These factors are described as follows [46–50]:

$$P_E = \sum_{n=1}^{\infty} p_{En} \quad (5)$$

These determinants make up a relatively extensive set of n factors p_E , which have their sources outside the company. They are of considerable importance for the way business processes are carried out within the company.

Two groups of determinants are presented above. These are the set of process drivers and the Institutional Determinants of Business Processes. It should be stated that, together, they make up the feeding input state of the process $P_i(T)$. This can be written in the following form:

$$P_i = P_S(T) \cup P_D(T) \quad (6)$$

where P_i denotes the feeding input state of the process T . Each process executed within the boundaries of the firm operates under the influence of a broad Supply Factors of Business Process (SFBP) and the expected institutional determinants of that process (IDBP).

3.2. The Principle of Rational Change of State

Business processes operating within the boundaries of a company can be viewed as dynamic input–output systems. Implementing these processes involves operationalizing the supply forward factors that are in the input state P_i into the form of the output state P_j . This directly determines all business process outputs $P_R(T)$. It is also important to highlight the fact that the enterprise is seen here as a complex network of interpersonal relationships. This leads to the business process being defined as individual elements of multifunctional value-added chains. In this context, four key principles of Institutional Determinants of Business Processes are proposed. The first of these is the principle of rational state change.

In describing the individual rules, the Petri net method was used. This will allow a dynamic representation of the different stages of the business process chains within the company boundaries [51]. Thus, a rational state change principle can be presented. It is assumed that there are jointly such sets of expected institutional business process determinants $P_D(T)$ and supply factors $P_S(T)$ that form a cumulative supply state P_i . This means that it is only possible to achieve the results of the process $P_R(T)$ efficiently by using all the determinants and factors from the supply state set. It should be noted here that the business processes will be *AND – join* concurrent transitions. This means that the outcome of the process $Out(T, P_R)$ depends jointly on all the elements in the supply state of the process [52]. This principle can be written in the following form:

$$\exists \cup \{P_D, P_S\} : s(P_j) = s(P_i) - In(P_D, T) - In(P_S, T) + Out(T, P_R) \quad (7)$$

where P_j is the initial state of the process T ; $In(P_S, T)$ is the supply of P_S factors to the process T ; and $Out(T, P_R)$ is the effects of implementing the process T as its output P_R .

From this principle, a certain relationship follows. The results of the business processes will only be achievable efficiently if two conditions are met together. The first is the need to adequately feed the process with the expected Institutional Determinants of Business Processes and the supply factors of the process. The second condition is that there must be an effective relationship between its consequence ($Out(T, P_R)$) and the baseline of the business process. This condition refers to when the effects of the relevant process gain the status of the result. The principle of rational state change creates a kind of space in which to make control measurements of business processes.

3.3. The Principle of Incorrect Definition of Determinants

The determinant mis-specification rule applies to the division of IDBPs into expected and actual determinants. The claim that companies operate under the influence of constant changes in the environment, both near and far, no longer raises doubts today [53–55]. In this environment, managers are forced to constantly search for information to help optimize business processes. In this issue, the following question is relevant. The ability to recognize and effectively search for those determinants of the business environment is important, even if only indirectly, for the effectiveness of the business processes carried out within the company. In this context, the phenomenon of mis-defining the determinants of business processes appears. Assuming that the business environment is a set of a very large number of factors, which in different ways determine the processes occurring within the boundaries of the company, this situation can be written as follows:

$$\exists \cup \{\overline{P_D}\} : \overline{P_D} = P_D \cup \dot{P_D} \quad (8)$$

where $\overline{P_D}$ is the aim determinants, P_D are expected determinants, and $\dot{P_D}$ are unexpected business process determinants.

Equation (8) shows that there is a complex set of aim determinants of business processes in the broad business environment. However, it is characteristic that only a part of them was taken into consideration while defining business processes. The remaining factors are unexpected determinants of business processes (The nature of unexpected determinants of business processes should be understood from the managers' perspective. This means that this group of NDBPs was not included by them in the business process design process. The sources of this can range from information constraints [56,57] to the fixation of managers [58,59]). Nevertheless, this second group of determinants has a very important feature. It can be represented in the following formula:

$$\exists P'_D \in \dot{P}_D : P'_D \cap P_D = \emptyset \quad (9)$$

where P'_D stands for unexpected determinants affecting process T . The set of unexpected determinants of business processes includes (or may include) such determinants that affect the way processes that occur within the boundaries of the company are executed. Thus, the sum of all determinants that affect the way business processes are executed should be written as $P_D^T = P'_D \cup P_D$. The phenomenon of the error of defining determinants of business processes is revealed. It will be designated with the symbol ε . This error should be understood as an incomplete identification of institutional determinants that directly or indirectly affect the way business processes are executed. This can be written in the following form:

$$\begin{aligned} \forall \overline{P}_D \{P'_D \geq \emptyset \rightarrow \exists \varepsilon : \forall t : \varepsilon_{t+1} \rightarrow 0\} \\ \varepsilon = P_D^T - P_D \end{aligned} \quad (10)$$

The above equation is also the basis of the so-called principle of misidentification of business process determinants. It says that once an error is revealed at time t , managers take specific corrective actions (or should take such actions) that lead to the elimination of the state of incompleteness of expected business process determinants. This leads to a reduction in the error rate, which in the most positive scenario takes on the value of zero ($\varepsilon_{t+1} \rightarrow 0$).

