

Beata Dratwińska-Kania

University of Economics in Katowice

e-mail: beatakania@ue.katowice.pl

ORCID: 0000-0002-2024-5879

THE IMPORTANCE OF THE PRODUCTION CONTROL METHOD FOR MATURE MODEL PARAMETERS OF PRODUCTION CONTROL EFFECTS BASED ON THE CONDUCTED SURVEY QUESTIONNAIRE

ZNACZENIE METODY KONTROLI PRODUKCJI DLA STANOWIENIA PARAMETRÓW MODELU DOJRZAŁOŚCI EFEKTÓW KONTROLI PRODUKCJI W ŚWIECIE PRZEPROWADZONYCH BADAŃ ANKIETOWYCH

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Summary: The paper presents a model approach to production control. A maturity model was developed for production control effects, which is a tool to improve the current state in the desired direction. A survey questionnaire was also carried out to determine which type of control should be chosen to reinforce the model parameters (achieve a higher level of maturity). The research revealed that the model parameters indicate differentiation due to the choice of the control method. The respondents chose different methods of production control for individual parameters of the model. Based on the conducted research, the goal of the paper is to develop a maturity model of production control effects and assess the production control types in terms of adjusting to the maturity model parameters of the production control effects. The study adopted the literature review and a survey questionnaire as research methods. The considerations focus on the possibility of improving the maturity model parameters of production control effects by selecting an appropriate type of production control.

Keywords: control, production control, maturity model.

Streszczenie: W artykule przedstawiono podejście modelowe do kontroli produkcji. Opracowano model dojrzałości dla efektów kontroli produkcji, który stanowi narzędzie doskonalenia stanu aktualnego w kierunku pożądanego. Przeprowadzono także badania ankietowe, które miały na celu stwierdzenie, jaki rodzaj kontroli należy wybrać, aby wzmocnić parametry modelu (zrealizować wyższy poziom dojrzałości). Badania wykazały, że parametry modelu są

zróżnicowane ze względu na wybór metody kontroli, dla poszczególnych parametrów modelu osoby ankietowane wybierały różne metody kontroli produkcji. Celem artykułu jest opracowanie modelu dojrzałości efektów kontroli produkcji oraz ocena rodzajów kontroli produkcji pod względem dopasowania do parametrów modelu dojrzałości efektów kontroli produkcji, dokonana na podstawie przeprowadzonych badań. W opracowaniu zastosowano takie metody badawcze, jak studia literaturowe i badania ankietowe. Za przedmiot rozważań uważa się możliwość doskonalenia parametrów modelu dojrzałości efektów kontroli produkcji przez dobór właściwego rodzaju kontroli produkcji.

Słowa kluczowe: kontrola, kontrola produkcji, model dojrzałości.

1. Introduction

The model approach is often adopted in accounting. According to E. Nowak, this facilitates the search for solutions in various decision-making situations, as well as it increases the level of importance and objectivity of decision-making and assessment [Nowak 2003, p. 18]. The paper presents such a model approach, namely a maturity model of production control effects, which is a prescriptive model, serving as a tool for improving the current state in the desired direction. Such an improvement of model parameters is achieved, among others, by choosing the right type of production control. The production control model is an original approach, the author has not encountered such solutions in the literature. The same article fills a gap in the discussion about maturity models [Kohlegger, Maier, Thalmann 2009; Trocki (ed.) 2011; Kania 2013; Głuszek, Kacała 2015; Röglinger, Pöppelbuß, Becker 2012; Dratwińska-Kania 2018]. The goal of the paper is to develop a maturity model of production control effects and assess production control types in terms of adjusting to the maturity model parameters of production control effects. The study adopted the literature review and a survey questionnaire as research methods.

2. Maturity model of production control effects

Control is one of the management functions. It aims at creating the possibility to assess an enterprise's position in comparison with its intentions, in particular at monitoring the proper functioning of the management process and achieving the enterprise's objectives [Paczuła 2010; Winiarska (ed.) 2010, p. 10; Dratwińska-Kania 2016]. Control in an enterprise fulfils an important task expressed in the functions it performs, including: preventive, informative-signalling, correcting, instructive, and stimulating [Winiarska (ed.) 2010, pp. 15-16]. Production control boils down to monitoring and comparing with the plan such production characteristics as: production quality, production volume, and production costs or work productivity per employee.

