Analytical Model of Technological Process Correctness and its usage in industrial company

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Analysis and modelling

ABSTRACT

Purpose: Presents a new approach for continuous improvement of process in production company with usage quality management.

Design/methodology/approach: Improvement of company is relating to all elements of organization: participation of workers, realization of processes and monitoring of all steps of processes. The possibility of usage of quality research and estimation methods are connected with this continuous improvement of organizations. Interdependence of the cycle PDCA and quality research and estimation methods in production and management processes has been taken into account.

Findings: At the present time the enterprises should integrate management system and their continuous improvement with quality management, knowledge management and intellectual capital. Such kind of strategy will enable to achieve success for these companies.

Research limitations/implications: Described quality methods and "Analytical Model of Technological Process Correctness" can be employed in companies, in which Quality Management System has been implemented.

Practical implications: "Analytical Model of Technological Process Correctness" can be used in all kinds of companies. Usage of this Model can improve functionality of production process on all its stages.

Originality/value: Analytical Model of Technological Process Correctness "has been presented. This model is a propose of new lifting strategy of effectivities and efficiencies activities of technological processes in production company.

Keywords: Quality steering; Production process; Quality improvement; PDCA cycle; Quality methods

1. Introduction

At present times industries function in progressive conditions transformations and changeability. The future of enterprises depends from possessed and got information. They become the more and more elastic, distracted and to be well- versed in on task. Their aim is to increase the value of enterprise, and the communication techniques and information transfer as well as modern management facilitate the achievements of competitive superiority.

So important question of present organization is the assurance of suitable reports on the road organization – customer. Therefore some enterprises begin more strongly steering also their working on customer to better understanding the problems, needs and often their demand. It requires the continuous observation of markets and trends of market[1].

The skill of creating of integrated system management the enterprise and their continuous improvement connecting with quality management, knowledge management and intellectual capital with skilful study of strategic working and marketing working organizations is the key and determinant to success [2].

Companies improvement became so conscious intentional and planned activity with participation of functional organization rungs, which embracing all realized processes. It is connect with

elements such a quality of company organization information system and also construction and technological aspects, and also quality of each stages of formation final product, how also a proper product and date of keeping realization of orders [2-3].

The present idea of quality management, assurance and control relies first of all on change of quality approach strategy. At present special pressure puts on "prevention strategy " which take place "detecting strategy " [4]. This approach has influence on optimisation of production process and also reducing of costs [5].

Foregoing aspects can be realized across suitable selection and utilization of quality researches and estimation methods, and also for example creating "Analytical Model of Technological Process Correctness".

2. Quality continuous improvement of produstiojn industries

In circumstances reaching of market transformation and growing more in tense of competition, Polish firms are subject many transformation. This transformation caused are continuous their adapting to come into being and of conditionings environments, how also with endeavour to widely understood success through delivery of products and of services about high qualities [5-6].

In companies more and more general consciousness, that quality of products is not only result of productive process, and what behind this goes of activities immediate performers, but with result of many connected processes with formation and with possession of product [7].

In practice hardly ever exists chance so that process was isolated.

In most it is related with row of other processes. In this manner shapes chain of cooperating processes, where parameters, exit - sizes one are simultaneously sizes parameters of entrance - next process of flaws, and this creates so general process of working productive firms, usage of quality researching and estimation methods on production process [5-7].

Improvement of company is provided activity, relating to all elements of organization with active participation of workers, embracing realization and monitoring all stepping out there of processes. At what, improvement of processes is continuous activity. Passed researches in select firms showed, that development come into being of leading problems to improvements of quality should be monitoring road of initiation their in life on every stage of creation of finished product [8].

So that came into being possibility continuous improvements of quality of processes, and what behind this goes qualities finish product, should come into being suitable and efficient model making possible analysis their realizations (fig. 1).

Important aspect becomes skill efficient connection of cycle PDCA (Plan- Do - Check – Act) with use of quality methods, techniques and tools (fig.2).

Suitable selection of tools and methods, orientation in which one point of process we are, realization of suitable measurements will make possible analysis and understanding of reasons of formation of errors in working processes, and what behind this goes in all firm, and this in turn will permit on identifications and use of activities correcting.
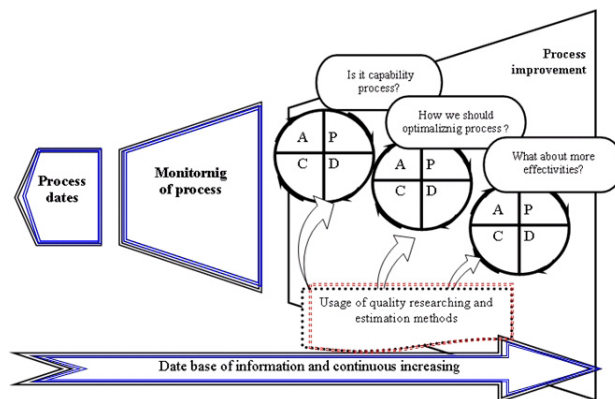

Fig. 1. Continuous improvement of process in production company

Rightness of decision, and in this use of suitable quality researching and estimation methods will influence on process continuous improvements of quality product.

