



## EVALUATION MODEL FOR PRODUCTION PROCESS ECONOMIC EFFICIENCY

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**ABSTRACT. Background:** Economic activity focused on manufacturing and supplying products for sale is one of the basic processes in the logistics supply chain. The specificity of production processes requires concentration on the factors, which are crucial for the continuity of the material flow in terms of both business practice and in relation to the relevant literature. The significant impact of production processes on the financial result of the company affects the costs, revenues, turnover of assets and working capital cycle, so this is the main reason to focus production management on ways to improve process efficiency for both internal and external supply chain, and also on the continuous supervision and evaluation of the results obtained. This article presents an original model for the analysis and evaluation of production process efficiency in economic terms.

**Material and methods:** The results of research carried out in Polish companies in 2011-2013 and the results of a literature review indicate the unsatisfactory use of efficiency analyses in managing production processes, related supply chains and the production environment. These formed the basis for the selection and compilation of factors to evaluate the production process' economic efficiency. Complementary research concerning the importance of each factor in business practice was carried out in the first half of 2015 in 138 manufacturing companies in Wielkopolska Voivodship.

**Results:** Based on the results and observations, the authors developed a model for evaluating the economic efficiency of the production process, which will make it possible to conduct multivariate simulations using parametric models of production processes and the environment at later stages of their research.

**Conclusions:** Despite numerous considerations in the literature, the issue of production process efficiency has not yet been comprehensively presented nor developed. The concept for evaluation of production process efficiency presented here applies to its economic aspects. The authors are aware of the need to combine the analytical scope with analysis and evaluation of operational efficiency, thus further research will aim to provide a comprehensive analysis and evaluation of production process efficiency and value engineering in its operational development.

**Key words:** production process efficiency, operational controlling, balanced scorecard.

### INTRODUCTION

It is difficult to clearly define the concept of efficiency. In the economic aspect, efficiency is the result of company's business activity, which is the ratio of the effect achieved to the spending incurred:

$$E = \frac{e}{s} \quad (1)$$

where:

E - efficiency; e - effects; s - spending

Therefore, efficiency is a measure of expected results to the actual production volume, usually shown as a percentage [APICS 2004]. The presented efficiency measurement formula (1) became the basis for considerations in literature and study of business practice in respect of comprehensive evaluation of the production process efficiency.

The resulting efficiency improvement can be achieved through a deliberate development

of value-oriented processes, thus establishing the proper (standard) allocation of resources. The method for evaluating the resource allocation efficiency presented in this paper is consistent with the concept of Kaldor-Hicks efficiency, according to which the solution leads to increased efficiency when the proper allocation of resources enables improvement of efficiency ratio described by formula (1). In a situation where any change of a specific allocation of resources causes a decrease of efficiency ratio - the current allocation is the most effective [Kaldor, 1939; Hicks, 1939]. According to P. Blaik, efficiency also contains the effect evaluation from the point of view of

the purpose of operation and the adoption of the following two basic aspects in analyses [Blaik 2010]:

- the market aspect, leading to development of the optimal value added structure for the customer,
- the process structure aspect examines operations and costs while taking into account rational economic relations.

The production process efficiency in the market and structural aspect is shown in Table 1.

Table 1. Production process efficiency  
 Tabela 1. Efektywność procesu produkcji

Market aspect	Structural aspect
Comparison of results requested and results achieved through the production process	Rationality of projects - a proper effects-spending ratio in the production process
Customer orientation (customer value)	Orientation on production costs and the costs of entire company
Criterion of purpose and usefulness of the production process effect	Criterion of the right selection of means in the production process
Highest efficiency - full compliance with customer preferences	Highest performance - optimal application and utilisation of production resources
Analysis of the market as a source of creation of conditions for the production process efficiency	Analysis of the production potential as a source of creation of conditions for efficient production projects
Benefits for the customer, taking into account long-term production process effects	Rational involvement of the production process components in order to create value

Source: Own work based on [Blaik 2010]

The economic aspect of the production process efficiency makes it necessary to take into account the analysis and evaluation of the production cost. Direct production costs are determined by material consumption, labour, energy consumption and the ratio of inventory being treated. Their importance for the production efficiency lies in the fact that they are a reference point for the design and evaluation of the entire system. The ratio between the direct and total production cost should be an economic criterion for evaluating the production process [Fertsch 2010]. However, the analysis of efficiency of production processes carried out in companies and supply chains requires a broad perspective to balance all the elements of the logistics process and customer service. A multivariate analysis of efficiency makes it possible to balance all production process resources in

order to improve their cooperation and achieve the synergy effect. It should be noted however that efforts to maximize the production process efficiency can entail a number of risks. The most important traps while maximising the production process efficiency are as follows:

- lack of coordination between operational objectives of individual departments with strategic objectives of the company or supply chain,
- conflict of strategic objectives developed by individual companies, which are elements of the supply chain,
- conflict of operational objectives of various departments within the company,
- risk of negative impact on the environment.

## ANALYSIS OF PRODUCTION PROCESS ECONOMIC EFFICIENCY

The production process efficiency analysis should be based not only on operational indicators directly related to the production process, but also on financial indicators. The objectives and measures of the production process efficiency analysis should be a result of the company's vision and strategy. The production process efficiency analysis should be considered complete when it relates not only to the measures concerning the past results, but also to the measures that allow anticipating the impact on the results in the future. The issue of the production process efficiency evaluation may be based on assumptions of Balanced Scorecard [Michalska, 2005] developed by R. Kaplan and D. Norton. The authors proposed a balanced performance evaluation according to the relation between the objectives and the value of their measures in the following perspectives: financial, customer, internal business

processes, and learning and growth [Kaplan and Norton, 1996]. Economic efficiency should therefore be understood as analysis and evaluation using financial and non-financial indicators that have a direct impact on the production process economics.

A set of measures was developed according to the production process efficiency analysis in these four perspectives [Corbett 1998; Śliwczyński 2011; Twaróg 2005] while taking into account the basic efficiency feature described by formula [1]. The first proposal of a set of indicators was included in the publication [Koliński 2013]. Table 2 shows the selected measures of economic evaluation of the production process efficiency in the financial perspective. Pre-selection of measures representative for each perspective (for which the importance analysis is presented in the article) was based on the sensitivity analysis for the main objective in each perspective with respect to multiple measures applied in companies.