The maturity model of production control effects presented in Table 1 is modelled on the maturity models described in the literature [Trocki (ed.) 2011; Kania 2013; Głuszek, Kacafa 2015; Röglinger, Pöppelbuß, Becker 2012; Dratwińska-Kania 2018], yet it is their modification. The presented model is the author's own contribution, it is not an adaptation of one of the existing maturity models. This contribution consists in adapting the evolutionary path of growing maturity to the indicated effects of production control. The presented model was built on process maturity models, whereas the process in this case should be considered as production control and the effects assigned to it.

Table 1. Maturity model of production control effects

Parameters of the model of production control effects/production control effects	Unsatisfactory performance	Low level of satisfactory performance	High level of satisfactory performance
Production quality	Large number of complaints about products sold	Acceptable (average) number of complaints about products sold	Small number of complaints about products sold
	Large number of products that have not passed internal quality standards	Acceptable (average) number of products that have not passed internal quality standards	Small number of products that have not passed internal quality standards
Production volume	Large number of shortages, production volume below the demand standards	Acceptable (average) number of shortages and production volume	Small number of shortages, production volume as planned
Production costs	Level of production costs significantly exceeds the budget	Acceptable (average) level of production costs	Small level of production costs, production costs as planned
Work productivity per employee	Low work productivity of employees, frequent periods of inactivity	Acceptable (average) work productivity of employees	High work productivity of employees

Source: own elaboration.

The model is based on the four parameters of production control effects: production quality, production volume, production cost and work productivity per employee. In general the model consist of three maturity levels: unsatisfactory performance, low level of satisfactory performance and high level of satisfactory performance.

The presented maturity model of production control effects represents a specific, evolutionary path of the growing maturity of production control effects, enabling

the determination of the stages of the increasing ability of the model parameters to control production in a better way, thus contributing to the quality, volume and cost-efficiency of production. The maturity model of production control effects is based on specific levels that create a certain logical path from the initial state, i.e. unfavourable effects of production control, to the desired level of production control effects, which is related to the situation when the entity implements certain assumptions for the different levels [Dratwińska-Kania 2018].

The maturity model has been prepared to improve the effects of production control, moving towards more mature production control effects. This is useful in an enterprise, especially when it is implemented in the business management process. In such a case, higher level maturity in the model is usually reached faster. It has been decided in the study that in order to achieve the individual stages of the maturity of production effects, it is important to choose the method of production control. Therefore, further study will focus on the problem of choosing the right method of production control. In this regard survey questionnaires were carried out, which are described in the next section of the study.

3. Survey questionnaire results of the importance of the control type for maturity model parameters of production control effects

3.1. Study description

The influence of the control type on maturity model parameters of production control effects was examined. The study investigated the following types of controls: full, sectional, internal, external, announced and unannounced. The research sample was divided into subcategories:

1. Male/female
2. Employed/unemployed
3. According to the average grade from the last semester.¹

The research sample consists of 200 Master's students at the Department of Finance and Insurance at the University of Economics in Katowice, and included:

1. 157 female students (including 36 with an average grade over 4, 121 with an average in the interval of $\langle 3; 4 \rangle$) and 43 male students (including 4 with an average over 4, 1 with an average below 3, 38 with an average of $\langle 3; 4 \rangle$);
2. 198 employed and 2 unemployed;
3. 1 person with an average below 3, 158 people with an average of $\langle 3; 4 \rangle$, 40 people with an average above 4.

Thus most of the respondents are women with an average grade in the interval of $\langle 3; 4 \rangle$ and people declaring taking up a job. Therefore it can be concluded that the

¹ Polish grade system for the grades quoted in the study: 4 (good) = B; 3 (satisfactory) = C.

majority of the research sample are professionally active people and omit this factor in the study.

3.2. Importance of the control type for maturity model parameters of production control effects based on the survey questionnaire

In order to reinforce the production model parameter, the most frequent choices were: sectional (random) control, internal and unannounced. The sectional control was chosen by 161 respondents, the full control by 39. It follows that, according to the respondents, the improvement of the quality production model parameter does not require full control, and the stage control may be sufficient. 42 male and 119 female respondents hold this view, namely:

- 21 respondents with an average above 4 (3 males and 18 females),
- 139 respondents with an average between $\langle 3; 4 \rangle$ (38 males and 101 females),
- 1 person with an average below 3.