Analysing above - one from essential aspects of realization these of proquality assignments is suitable selection talked over in quality researching and estimation methods on every stage of finished product creation. Passed research permitted on ascertainment, that methods these carry in essential contribution in improvement of quality and productiveness in cycle of product life [9].
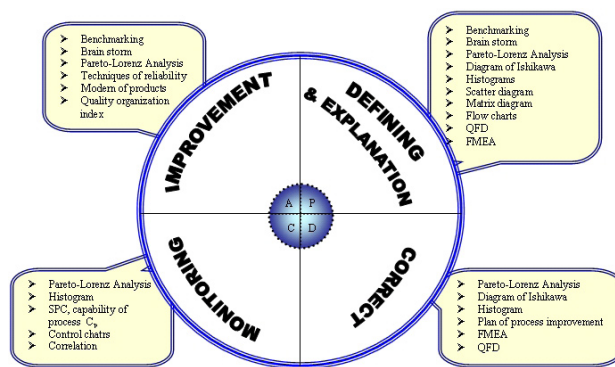

Fig. 2. Connection PDCA cycle with quality methods

3. Analytical Model of Technological Process Correstness as a new conception of monitoring and improvement process in industrial companies

It every material article was received in result of realization of productive process, being team related with one another and well ordered workings. The technological processes are basic and the most important his part, during which change the shape, figure, the dimension and physical chemistry properties of materials, transforming on elements, permitting on creation of final product.

Taking under attention the fact, that steering on technological processes has aim at the prevention of incompatibility formation

during realization of processes, it seems to be good idea creation of *"Analytical Model of Technological Process Correctness".*

Pattern this the taking into account the most essential quality factors of technological process, which becomes helpful in undertaking the decision to suitable preparation of production, the correct leadership of productive process how also him the solid continuous supervising in aim of improvement and making better the quality.
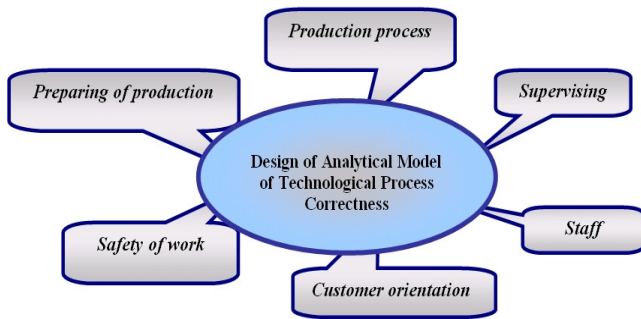

Fig. 3. Six the most important groups of criterions for Analytical Model of Technological Process Correctness

Worked out pattern consists from six the most important groups of criterions (fig. 3), which they in total take into account 26 quality factors.

Considered quality factors this:

1) the time of order realization
2) the selection of supplier
3) the selection of materials
4) the precision of realization
5) the ergonomics of work-stand
6) the numbers of complaint
7) the numbers of trainings
8) the quality of workers' qualification
9) the quality of tools
10) the quality of putting of productive equipment
11) the numbers of defects
12) the storing of products
13) the describe of machine capability
14) the describe of process capability
15) the optimum price of product
16) the level of noise
17) the understanding of work-stand instructions
18) the form of product loading
19) the level of process automation
20) the level of skill of control equipment utilization
21) the product producibility
22) the deliveries realization on time
23) the transport
24) the creating of control process charts of type X - R
25) the skill of working in team
26) the ability with order.

For estimation of technological processes punctual scale was accepted (fig.4).
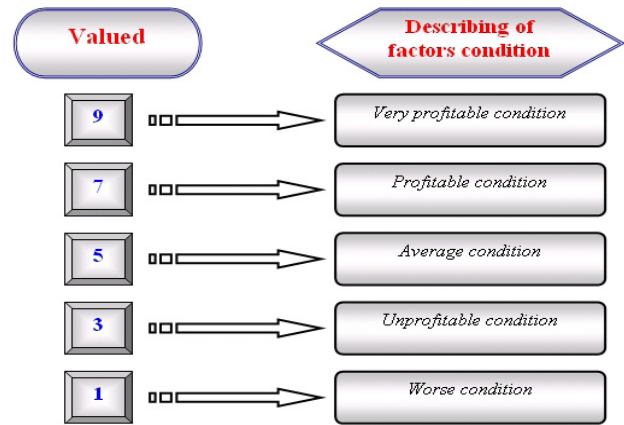

Fig. 4. Punctual scale for estimation quality factors

It in it was conduct the sheet of Analytical Model of Technological Process Correctness was created.

