MANAGEMENT TECHNIQUES AND TOOLS IN PROJECT PLANNING – PART 1. QUANTITATIVE RESULTS OF RESEARCH

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Summary: The paper is the first part of the elaboration on identifying processes in a planning phase of a project. The paper presents a short description of project management as a theoretical background the experiment conducted with 10 managers of small projects. There is also a description of the methodology of the research, the content of the experiment and features of research tools. Another part of the paper is a description of quantitative results of the experiment containing a description of managers' behaviour during the experiment and a comparison of their actions. The next part of this elaboration is the complementary paper called "Management Techniques and Tools in Project Planning – Part 2. Qualitative Results of the Research".

Keywords: project management, managerial technique, managerial tool, goal, task

1. Introduction

In recent years project management has been still a developing concept in the management science and business practice. Despite the fact that project management approach to activities in companies was launched more than 30 years ago and during that period many trends appeared and faded out, there is a core of activities which really matter. A well-established and recognized division the activities includes two types of them: quantitative and qualitative techniques of project management [1]. This approach was a foundation of the research project which results were presented in this paper and the complementary paper called "Management Techniques and Tools in Project Planning – Part 2. Qualitative Results of the Research".

Main goal of these two papers is to identify processes in a planning phase of a project. Because of a huge number of data gathered in the conducted experiment there was a necessity of divide results according to the division of techniques mentioned above. This paper presents quantitative results about the planning phase gathered by recording activities of experiment participants by the online management tools which they used in order to plan the project.

Specific objectives within the main goal of the paper are as follows:

- describing theoretical background of project management used in the experiment with the particular consideration of project planning,
- presenting definitions and features of managerial techniques with a focus on setting goals and describing tasks in a project (a foundation of recording activities of experiment participants),
- presenting a methodology of the research, the content of the experiment and features of research tools (online management tools to set goals and to describe tasks),
- describing quantitative results of the experiment containing a description of managers' behaviour during the experiment and a comparison of their actions.

The paper is a first part of elaboration about the results of the conducted experiment. The second paper entitled: „Management Techniques and Tools in Project Planning – Part 2. Qualitative Results of the Research" refers to selected soft managerial techniques useful in project planning and presents results and conclusions drawn from data gathered by observation of managers on their behaviour and a survey conducted among them after the experiment on their opinion about working with and without online management tools.

2. Elements of Project Planning

In order to present a theoretical foundations of the research and its results it is essential to define an organizational term which was the basis of the investigation. A project is a temporary team enterprise started to satisfy some business needs [2]. Authors emphasize that it differs from a typical organisational activity, because it has defined moments of its start and its end [3]. Additionally, the project should lead to achieving organisation's goals [3]. Projects are conducted on every level of the company. Some organisations particularly change their structures to achieve their goals within projects more effectively [4]. Big companies such as Microsoft, Siemens, NASA, IBM adapt project management to make innovations. Also government and non-government organisations have strictly delimited rhythm of work which is defined by two factors: budget and time [5].

Every project consists of six stages: defining customers' needs, setting project goals, planning tasks (taking into account organisational conditions), performance, controlling and evaluation of the project [6]. The idea for the project can come as well from the management board as from employees or middle managers. Who initiates a project is very important because it has a big influence on a project's budget and its continuation in further stages of project management [7].

Fig. 1 presents stages of a project in a chronological order. Directions of arrows mean work advancing in the project. In the conducted research not all the stages of the project were examined. The stage of defining customers' need were examined by an intended observation conducted by the researchers and a survey technique among experiment's participant. Whereas the stages "setting project goals" and "setting task" were observed by using ordinary online management tools which were simultaneously research tools.

From the practical point of view it is worth saying that the main direction of stages following should be read clockwise, in many situations there is a need of return to a previous stage to correct it. As it was presented in the Section 5, almost all managers who took part in the experiment, changed assumptions described in goals and tasks during the planning process.