Thus, the full control was supported by: 1 male with an average above 4, 18 females with an average above 4, 20 females with an average of $\langle 3; 4 \rangle$, therefore a total of 38 females and 1 male.

The conducted research points to the fact that for reinforcing the production quality control, the internal control was chosen by 170 respondents, 30 respondents chose the external control. It follows that the internal control will be sufficient to reinforce the production quality parameter. 130 females and 40 males hold this view, namely:

- 12 people with an average above 4 (10 females and 2 males),
- 157 people with an average between $\langle 3; 4 \rangle$ (120 females and 37 males),
- 1 person with an average below 3.

Thus, 3 males were in favour of external control (2 with an average over 4 and 1 with an average between $\langle 3, 4 \rangle$) and 27 females (26 with an average above 4, 1 with an average of $\langle 3; 4 \rangle$).

To reinforce the production quality parameter, the majority of respondents chose the unannounced control: 152 females and 43 males, while 5 females with an average $\langle 3; 4 \rangle$ did not choose any answer. It follows that the unannounced control will be beneficial to ensure production quality.

To reinforce the production volume parameter, the most frequently selected were: sectional, internal, and unannounced control. Sectional control was chosen by 152 people, full control by 48 respondents, and unannounced control by 191 people.

Analysing the results in detail, it should be stated that in order to reinforce the production volume parameter, 43 males and 109 females considered sectional control to be sufficient, namely:

- 14 people with an average above 4 (4 males, 10 females),
- 137 people with an average $\langle 3; 4 \rangle$ (38 males, 99 females),
- 1 male with an average below 3.

Thus 48 females were in favour of full control, including 26 with an average above 4 and 22 with an average between $\langle 3; 4 \rangle$.

To reinforce the production volume parameter, internal control was chosen by 168 respondents, while 32 respondents chose the external control. It follows that internal control, according to the respondents, is sufficient to reinforce the production volume parameter, where 40 males and 128 females held this view, namely:

- 12 people with an average above 4 (2 males and 10 females),
- 155 people with an average between $\langle 3; 4 \rangle$ (37 males and 118 females),
- 1 male with an average below 3.

Thus 3 males were in favour of external control (2 with an average above 4 and 1 with an average between $\langle 3, 4 \rangle$) and 29 females (26 with an average above 4, 3 with an average between $\langle 3, 4 \rangle$).

To reinforce the production volume parameter of the maturity model, the respondents chose unannounced control. This was the case for 150 females and 41 males. Whereas 7 females with an average $\langle 3; 4 \rangle$ did not choose any answer, 2 males with an average $\langle 3; 4 \rangle$ chose announced control.

Full, internal and announced control were most often selected to reinforce the parameter of production costs.

Full control was chosen by 200 respondents (full research sample). This shows the importance of cost control for production control. Full control in this case will allow to examine whether the production costs are within the norms, all cost centres should be examined.

To reinforce the model parameter of production costs, internal control was chosen by 145 respondents, including 43 males (full sample) and 102 females (98 with an average between $\langle 3, 4 \rangle$ and 4 with an average of above 4). To reinforce the model parameter of production costs, 55 females chose external control as a better way, including 32 with an average above 4 and 23 with average grades in the interval of $\langle 3; 4 \rangle$. On the basis of the above, it can be noted that internal control in this respect is a better solution, the parameter of production costs is simple enough to assess that the internal nature of the control will meet the test.

To reinforce the parameter of production costs, 179 people chose announced control, including 40 males (1 with an average grade below 3, 35 with an average between $\langle 3, 4 \rangle$, 4 with an average above 4) and 139 females (120 with an average between $\langle 3; 4 \rangle$ and 19 with an average grade above 4). Thus unannounced control was chosen by 3 males with an average grade between $\langle 3, 4 \rangle$ and 18 females, including 1 with an average grade between $\langle 3, 4 \rangle$ and 17 with an average over 4.

To reinforce the model parameter of work productivity per employee, the majority of respondents chose the responses: stage, internal and unannounced.

To reinforce the model parameter, 198 people chose stage control, namely 155 females (36 with an average above 4, 119 people with an average of $\langle 3; 4 \rangle$) and 43 male, while 2 females did not provide any answer.

To reinforce the indicated model parameter, internal control was chosen by 200 people (full sample). Unannounced control was chosen by 156 people, including

136 females (36 with an average grade above 4, 100 with an average of <3; 4)) and 20 males (4 with an average grade above 4, 16 with an average grade between <3; 4)). Thus announced control was preferred by 21 females with an average between <3, 4) and 23 males, including 1 with an average grade below 3, and 22 with an average grade between <3; 4).