Table 2. Measures of the production process economic efficiency in the financial perspective  
 Tabela 2. Mierniki efektywności ekonomicznej procesu produkcyjnego w perspektywie finansowej

No.	Measure name	Data relation	Data	UoM
1.	Share of defective production	$\frac{a}{b}$	a - value of defective products	%
			b - total value of products	
2.	Return on labour		a – net profit	%
			b - salary costs	
3.	Return on sales (ROS)		a – net profit	%
			b – net sales	
4.	Labour productivity rate		a – net sales	PLN/employee
			b - size of employment	
5.	Inventory turnover ratio		a - costs of material consumption	number of cycles
			b - average inventory value	
6.	Employee productivity rate	a – net sales	%	
		b - salary costs		

Source: Own work

The presented table includes only selected financial indicators; according to the Author, they are most frequently used to evaluate the production process efficiency also in the environmental aspect [Golińska 2013]. There may be much more indicators useful in business practice, but keep it should be borne

in mind that the greater the number of indicators applied in the analysis, the greater the risk of blurring its main objective. Table 3 shows the selected measures of economic evaluation of the production process efficiency in the customer perspective.

Table 3. Measures of the production process economic efficiency in the customer perspective  
 Tabela 3. Mierniki efektywności ekonomicznej procesu produkcyjnego z perspektywy klienta

No.	Measure name	Data relation	Data	UoM
1.	Order delivery effectiveness	$\frac{a}{b}$	a - number of orders delivered	%
			b - total number of orders	
2.	Quantity and value share in the market		a - size of the target customer group	%
			b - total market size	
3.	Average lead time		a - total lead time	h/order
			b - number of orders	
4.	Share of defective product deliveries to the customer		a - number of defective deliveries	%
			b - total number of deliveries	

Source: Own work

Some of the measures above are often reduced to one indicator - OTIF (On Time and In Full delivery). This indicator should be treated as customer service level seen from the perspective of the customer (e.g. retail chain) - "on-time, in-full" - the order is delivered on time and in full according to the customer requirements. In practice, sometimes OTIF is expanded to include "error-free" - taking into account picking errors (e.g. the quantity is right, but the delivered product variant is other

than ordered). OTIF has become a key factor for process improvement initiatives. The planning of orientation and organizational integration by optimizing the processes throughout the supply chain leads to higher service level associated with the reduction in inventory [Sehgal et al. 2006]. Table 4 shows the selected measures of economic evaluation of the production process efficiency in the internal process perspective.

Table 4. Measures of the production process economic efficiency in the internal business process perspective  
 Tabela 4. Mierniki efektywności ekonomicznej procesu produkcyjnego z perspektywy procesów wewnętrznych przedsiębiorstwa

No.	Measure name	Data relation	Data	UoM
1.	Production flow	$\frac{a}{b}$	a - production process uptime	%
			b - total production time	
2.	Use of production capacity		a - used production capacity	%
			b - total production capacity	
3.	Share of defects and waste in the production process		a - value of raw materials classified as defects in the production process and employee labour	%
			b - value of total raw materials released for production	
4.	Electricity use efficiency at production post		a - productive time using electricity	%
			b - total labour time at post	
5.	Lead time for production orders for assortment group		a - total lead time for production orders	h/order
			b - number of production orders	

Source: Own work

The aspect of production process economic efficiency is most evident in the compilation of indicators in the company's internal business process perspective. This should not be surprising, as the operational processes that enable manufacturing of products have the

greatest impact on the evaluation of the production process efficiency. Table 5 shows the selected indicators of economic evaluation of the production process efficiency in the learning and growth perspective.

Table 5. Indicators of the production process economic efficiency in the learning and growth perspective  
 Tabela 5. Wskaźniki efektywności ekonomicznej procesu produkcyjnego z perspektywy uczenia się i wzrostu

No.	Indicator name	Data relation	Data	UoM
1.	Share of replacement parts in the product	$\frac{a}{b}$	a - number of replaceable components	%
			b - total number of components in the product	
2.	Production process flexibility		a - number of special orders delivered	%
			b - total number of special orders	
3.	Effectiveness of design of new products		a - number of delivered designs of new products	%
			a - total number of designs of new products	
4.	Share of defective deliveries of raw materials		a - number of defective deliveries of raw materials	%
			b - total number of deliveries of raw materials	

Source: Own work

The indicators of production process efficiency evaluation in the learning and growth perspective are the most desirable form of evaluation, but are also the most difficult indicators to develop. The risks posed by learning and growth indicators may not only be contrary to the production process management objective, but also to the basic strategic objectives of the company or supply chain [Lichocik and Sadowski 2013]. While preparing the compilation of indicators of production process efficiency evaluation it should be taken into account that there are close links between the various perspectives according to the balancing of perspectives in the BSC. Analysis and development of measures for efficiency evaluation separately for each perspective can lead to effect opposite to the one expected - a set of indicators that are mutually exclusive or show divergence of objectives can be obtained.

## IMPORTANCE ANALYSIS OF INDICATORS - RESULTS OF BUSINESS PRACTICE RESEARCH

The set of indicators developed above was confronted by the Authors with the business practice expectations. The research involved the importance analysis of the developed indicators in individual perspectives. The research was conducted in the first two quarters of 2015. 138 production companies in the Wielkopolska Province participated in the

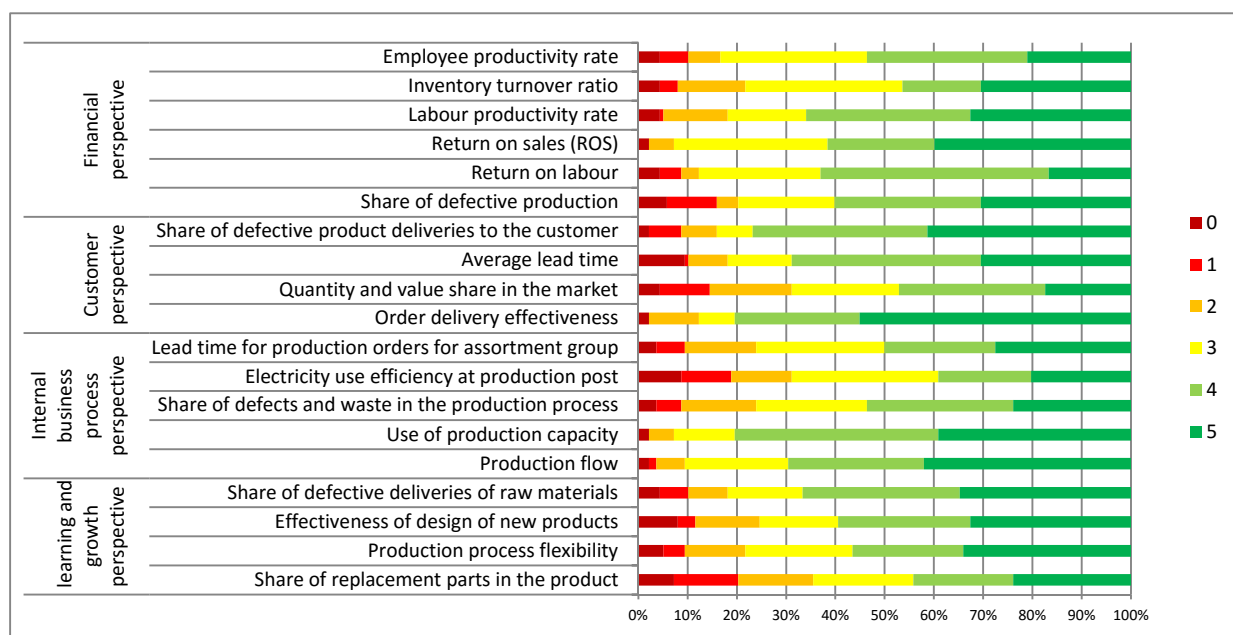
research. Basic information on the surveyed companies is presented in Table 6.