In the determinant mis-specification rule, Equation (7) should be changed. It should appear as below:

$$\exists \cup \{P_D^T, P_S\} : s(P_j) = s(P_i) - \text{In}(P_D^T, T) - \text{In}(P_S, T) + \text{Out}(T, P_R) \quad (11)$$

This subtle change can have a very significant impact on business process efficiency. It results from the fact that the determinants of the P_D^T set may affect business processes in a positive or negative way. This already depends on the characteristics of the determinants themselves. However, consciously ignoring or unconsciously overlooking these factors can be important for the quality of the last outcome of the business processes that are performed within the boundaries of the company. In this context, it is important to emphasize the existence of so-called bounded rationality. It causes managerial decisions to be made based on incomplete information.

3.4. The Principle of Rational Determinants

In previous considerations, the principle of rational determinants must be derived here. Its foundation is the claim that each of the Institutional Determinants of Business Processes determines the supply state of the process T . This means that IDBPs influence the quantity and quality of process supply within the firm's boundaries. The relationship also ultimately determines their ultimate outcome. The rule can be written in the following form:

$$\forall (P_P \cup P_O \cup P_E) \in P_D : s(P_D) = \text{In}(P_D, T) \quad (12)$$

All subsets of the group of expected Institutional Determinants of Business Processes form a cumulative state that feeds business processes within the firm boundaries. So, it

will be undesirable to start the right process when any of the NDPBs are missed. This can cause an inefficient execution of the business process. Bounded rationality becomes apparent. This can be seen clearly in Equation (12). The symbol P_D was used here (it symbolizes the expected determinants of business processes) instead of P_D^T . The latter symbol defines all determinants of business processes that affect the way they are executed (see Formula (11)). This has been justified because the determinants are wrongly defined. In this context, however, it is important to emphasize the mechanism of bounded rationality. It is one cornerstone of managerial decision making under conditions of incomplete and/or uncertain information [60–62]. In our context, this information will clearly relate to the existence of determinants that can affect different ways the way business processes are executed within the boundaries of the company.

The different ways mentioned here in which neo-institutional determinants of business processes influence the way processes are executed within the firm's boundaries can be further detailed. This can be written as follows:

$$\forall (P_D^+ \cup P_D^0 \cup P_D^-) \in P_D : s(P_D^+ \cup P_D^-) = In(P_D, T) \quad (13)$$

where P_D^+ , P_D^0 , P_D^- are the expected determinants of positive, neutral and negative business processes, respectively. The set of expected institutional determinants will include factors whose impact on the functioning of business processes will be positive (P_D^+), neutral (P_D^0) or negative (P_D^-). A feature of this division of the IDBP may be highlighted here. The input state of business processes should include those determinants whose influence will remain indifferent to their (processes') effectiveness. However, keeping the determinants neutral in managers' minds at time t is important because their current nature may change at time $t + 1$.

In the principle's context of rational determinants, one should also not forget about the supply factors of the business process, which were previously included in the set P_S . They have one slightly different role in the process's implementation T . This can be described as follows:

$$\forall P_S : s(P_S) \geq In(P_S, T) \quad (14)$$

The state feeding the business processes should contain a set of SFBPs in an amount no less than that required to start the process. Failure to meet this condition will not result in an inefficient implementation of the process but will prevent it altogether. Thus, business process enablers are absolutely necessary for the successful launch and effective execution of business processes within the boundaries of the company. The determinants from the IDBP group affect their effectiveness.

3.5. The Principle of the Intensity of the Impact of Determinants

The principle of rational determinants suggests different ways of their influence on the implemented business processes within the boundaries of the company. The focus here is on another issue. It is the power of the IDBP to influence business processes. The starting point for defining the principle of determinant intensity is the understanding of the firm. They are defined here as entities that make up a network of various human relationships and connections. All activities within the boundaries of the company, and therefore, also business processes, are carried out in the so-called institutional sphere, which, on the one hand, limits and enables these activities [63]. However, these factors and determinants have varying degrees of impact on the acting individual within the boundaries of the company.