It was qualified also that the maximum opinion of technological process is equivalent 234 points.

It auxiliary boards for better analysis were created was, and this suitably (tabl.1-3):

The quality of analysed technological process:

$$Jpt=(S/234)*100\% \tag{1}$$

Table 1.
Sum of individual groups of criterions

	Received the criterions	Sum of points of individual criterions
A	Preparing of production	
B	Production process	
C	Supervising	
D	Staff	
E	Customer orientation	
F	Safety of work	
The sum of got points S = Σ (Aᵢ Fᵢ)		
Σ (Aᵢ...Fᵢ) max : 234		

Tabble 2.
Percentage share of individual groups of criterions

	Received the criterions	Percentage share of individual groups of criterions Up= (Σ Aᵢ/S)*100 %
A	Preparing of production	
B	Production process	
C	Supervising	
D	Staff	
E	Customer orientation	
F	Safety of work	

The next step it was proposed the calculation the index of quality technological process Jpt definite as (1):

Table 3.
The quality index of analysed technological process J_{pt}

The quality index of analysed technological process J_{pt} = (S / 234)* 100 %	J_{pt} =Σ (A_i...F_i) max : 234

The next step has been creating sheet of Analytical Model of Technological Process Correctness.

Analytical Model of Technological Process Correctness		
Received the criterions X = A (or adequate B,C, D,E,F)		Punctuation
A	Preparing of production	A_{max} : 36
A1	the selection of supplier	
A2	the selection of materials	
A3	the quality of tools	
A4	the quality of putting of productive equipment	
	The sum of got points Σ A_i :	
B	Production process	$B_{max.}$: 54
B1	the precision of realization	
B2	the storing of products	
B3	the form of product loading	
B4	the level of process automation	
B5	the level of process automation	
B6	the transport	
	The sum of got points Σ B_i :	
C	Supervising	$C_{max.}$: 36
C1	the numbers of defects	
C2	the describe of machine capability	
C3	the describe of process capability	
C4	the creating of control process charts of type X - R	
	The sum of got points Σ C_i :	
D	Stuff	$D_{max.}$: 36
D1	the numbers of trainings	
D2	the quality of workers' qualification	
D3	the level of skill of control equipment utilization	
D4	the skill of working in team	
	The sum of got points Σ D_i :	
E	Customer orientation	$E_{max.}$: 45
E1	the time of order realization	
E2	the numbers of complaint	
E3	the optimum price of product	
E4	the deliveries realization on time	
E5	the product producibility	
	The sum of got points Σ E_i :	
F	Safety of work	$F_{max.}$: 27
F1	the ergonomics of work-stand	
F2	the level of noise	
F3	the understanding of work-stand instructions	
	The sum of got points Σ F_i :	
	The sum of got points Σ (A_i ...F_i)	

Analytical Model of Technological Process Correctness

Received the criterions X = A (or adequate B,C, D,E,F)		Punctuation
A	Preparing of production	A_{max} : 36
A1	the selection of supplier	9
A2	the selection of materials	7
A3	the quality of tools	3
A4	the quality of putting of productive equipment	3
	The sum of got points ΣA_i :	22
B	Production process	$B_{max.}$: 54
B1	the precision of realization	5
B2	the storing of products	7
B3	the form of product loading	7
B4	the level of process automation	3
B5	the level of process automation	5
B6	the transport	7
	The sum of got points ΣB_i :	34
C	Supervising	$C_{max.}$: 36
C1	the numbers of defects	3
C2	the describe of machine capability	5
C3	the describe of process capability	5
C4	the creating of control process charts of type X - R	7
	The sum of got points ΣC_i :	20
D	Stuff	$D_{max.}$: 36
D1	the numbers of trainings	5
D2	the quality of workers' qualification	7
D3	the level of skill of control equipment utilization	5
D4	the skill of working in team	7
	The sum of got points ΣD_i :	24
E	Customer orientation	$E_{max.}$: 45
E1	the time of order realization	7
E2	the numbers of complaint	5
E3	the optimum price of product	7
E4	the deliveries realization on time	7
E5	the product producibility	7
	The sum of got points ΣE_i :	33
F	Safety of work	$F_{max.}$: 27
F1	the ergonomics of work-stand	7
F2	the level of noise	3
F3	the understanding of work-stand instructions	3
	The sum of got points ΣF_i :	13
	The sum of got points $\Sigma (A_i ...F_i)$	146

4. Practical usage of designing Analytical Model of Technological Process Correctness

It conducts in more far course were implementing the use Analytical Model of Technological Process Correctness for chosen technological process.