Table 6. Basic information on the surveyed companies  
 Tabela 6. Podstawowe informacje dotyczące badanych przedsiębiorstw

Survey sample characteristics	Responses (%)
1. Number of staff employed by the company:	
fewer than 10 employees	2.9%
10 to 49 employees	5.8%
50 to 250 employees	55.8%
more than 250 employees	35.5%
2. Type of company:	
production	60.87%
production and trade	2.17%
production and services	18.12%
production, trade and services	18.84%

Most of the analysed companies are large and medium-sized enterprises, which increases the reliability of statistical sample, as such companies use IT systems that support management support for data and indicator analysis.

The analysis of importance of various indicators of production process economic efficiency is shown in Figure 1.



Legend: The importance of evaluation indicators: 0 - no significance, 1 - very low significance, 2 - low significance, 3 - medium significance, 4 - high significance, 5 - very high significance

Source: Own research

Fig. 1. Importance analysis of the production process economic efficiency

Rys. 1. Analiza istotności ekonomicznej efektywności procesu produkcyjnego

Table 7. Detailed importance analysis of individual efficiency evaluation indicators  
 Tabela 7. Szczegółowa analiza istotności poszczególnych współczynników indywidualnej oceny efektywności

Perspective	Name of indicator	Indicator importance [number of responses]						Average value
		0	1	2	3	4	5	
Learning and growth perspective	Share of replacement parts in the product	10	18	21	28	28	33	3.051
	Production process flexibility	7	6	17	30	31	47	3.543
	Effectiveness of design of new products	11	5	18	22	37	45	3.478
	Share of defective deliveries of raw materials	6	8	11	21	44	48	3.688
Internal business process perspective	Production flow	3	2	8	29	38	58	3.964
	Use of production capacity	3	0	7	17	57	54	4.080
	Share of defects and waste in the production process	5	7	21	31	41	33	3.413
	Electricity use efficiency at production post	12	14	17	41	26	28	3.007
Customer perspective	Lead time for production orders for assortment group	5	8	20	36	31	38	3.406
	Order delivery effectiveness	3	0	14	10	35	76	4.188
	Quantity and value share in the market	6	14	23	30	41	24	3.145
	Average lead time	13	1	11	18	53	42	3.616
Financial perspective	Share of defective product deliveries to the customer	3	9	10	10	49	57	3.913
	Share of defective production	8	14	6	27	41	42	3.486
	Return on labour	6	6	5	34	64	23	3.543
	Return on sales (ROS)	3	0	7	43	30	55	3.899
	Labour productivity rate	6	1	18	22	46	45	3.710
	Inventory turnover ratio	6	5	19	44	22	42	3.428
Employee productivity rate	6	8	9	41	45	29	3.435	

Source: Own research

The Authors assumed that the concept of significance (importance) expresses the respondent's strength of belief/confidence as to the validity, effectiveness and the ability to use the indicator in various perspectives. The same mechanism was established for evaluation of each criterion - based on a five-level Likert scale [Likert 1932], plus a zero level. The indicator importance measurement scale was developed to determine the strength of impact according to an average of the results obtained. The position of many research teams presented in the literature indicates that the analyses based on the assumptions of Likert scale are quantitative [Elliott and Woodward 2007; Gamst, Meyers and Guarino 2008; Gatignon 2013]. The scores mean the following:

- 0 - no significance,
- 5 - very high significance.

When analysing the importance of each indicator, it should be noted that all the evaluated indicators were considered important. The decision threshold was an average of the results obtained above 3.0 (medium significance). Table 7 presents detailed results for individual indicators used for evaluating the production process economic efficiency.

## **CONCEPT OF EVALUATION MODEL FOR PRODUCTION PROCESS ECONOMIC EFFICIENCY**

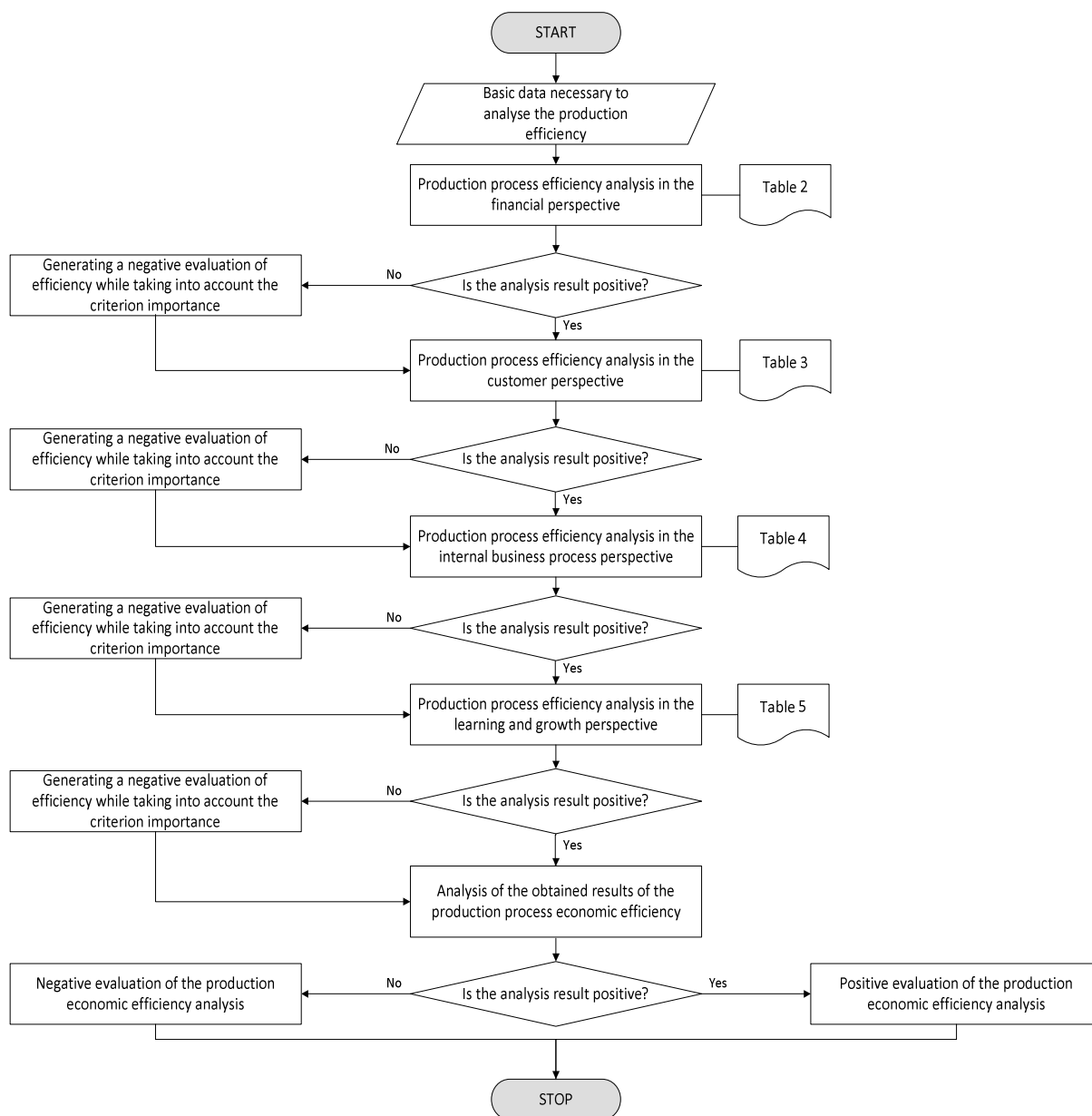
Based on the analysis of literature analysis and taking into account the importance of each indicator in economic practice, an evaluation model was developed for the production process economic efficiency. The figures below show the concept of evaluation model for the production process economic efficiency, detailed algorithms for efficiency analysis in individual perspectives of the Balanced Scorecard, and also present the logic of analysis of economic benefits of the results obtained.