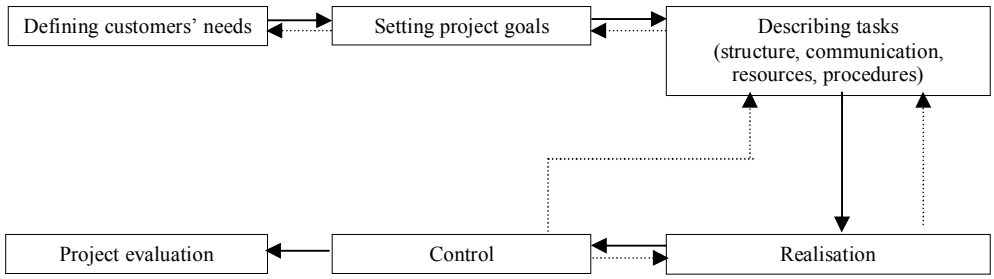

Fig. 1. Project stages [8]

The Tab. 1 consists of a division of different activities of project management. Some of these areas were investigated in the research and their results were presented in the Section 5 and in the complementary paper called „Management Techniques and Tools in Project Planning – Part 2. Qualitative Results of the Research".

Tab. 1. Verification of activities of project management examined in the research

activities of project management	Quantitative Results of the Research	Qualitative Results of the Research
goals and tasks integration, i.e. an overall view on the project considering all possible activities within it	yes	no
managing tasks that practically means an ability to delegate tasks and set patterns of their realisation	yes	no
time management among managers and their subordinates considered as one of the most important project manager's skill	yes	no
supply management, i.e. making decisions on purchase of new devices and searching for opportunities among suppliers' offers	no	no
human resources management, i.e. skills of building a project team and being a leader of that team	no	yes
interpersonal communication and decision making	no	yes
caring about a quality of the project performance	no	no
project costs management	no	no
risk assessment of project realisation	no	no

Source: [8] and own elaboration.

It is said that a key to effective project management is the ability to manage the triple constraint of quality, a schedule and a budget as well as to track and control the progress of the project [9, 10, 11]. Another thing thought as crucial factor in guiding a project manager toward successful completion is effective set of management tools [12, 13, 14, 15, 16]. The management tools are used within a management techniques and can help determine conducting a pre-set schedule and identify the need for additional resources. They can allow to analyse various alternative approaches and identify optimal completion of tasks. The tools can also assist in managing an ambitious schedule by identifying if a particular schedule is realistic and/or if additional resources are required [17]. As it was mentioned above, in the research two original online tools were used. Their features were presented in the Section 4.

3. Management Techniques and Management Tools

The activity that is a substance of work performed by leaders in an organisation as well as in a project is called management [18]. Management is being defined as "a specific kind of managing which uses a formal hierarchical supremacy of a managing object over an object that is managed by the former one" [19]. Management is also an activity of administrating resources [20].

In order to present some theoretical foundations of the research and its methodology from the management point of view it is necessary to claim that organisations operate according to managerial methods which are used by people, particularly by managers [21]. The literature presents a managerial method as a systematic work based on the scientific knowledge that is aimed to solve a problem in an existing or projected organisation [22]. A managerial method include managerial techniques that are highly detailed ways of acting which are additionally verified referring to its utility [23]. Organisational techniques have strictly defined procedures that have to be kept in solving a particular problem in an organisation [22]. The object of management by managerial techniques is a manager [18].

Manager who realises functions of management needs proper tools. Literature often presents such terms as managers' skills, roles, predispositions and functions [24]. The managerial tool sometimes is treated as a technique. Therefore this is perceived, on one hand, as a research tool, a physical or mathematic model, and on the other hand as a way of using the instrument [25].

However, from the lexical point of view it seems all the terms above do not include a material aspect of things necessary to manage the organisation. To fill this gap it is necessary to define a term of a management tool that will mean a simple or compound instrument enabling working by managers [26]. We assume that the instrument can be in a real form (a.e. a paper sheet, work cards, tables) or in virtual one (a.e. a software, data bases saved on the computer). Using a management tool the manager can use some technique, so we can call the management tool an aimed, rational and based on the theory a way of doing the managers' work [27]. Therefore a management tool is detached from a manager, his/her predispositions and skills of using techniques and methods of management. A management tool is an algorithmic and efficient way of accomplishing management functions, possible to use by any manager.

The description present adobe was a basis of the methodology of the research and a premise to use online management tools as research tools during the observation of managers' work. The management tools used in the research have such features:

- they split a process of management into small parts (according to the idea of an „unit of behaviour" [28]),
- a result of using management tools is an object that is an effect of a management process [29],
- is useful for management process documentation (as a resource according to the fact theory [30]).