In this context, it has been proposed that Institutional Determinants of Business Processes will be divided into essential and sub-essential factors. The former will be fundamental determinants for the execution of business processes. Sub-essential factors will determine the realization of these processes in such a way that, while influencing their realization, they do not change their essence. Therefore, it can be said that the sub-essential determinants complement the institutional impact, which has its sources in the broadly understood business environment. It should also be emphasized that each of these

determinants comprehensively creates an institutional space that determines how business processes are carried out within the company.

On this basis, the principle of intensity of determinants' influence is derived. It shows that in thirst of institutional determinants of P_D business processes, subsets of essential and sub-essential determinants of these processes coexist. These affect the last outcome of business processes with varying intensity. This can be written as follows:

$$P_D^e \cup P_D^s = P_D \text{ oraz } P_D^e \cap P_D^s = \emptyset \quad (15)$$

The set of expected Institutional Determinants of Business Processes comprises two subsets. These are the essential determinants (P_D^e) and the sub-essential determinants (P_D^s). The relationship between the two is important. These two subsets of determinants have no common part and complement each other to form a cumulative IDBP state.

Equally important is another characteristic of the two subsets. This can be written as follows:

$$\forall p_D \in P_D : \exists P_D^e : s(P_D^e) = In(P_D^e, T) \quad (16)$$

$$\forall p_D \in P_D : \exists P_D^s : s(P_D^s) \geq In(P_D^s, T) \quad (17)$$

The above two equations reveal the difference between essential and sub-essential determinants. It deals with the determinants' requirement from the perspective of the effective execution of business processes within the company boundaries. Equation (16) applies to the essence determinants. It shows that a state of equality between the input factors defined in the process and the feeding input state is absolutely required to start a business process. This means that a business process cannot start if even one of the expected essential business process determinants of an essential nature is missing. A slightly different relation is written in Equation (17). It does, however, relate to the sub-essential determinants. Here, any of the determinants may miss when the business processes are started. However, this situation may cause suboptimal functioning of business processes and the inefficient production of their results.

In the above paragraphs, the intensity principle has only been described from the perspective of the IDBP. It is also important to briefly address the drivers that feed business processes. This can be written as follows:

$$\begin{aligned} \forall p_S \in P_S : \exists P_S^e : s(P_S^e) &= s(P_S) \\ P_S^s = \emptyset &\rightarrow P_S \equiv P_S^e \end{aligned} \quad (18)$$

The set of factors that feed the business process includes only those factors that are essential to the execution of the business process. The set, therefore, of sub-supply factors, the business process, is an empty set. This is because starting a business process, also suboptimal in terms of its efficiency, in the absence of the defined supply factors means the process is completely impossible. It is impossible to produce, e.g., complete glasses without the required resources, i.e., lenses and temples, or the process of educating students without academic teachers.

The concept described in this section is a general concept of business process metrics. The authors aimed to describe its most important and fundamental principles. It is to be expected that the general nature of this concept should be refined to the context of a circular economy. However, that was not the purpose of this article. This can be seen as its limitation. This means that we can expect the continuation of the authors' work on developing a detailed concept of business process metrics in the context of the circular economy.

4. Discussion

The research presented was an attempt to develop a mechanism for measuring business processes from the perspective of Supply Factors Business Process and Institutional Determinants of Business Processes. The issue is set in a rapidly developing closed-loop economy. This paper presents the author's method, which is based on an institutional—

very holistic—approach to factor analysis. This method relies on measurements of the supply factors of the process. They also include those factors and determinants that relate to environmental, social and corporate governance principles. The definition of a set of analyzed factors will allow identifying and measuring the implementation of circular economy principles in the enterprise.

The method described above is a general concept for measuring business processes. This means that it presents only general mechanisms and principles that should be considered in the design of detailed measurement processes. Five fundamental principles are presented. They are (1) the principle of Institutional Determinants of Business Processes, (2) the principle of rational change of state, (3) the principle of incorrect definition of determinants, (4) the principle of rational determinants and (5) the principle of the intensity of the impact of determinants. These principles can measure business processes in a general company environment. In this article, however, the issue is embedded in a circular economy. So, what was found new in this approach?

Within the individual principles and groups of determinants described, it is possible to identify those that will be interpreted as factors related to implementing circular economy principles. The first thing to mention is the drivers that feed the business processes. They can be interpreted in two ways. The first way will define SFBP as resources whose use should be minimized according to circular economy principles. The second way concerns the concept of reverse supply chains. Here, process supply factors will be defined as resources extracted from the recycling process as broadly understood. In this way, a set of three types of supply factors' business processes were obtained, which are denoted by the symbol p_s in the paper. The third type of SFBP will be factors that are neutral from a circular economy perspective.