Figure 2 shows an overall evaluation model for the production process economic efficiency.

The algorithm for evaluation of the production process economic efficiency shown in Figure 2 is based on the assumption that individual perspectives of the analysis are equivalents in terms of decision-making. Therefore, in the absence of a positive result of any of the perspectives, the analysed production process state is deemed economically inefficient. It should be noted, however, that the efficiency analysis in individual perspectives does not have to generate all the results within the normative values. It is possible to use the analysis of economic benefits to establish that despite the presence of deviations the process situation can be considered effective or economically acceptable. Figures 3-6 show the concept of the production process economic efficiency evaluation in individual perspectives.

The algorithm in the figure 3 shows the procedure for determining the indicators of production process economic efficiency evaluation in the financial perspective according to the set of indicators set out in Table 2. After obtaining the data needed for analysis and after determining all indicators a comparative analysis should be conducted for the results obtained and normative values. The analysis of economic benefits (shown in Figure 7) is used to evaluate the set of indicators in this perspective. A positive or negative evaluation of the perspective is used for further analysis of the overall evaluation of the production process economic efficiency.

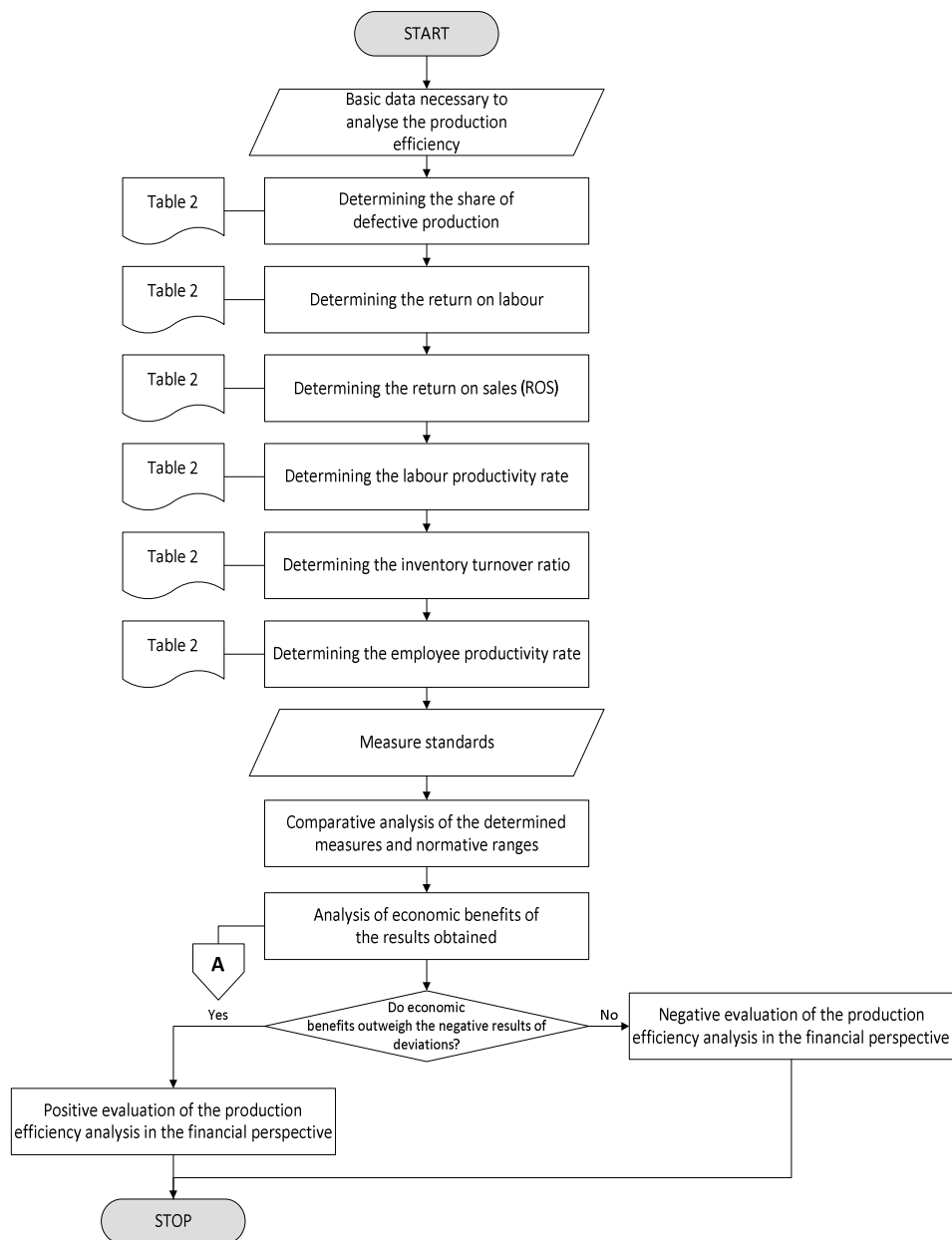
Figure 4 shows the evaluation model for the production process economic efficiency in the customer perspective. After determining the values of all the indicators in this perspective, an analysis of economic benefits should be conducted again.