Using these methods in Polish industry introduced on example of own researches of select product of metallurgic industry.

This model has been presented on example the pipes pulling on cold 38x 3.2x 14070.

Table 4.
Sum of individual groups of criterions for researched process.

	Received the criterions	Sum of points of individual criterions
A	Preparing of production	22
B	Production process	34
C	Supervising	20
D	Staff	24
E	Customer orientation	33
F	Safety of work	13
The sum of got points S = Σ (A$_i$ ...F$_i$)		146
Σ (A$_i$...F$_i$) max : 234		

Table 5.
Percentage share of individual groups of criterions for researched process.

	Received the criterions	Percentage share of individual groups of criterions Up= (Σ A$_i$/S)*100 %
A	Preparing of production	15,07 %
B	Production process	23,29 %
C	Supervising	13,7 %
D	Staff	16,44 %
E	Customer orientation	22,6 %
F	Safety of work	8,9 %

Table 6.
The quality index of analysed technological process J$_{pt}$

The quality index of analysed technological process J$_{pt}$ = (S / 234)* 100 %	J$_{pt}$ = 62,4 %
Σ (A$_i$...F$_i$) max : 234	

The usefulness of applying in analysed examples was confirmed the proposed pattern.

Affirm, that it lets the wide opinion on technological process permits to estimate which stage of process should be more perfected, it influences on prevention the formation the incompatibilities, thanks what possible profitably is early the reacting in aim of minimalizing in final article the possible defects.
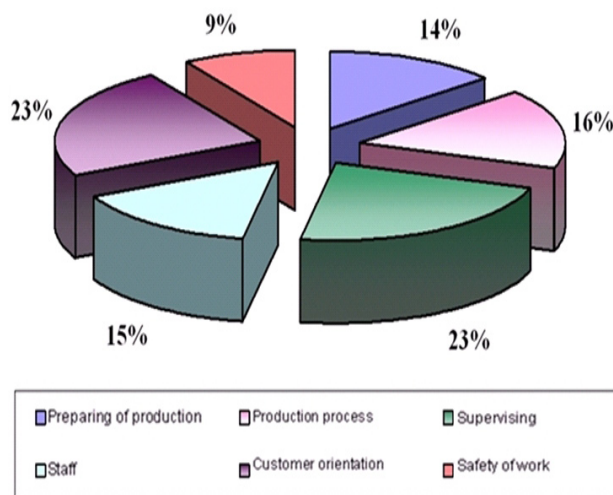

Fig. 5. Percentage share of individual groups of criterions Analytical Model of Technological Process Correctness for technological process: the pipes pulling on cold.

5. Summary

The today's directions the development and tendencies in industry, such how increase the complexity of processes and their automation, elastic flow of information, optimization of these processes and reducing the costs, as they exert the also computer aid of functioning the companies put a pressure to beginning active search of solving problems as well as new possibilities of opinion of its processes and articles, their monitoring and improvement.

The achievement of intentional aims and in this the success, possible it is in such enterprise which be able to take care about one's solid improvement near simultaneous fulfilling customer's and satisfaction requirements only. It achieves cells these across initiation the modern conceptions of management the quality, and in this using in its workings many methods of investigation and opinion of quality, in production and preproduction sphere and so on every stage creating the final product.

The gathered data and analysis were of service so to study of model of influence methods investigation and opinion quality on technological processes, defining the degree of utilization the analysed statistical and expert methods, organizing methods on quality of studied technological processes.

The running out in future effective and effective functioning the productive enterprises it the utilization by it the conception of modern management the quality, depending on prevention stood the formations the incompatibilities in track of realization of technological processes one of guideline to study *"Analytical Model of Technological Process Correctness"*.

It in course of conducted analyses' was affirmed that the worked analytical model will to be of service to keeping the suitable parameters of process, and what it for this goes the property of articles.

This Analytical Model taking into account the most essential quality factors of technological process, which will be possible to

utilization of during undertaking the decision to suitable preparation of production, the correct leadership of productive process how also him the solid continuous supervising in aim of improvement and making better the quality, what the state sure novelty in area of analysed questions.

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