The second area of implementation of circular economy principles should be Institutional Determinants of Business Processes. In fact, each of the three subsets described can contain determinants that will relate to environmental, social and corporate governance management. However, the set of expected determinants of the environment (P_E) will be the one that will first be fed by factors resulting from the growing popularity of the closed loop economy. It can therefore be concluded that the measurement and analysis of such determinants will be important in the implementation's context and adaptation of enterprises to the principles of the circular economy. Nowadays, we can see that there are more and more institutions, formal and informal, which force entrepreneurs to take actions to ensure the optimal functioning of their products and services on the market.

Another area where the possibility of embedding circular economy principles in a business process measurement mechanism has been identified is the principle of determinant mis-specification. Based on many scientific studies and economic practice, it can be concluded that today we are dealing with many factors anchored in the principles of a circular economy. Thus, they were also considered fitting into the catalogue of aim determinants marked earlier with the symbol $\overline{P_D}$. This can be interpreted in two ways. The first will boil down to the fact that all determinants related to environmental, social and corporate governance should be included in the set of expected determinants (P_D). However, this situation is not common in all companies. There are some areas where circular economy principles have not been implemented for various reasons. A second way of implementing circular economy principles into the concept of business process measures is revealed. It concerns the mis-definition of determinants. For the overall concept of business process measures, two causes of this error were identified. The first is because of managers' lack of knowledge of the existence of circular economy principles. Although it seems impossible, there is a certain group of entrepreneurs, especially in the small- and medium-sized business sector, where this is the case. A second reason for the error in defining determinants derived from circular economy principles may be the various difficulties in implementing them. It can be expected that there are many more of these causes. It is therefore suggested that this issue may be the subject of further research.

The fourth area of the implementation of circular economy principles into the general concept of business process measures concerns the principles of the rationality and intensity of determinants. In this context, the determinants that have their origin in the principles of the circular economy can be divided according to their influence on the way business processes are carried out. Some of it may be positive. This will mean that implementing these principles in the company will enable and/or facilitate business processes. Other determinants may be negative, which will be a source of limitations for the execution of business processes. However, an even more interesting division of the determinants of the circular economy will be the division according to the intensity of their impact. Analyzing the development of the circular economy concept, it can be said that in its early days, these principles were not widely recognized as relevant to businesses. However, as interest in this economic model has grown, the factors of the circular economy have taken on the character of sub-essential expected determinants. This means that implementing circular economy principles into production processes only complemented their holistic character. Nowadays, however, it can be seen that the principles of the circular economy are becoming increasingly important in a certain group of companies. It is not uncommon for them to be the focus of corporate strategy. This means that determinants that have their origins in the circular economy become expected essential determinants. In this context, one can see some dynamics of change taking place in companies. Therefore, it can be concluded that measuring business processes with the principle of impact intensity will reveal the level of implementation of circular economy principles in a company.

5. Conclusions

The presented areas of the implementation of circular economy principles into the general concept of business process measures reveal a completely unique nature of management than that which results from ESG reporting principles. The latter is designed primarily for large listed companies. However, the presented general concept can be applied practically in every enterprise. An analysis of business process measures can be helpful in developing economic system performance by identifying and eliminating negative internal and external affects. The only condition may be the need to define business processes executed within the company boundaries. Nevertheless, this results in specific tasks for managers. It is necessary here to identify all those determinants and factors that have their justification in the principles of a circular economy. Their analysis is also required to group these factors according to the described principles of the general concept of business process measures. This will make it possible to define business processes in such a way that they become optimal in view of the contemporary requirements of environmental and social management.

On this basis, certain conclusions were drawn. The presented general concept of business process measures can be used by enterprises in implementing circular economy principles. It has been shown that a holistic and institutional approach to business measurement can assist executives in managing environmental, social, and governance factors. Ultimately, it was also recognized that the effective achievement of business process objectives may depend on the adaptation and use of a wide stream of institutional determinants that make up the holistic environment of socio-economic phenomena occurring in the company, mainly in the dynamically developing closed-loop economy.

However, it should be clearly emphasized that the described general concept of business process measures has its limitations. This is because of the adopted purpose of the research. It was an attempt to develop a general mechanism for measuring business processes under the circular economy concept. This has meant that specific factors and determinants that are anchored in circular economy principles have not been identified and described, nor have specific processes been identified that should be included in the measurement and analysis. However, this is also because of the wide variation in operational activities of companies in different sectors of the economy. This is a clear limitation of the concept presented. However, this should not be seen as a disadvantage but

as a first step towards developing a detailed concept. In this context, it seems reasonable that the general concept of business process metrics should be subjected to scientific discussion. It can also become a starting point for developing a detailed concept of business process metrics, which will be a concrete tool for business management in circular economy conditions.

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