Source: Own work based on [Koliński, Śliwczyński and Golińska 2014]

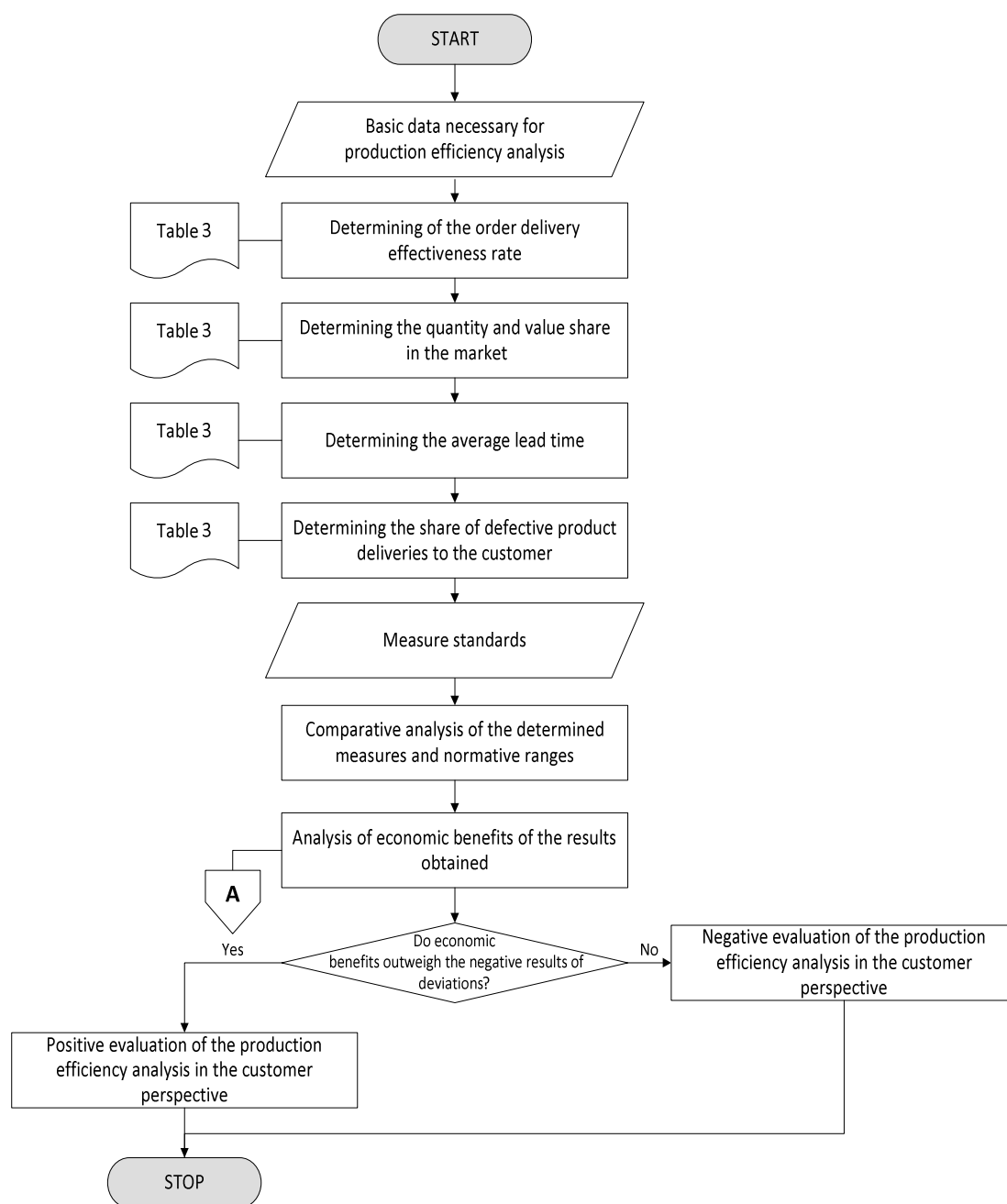
Fig. 2. Overall evaluation model for the production process economic efficiency  
 Rys. 2. Ogólny model oceny efektywności ekonomicznej procesu produkcyjnego





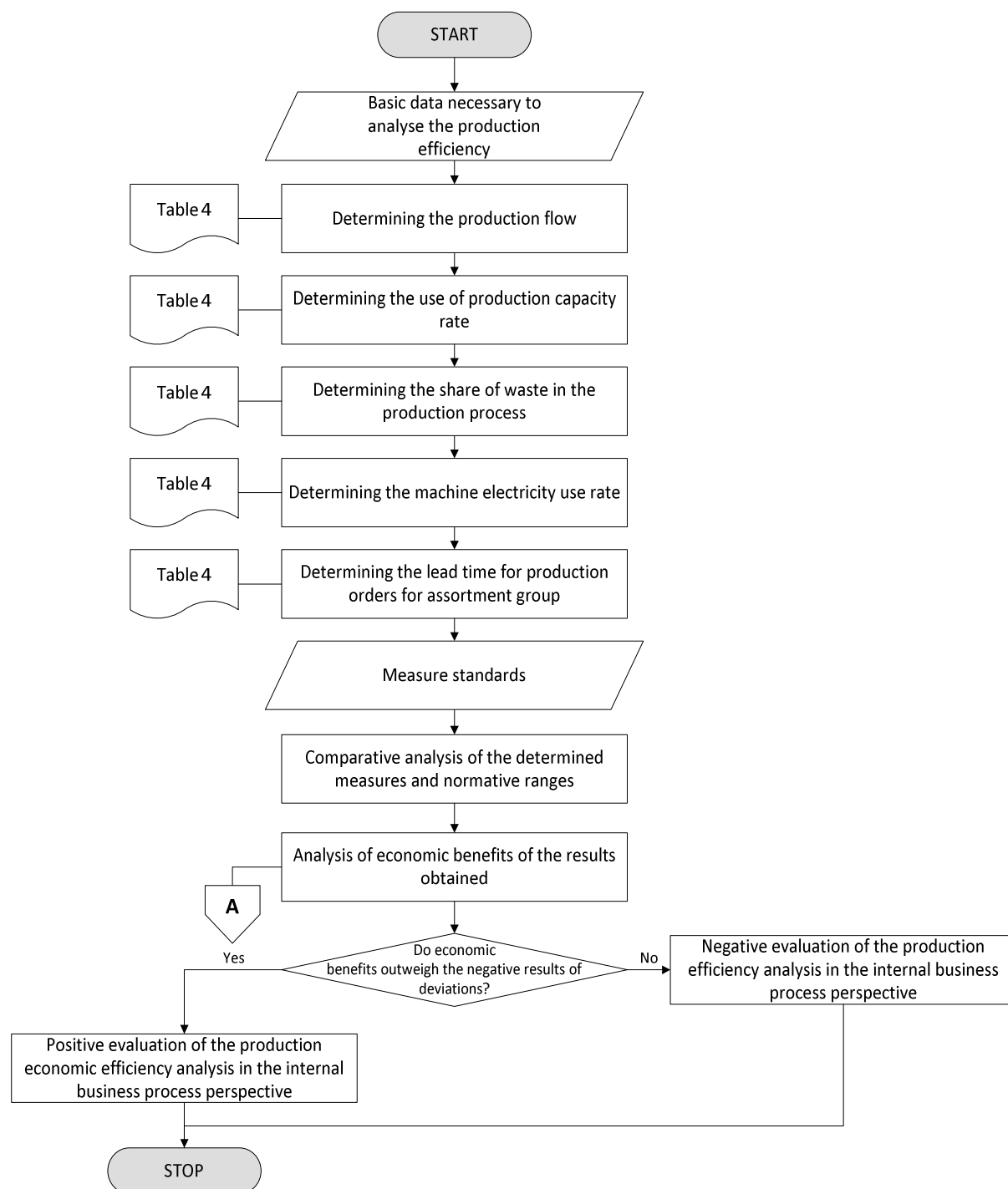
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Fig. 3. Evaluation model for the production process economic efficiency in the financial perspective  
Rys. 3. Model oceny efektywności ekonomicznej procesu produkcyjnego w perspektywie finansowej