The summaries of the research results are included in Tables 2 to 4.

Table 2. Importance of the control type for reinforcing maturity model parameters of production control effects in the results of the survey questionnaire

Model parameters/control types	1	2	3	4	5	6
Production quality	39	161	170	30	0	195
Production volume	48	152	168	32	2	191
Production costs	200	0	145	55	179	21
Work productivity per employee	0	198	200	0	44	156

Key: 1. Full control. 2. Stage control. 3. Internal control. 4. External control. 5. Announced control. 6. Unannounced control.

Source: own elaboration.

Table 3. Importance of the control type and gender to reinforce maturity model parameters of production control effects in the results of the survey questionnaire

A/B	1		2		3		4		5		6	
	M	K	M	K	M	K	M	K	M	K	M	K
C	1	38	42	119	40	130	3	27	0	0	43	152
D	0	48	43	109	40	128	3	29	2	0	150	41
E	43	157	0	0	43	102	0	55	40	139	3	18
F	0	0	43	155	43	157	0	0	23	21	20	136

Key: 1. Full control. 2. Stage control. 3. Internal control. 4. External control. 5. Announced control. 6. Unannounced control. A. Model parameters. B. Control types. C. Production quality. D. Production volume. E. Production costs. F. Work productivity per employee. M. Men. K. Women.

Source: own elaboration.

The conducted research proved that the model parameters indicate differentiation due to the proper selection of the control method. Therefore it is not unimportant what kind of control will be chosen for reinforcing the parameters of the presented maturity model, and thus to strive for the production control towards greater maturity. The results of the survey quite clearly indicate the choice of the right method of control. To ensure production quality, over 80% of respondents chose stage and internal control, considering them as sufficient. Almost 100% of the respondents were also in favour of unannounced control. To ensure the production volume, over

Table 4. Importance of the control type and grade average to reinforce the maturity model parameters of production control effects in the results of the survey questionnaire

A/B	1			2			3			4			5			6		
	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z	X	Y	Z
C	19	20	0	21	139	1	12	157	1	28	2	0	0	0	0	40	154	1
D	26	22	0	14	137	1	12	155	1	28	4	0	0	2	0	40	150	1
E	40	159	1	0	0	0	8	136	1	32	23	0	23	155	1	17	4	0
F	0	0	0	40	157	1	40	159	1	0	0	0	0	43	1	40	116	0

Key: 1. Full control. 2. Stage control. 3. Internal control. 4. External control. 5. Announced control. 6. Unannounced control. A. Model parameters. B. Control types. C. Production quality. D. Production volume. E. Production costs. F. Work productivity per employee. X. Average grades over 4. Y. Average grades in the interval of (3;4) Z. Average grades below 3.

Source: own elaboration.

70% chose stage control, over 80% internal control, and almost 100% unannounced control. To ensure an adequate level of production costs, 100% of respondents chose full control, over 70% internal control, and almost 90% chose announced control. To ensure work productivity per employee, almost 100% chose stage control, 100% chose internal control, and almost 80% chose unannounced control.

Based on the research, it should be noted that the results of the survey questionnaire in the choice between announced and unannounced control are the most unambiguous. The respondents were almost unanimous. In addition, the clearest selection of the control method took place in the case of the parameter: work productivity per employee. However, for all the other parameters of the model, the choice of the control method is also quite unambiguous. It should also be noted that the respondents selected the internal control in all cases, which can be considered as a sign of carelessness about the course of the control process, compared to more independent external control. Perhaps this was the professional experience that the majority of respondents had.

4. Conclusions

The study presents the maturity model of the production control effects and the possibilities of their reinforcement by choosing an appropriate method of production control. In general, the results of the research on the importance of the production control method to ensure individual model parameters are formulated for potentially any enterprise. In practice, the implementation of the maturity model into a specific enterprise management system may encounter numerous problems. Moreover, a control model indicated as the appropriate type of control for a chosen model parameter may not bring the desired results. Therefore the problem was deepened by examining the significance of the type of control for reinforcing the maturity model parameters. The type of production control model indicated in the results of the study can be considered appropriate for implementation.

The study is in line with the discussion on the selection of the most suitable type of production control to ensure the model parameters such as: production quality, production volume, production costs and work productivity per employee.

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