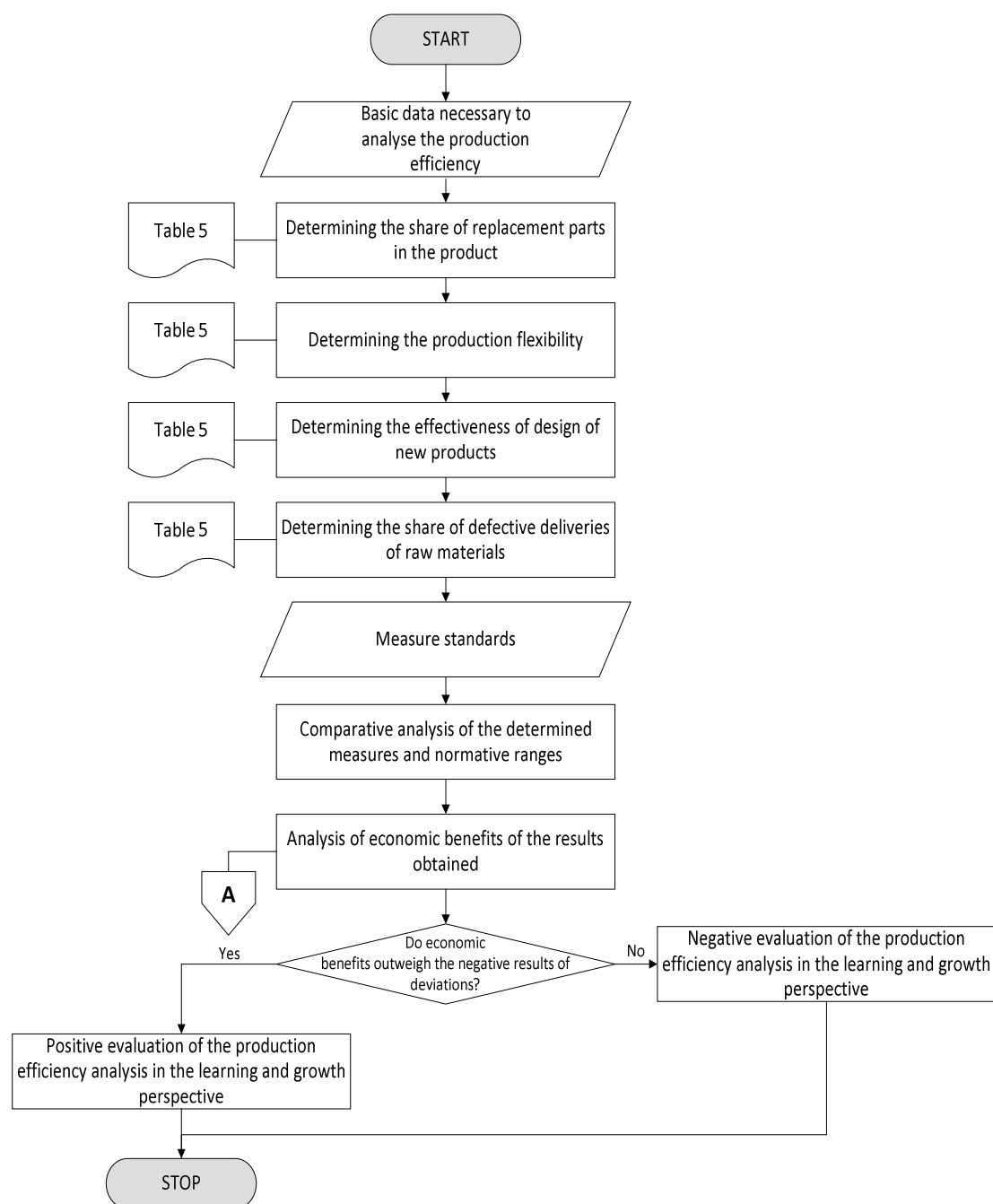
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Fig. 4. Evaluation model for the production process economic efficiency in the customer perspective  
 Rys. 4. Model oceny efektywności ekonomicznej procesu produkcyjnego z perspektywy klienta



Source: Own work

Fig. 5. Evaluation model for the production process economic efficiency in the internal business process perspective  
 Rys. 5. Model oceny efektywności ekonomicznej procesu produkcyjnego w perspektywie procesów wewnętrznych przedsiębiorstwa



Source: Own work

Fig. 6. Evaluation model for the production process economic efficiency in the learning and growth perspective  
 Rys. 6. Model oceny efektywności ekonomicznej procesu produkcyjnego w perspektywie nauki i możliwości rozwoju

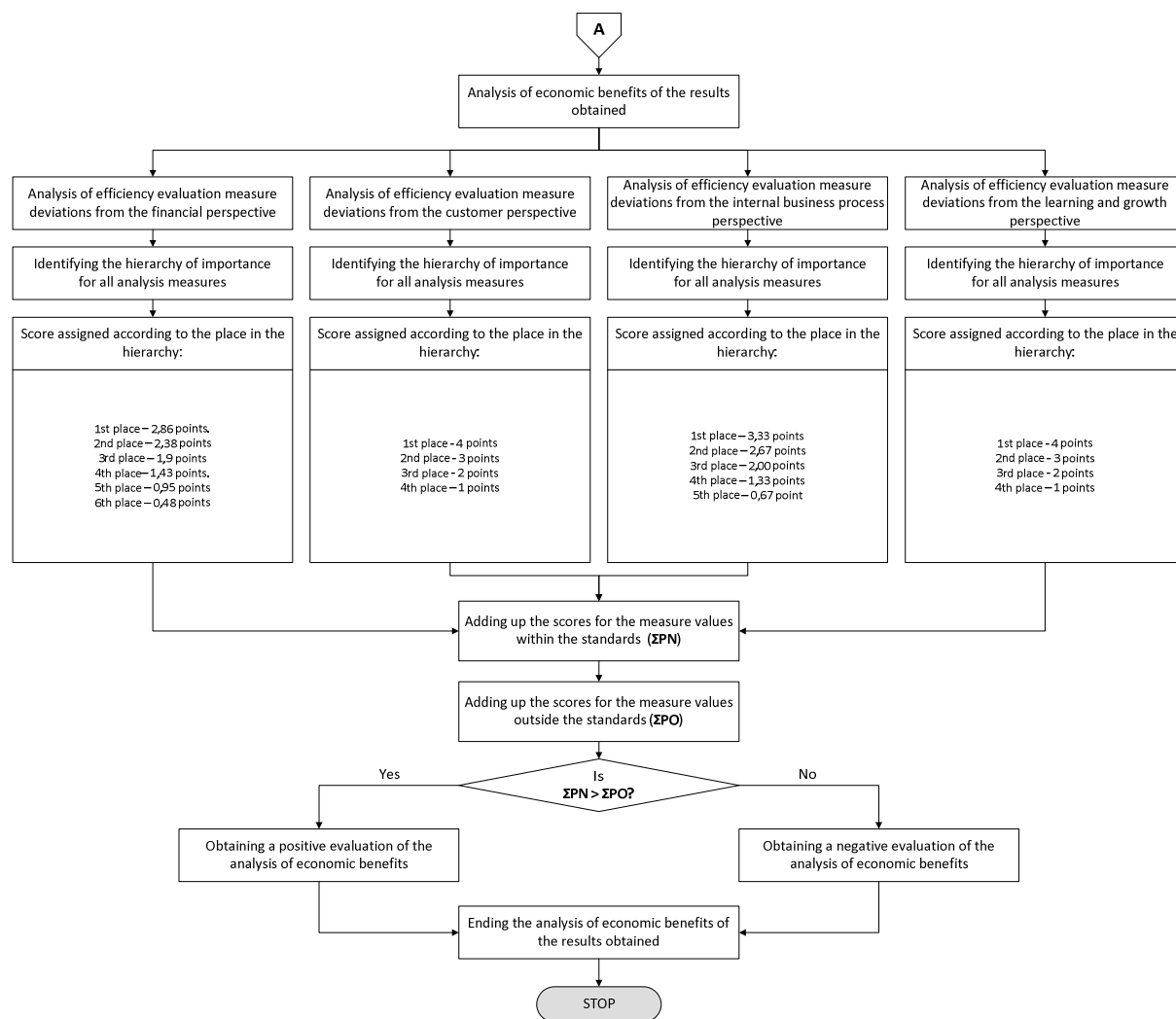
It should be noted that the algorithms of the production process economic efficiency in all perspectives are equivalent and independent of each other. A deliberate intent during the development of the evaluation model for the production process economic efficiency was to

develop similar algorithms in each of the analysed perspectives. The results of comparison of values calculated according to the input data with normative values are used in summarising the overall evaluation of the production process economic efficiency.

Another research problem for individual algorithms of the production process economic efficiency model is the generating of normative values for indicators in individual perspectives. Preliminary considerations for determining the normative values can be found in publication [Koliński 2014]. It should also be noted that a negative evaluation of one of the analysed perspectives makes the entire production process economically inefficient.

The diagram (Figure 7) of the analysis of economic benefits of the results obtained concerns scoring according to the following assumptions:

- maximum score - 10 points,
- after identifying the hierarchy of indicators, the amount of advantages or balance of the analysed measure compared to others was determined,
- scores were rounded up.



Source: Own work

Fig. 7. Analysis of economic benefits of the results obtained  
 Rys. 7. Analiza korzyści biznesowych otrzymanych wyników

The logic of score for each place in the hierarchy for the relevant elements of the production process economic efficiency evaluation in individual perspectives is identical. As an example, Table 8 shows the logic of scoring only for the internal business process perspective.

Production process efficiency analysis in the internal business process perspective:

- number of developed indicators - 5,
- description of indicators according to the hierarchy: (W1, W2, ..., W5).

The logic of analysis of economic benefits was developed based on the Author's own research results within the research project Simulation of managing the flow of company's material as an instrument of multivariant

analysis of transport processes efficiency No. N N509 549940 presented in publication [Doliński and Koliński 2011; Śliwczyński and Koliński 2012].

Table 8. Score assigned in the hierarchy of indicators - W5  
 Tabela 8. Punkty przypisane w hierarchii wskaźników – W5

	W1	W2	W3	W4	W5	Advantage	Weight	Score
W1	X	X	X	X	X	5	0.333	<b>3.33</b>
W2		X	X	X	X	4	0.267	<b>2.67</b>
W3			X	X	X	3	0.2	<b>2.00</b>
W4				X	X	2	0.133	<b>1.33</b>
W5					X	1	0.067	<b>0.67</b>
						15	1	<b>10</b>

Source: Own work

The algorithm of the analysis of economic benefits was developed due to the fact that it is unlikely to obtain all the analysis results in normative ranges. It is caused by the interaction between indicators, i.e. by taking intended actions to improve one indicator it is at the same time possible to negatively affect the value of other indicators. The analysis of respective variants should be based on the principles of process optimization and comprehensive evaluation according to the network thinking logic. The essence of the principle is the creation and subsequent value-based arrangement of the hierarchy of sets of solutions based on the objective function, which as a result leads to the selection of the best solutions. Therefore, the foregoing considerations also allow optimization variants defined as economically accepted for further analysis. The developed logic enables a universal defining of the hierarchy of indicators. The hierarchy of indicators presented in the article was developed in consultation with the management of a production company in the household appliances industry.

## CONCLUSIONS

Despite numerous considerations in literature, the issue of production process efficiency has not yet been comprehensively

presented and developed. Decisions made in companies operating in a dynamically changing environment are rarely verified for their impact on the efficiency of individual processes. This is due to the lack of or unclear efficiency evaluation procedures. According to the Authors, the issue of evaluation of the production process efficiency is an important element of effective business management, and requires a thorough analysis. The current academic works do not provide a clear solution for the scope and method of analysis and evaluation of the production process efficiency. The absence of precise theoretical indications makes it impossible to provide comprehensive development and application of the production process efficiency analyses in practice. In this article the Authors present an original concept of analysis and evaluation of the production process efficiency in the economic aspect. The developed concept should also include causal relations with the production process operational efficiency.

The direction of future research and continuation of this work should be an analysis of conditions and system connections as part of evaluation of the logistics process efficiency in companies and supply chains. The efficiency analysis should compare the key indicators in companies within specific industries. Observations on benchmarking of analysis and evaluation of logistics process efficiency prove

the need for managerial evaluation models and algorithms in business practice [Kolińska and Cudziło 2014]. Joint development of a set of indicators within the supply chain would enable a mutual comparison of the results obtained, which could have a direct impact on improving the efficiency of decisions - not only those affecting individual processes carried out within the company, but also throughout the supply chain.

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## MODEL OCENY EFEKTYWNOŚCI EKONOMICZNEJ PROCESU PRODUKCJI

**STRESZCZENIE. Wstęp:** Działalność gospodarcza skoncentrowana na wytwarzaniu i dostarczaniu produktów przeznaczonych na sprzedaż, jest jednym z podstawowych procesów zachodzących w logistycznym łańcuchu dostaw. Specyfika procesów produkcji powoduje konieczność koncentracji na czynnikach, które mają kluczowy wpływ na ciągłość przepływu materiałowego, zarówno w odniesieniu do praktyki gospodarczej, jak również w odniesieniu do literatury przedmiotu. Znaczący wpływ procesów produkcji na wynik finansowy przedsiębiorstwa, oddziałując na koszty, przychody, rotację aktywów oraz cykl kapitału obrotowego, jest główną przesłanką ukierunkowania zarządzania produkcją na sposoby poprawy efektywności procesów, zarówno wewnętrznego, jak i zewnętrznego łańcucha dostaw oraz ciągłego nadzorowania i oceniania uzyskanych rezultatów. Celem artykułu jest przedstawienie autorskiego modelu analizy i oceny efektywności procesu produkcji w aspekcie ekonomicznym.

**Metody:** Wyniki badań w polskich przedsiębiorstwach przeprowadzonych w latach 2011-2013 oraz badań literaturowych, świadczą o niezadowalającym stopniu wykorzystania analiz efektywności w zarządzaniu procesami produkcji, powiązanymi łańcuchami dostaw oraz środowiskiem produkcyjnym. Na ich podstawie dokonano wyboru i zestawienia wskaźników oceny efektywności ekonomicznej procesu produkcji. Badania uzupełniające dotyczące stopnia ważności poszczególnych wskaźników w praktyce gospodarczej przeprowadzono w pierwszej połowie 2015 roku w 138 przedsiębiorstwach produkcyjnych z województwa wielkopolskiego.

**Wyniki:** Na podstawie uzyskanych wyników i obserwacji, Autorzy opracowali model oceny efektywności ekonomicznej procesu produkcji, który umożliwi Autorom przeprowadzenie wielowariantowych symulacji parametrycznych modeli procesów i środowiska produkcji w dalszych etapach prowadzonych badań naukowych.

**Wnioski:** Problematyka efektywności procesu produkcji, pomimo wielokrotnego podejmowania rozważań literaturowych, nie została do tej pory kompleksowo przedstawiona i opracowana. Zaprezentowana koncepcja oceny efektywności procesu produkcji dotyczy aspektu ekonomicznego. Autorzy mają świadomość konieczności sprzężenia tego zakresu analitycznego z analizą i oceną efektywności operacyjnej, kierując dalsze badania na kompleksową analizę i ocenę efektywności procesu produkcji oraz inżynierię wartości w jego operacyjnym kształtowaniu.

**Słowa kluczowe:** efektywność procesu produkcji, controlling operacyjny, strategiczna karta wyników

## EIN MODELL FÜR DIE BEWERTUNG WIRTSCHAFTLICHER EFFIZIENZ EINES PRODUKTIONSPROZESSES

**ZUSAMMENFASSUNG. Einführung:** Einer der grundlegenden, innerhalb der logistischen Lieferkette vorkommenden Prozesse ist die wirtschaftliche Betätigung, die auf Erzeugung und Bereitstellung der für den Verkauf vorgesehenen Produkte konzentriert ist. Die Eigenart der Produktionsprozesse verursacht die Notwendigkeit einer Fokussierung auf die Faktoren der Produkt-Erzeugung sowohl hinsichtlich der Wirtschaftspraxis, als auch in Bezug auf die Gegenstandsliteratur, die einen schlüsselhaften Einfluss auf die Kontinuität des Materialflusses ausüben. Die ausschlaggebende Beeinflussung des Finanzergebnisses eines Unternehmens durch die Produktionsprozesse, die die Kosten, Einnahmen, den Kapitalumschlag und den Betriebskapital mit einprägen, macht die Hauptprämisse für das auf die Vervollkommnung der Prozesse ausgerichtete Produktionsmanagement, für die Verbesserung der inner- und außerbetrieblichen Lieferkette sowie für die Notwendigkeit der ständigen Überwachung und Bewertung der erzielten



Resultate aus. Das Ziel der vorliegenden Arbeit ist es, ein Autoren-Modell für die Analyse und Bewertung der Effizienz eines Produktionsprozesses unter dem wirtschaftlichen Aspekt darzustellen.

**Methoden:** Die Ergebnisse der in polnischen Unternehmen in den Jahren 2011-2013 durchgeführten Erforschung und der betreffenden Literaturforschungen zeugen von einem nicht zufriedenstellenden Niveau der Inanspruchnahme von Effektivitätsanalysen im Management von Produktionsprozessen, die mit Lieferketten und dem produktiven Bereich verbunden sind. Aufgrund dieser Ergebnisse wurden die Auswahl und die Zusammenstellung von Koeffizienten für die Bewertung der wirtschaftlichen Effizienz des Produktionsprozesses projiziert. Die ergänzenden, die Relevanz der einzelnen Koeffizienten in der Wirtschaftspraxis anbetreffenden Forschungen wurden in der ersten Jahreshälfte 2015 in 138 in Großpolen lokalisierten Produktionsunternehmen durchgeführt.

**Ergebnisse:** Aufgrund der erzielten Resultate und Wahrnehmungen haben die Autoren ein Modell für die Bewertung der wirtschaftlichen Effizienz des Produktionsprozesses ausgearbeitet, das den Autoren in ihren weiteren Forschungsarbeiten die Durchführung einer Mehrvarianten-Simulation von parametrischen Modellen für die Bewertung von Prozessen innerhalb des produktiven Bereiches ermöglichen wird.

**Fazit:** Die Problematik der Effizienz von Produktionsprozessen wurde, trotz der zahlreichen Inangriffnahmen von Fachliteratur-Erwägungen, bisher in ihrer Komplexität weder ausgearbeitet noch dargestellt. Das hiermit projizierte Konzept für die Bewertung der wirtschaftlichen Effizienz des Produktionsprozesses bezieht sich auf den wirtschaftlichen Aspekt. Die Autoren sind sich dessen völlig bewusst, dass es notwendig ist, den analytischen Bereich mit der betreffenden Analyse und der Bewertung von operativer Effizienz in einen Zusammenhang zu bringen, indem die weiteren Forschungen auf eine komplexe Analyse und die Bewertung der Effizienz des Produktionsprozesses sowie auf das Wert-Ingenieurwesen bei dessen Ausgestaltung ausgerichtet werden müssen.

**Codewörter:** Effizienz des Produktionsprozesses, operatives Controlling, strategische Ergebniskarte

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