Other characteristics of used management tools are as follows:

- a possibility of registering organisational resources as results of processes conducted within the organisation [31],
- a possibility of analysing information on processes and resources together, recorded in a management tool [28].

4. Methodology of the Research

In order to create a possibility of measuring phenomena in management in better way than it is being done nowadays the system of organizational terms was launched. A lack of such a theoretical solution in the past causes troubles during making comparisons data and verifying scientific statements [32]. In some extent it leads to limitation of abilities of theoretical discussions because there are no understandable standards and a shared ontology in the management science [25].

The ontology of the system of organizational terms is based on a formal logic and L. Wittgenstein's theory of facts. Among management phenomena we distinguish four types of facts: objective vs. subjective resources (things) and objective vs subjective processes (events) [18]. The system of organizational terms allows to detect actions of a manager and his/her subordinates during management process by using online management tools and through recording information as numeric data [33].

The system of organizational terms was a basis of two online management tools used in the research: a goaler (for setting goals) and a tasker (for describing tasks), which were used in the experiment. In the same time these tools were used in the experiment as research tools which recorded the participants' actions. The concept of the tools was described in the previous publications of the authors [20], but their short characteristic was presented below.

The tools consists of similar forms which are aimed on collecting data about planned actions. There is a strong division between both tools. The goaler is to put down goals of actions. A goal is meant as a solid state of a part of the world which is aimed to be achieved [34]. The tasker was projected to record real processes which are to be started to achieve goals. A process is described as a sequence of intended events which leads to the defined state of the world [35].

Goals in projects should always derive from defined customers' needs. The goal of a project says precisely what is going to be done for project's receivers [36]. This means that not every project has to reach a final stage when some changes will happen i.e. customers' needs change or other difficulties appear [37]. Project's goals should be measurable and set as much specific as it is possible. However, there is a need of reassuring that the goal is [38]:

- specific – clearly defined by no more than a few sentences,
- measurable – to assess in what extent a goal is achieved,
- achievable – to prevent a frustration among doers,
- related – connected with a mission of the company, department or employee,
- timed – time bounded.

According to these rules the form of the goaler consists of several features of the goal. A manager who used the goaler could describe a goal as presented in Tab. 2.

On the other hand the reason for unsuccessful projects is very often poor performance of this activity [39]. The planning phase of the project is very sensitive to that. Tasks description in the project consists of many, frequently unconnected activities. Up-to-date methods of planning projects were invented by econometrists and are based on mathematic calculations what and when should be carried out [40].

Tasks can be described by several features, such as time intervals i.e. days, weeks or months, doers of tasks, way of tasks performance etc. [41]. The form of the tasker consists of several features of the tasks described in Tab. 3.

Respondents who participated in the research were students of the third year of bachelor studies in the WSB University in Chorzow. Students were asked to prepare a plan of project that were realized by them in their bachelors theses. The WSB University has introduced a group form of bachelors theses which have been called projects since the academic year 2014/2015. Groups of students were led by managers (for the aim of papers each group is called "a project manager"). The researcher gave the following instruction: "Prepare a plan consisted of goals and tasks which will allow you to prepare your team project (bachelor theses)".

Tab. 2. Features of goals in the goaler

Features of a goal	A way of description
A vision of the future:	Form - 300 characters
A short name of the goal:	Form - 60 characters
The period of time or date:	Buttons and lists of options
Measurers x 10:	Form - 300 characters
Is the goal real to achieve?	List of options: {choose, yes, mostly yes, partly, mostly no, no}
Does the goal belong to your duties?	List of options: {choose, yes, mostly yes, partly, mostly no, no}
Create the goal based on green box details:	Form - 480 characters
The goal is in the field of:	List of options: {choose, finance, human resources, logistic, management, marketing, products and services}
The goal is:	List of options: {shortterm, longterm}
The goal belongs to:	List of options: {strategy, operation}
The goal is valid:	List of options: {always, occasionally}
The goal concerns:	List of options: {one person, a group of people}

Source: Own elaboration.

Tab. 3. Features of a task in the tasker

Features of a task	A way of description
A short name of the task:	Form - 60 characters
To which goal the task belongs:	List of options: dynamic list of names of goals
A verb what is to do:	Form - 120 characters
Names who is to do this (x9):	Form - 60 characters
How long does it take:	Lists of options
Add details how to do this:	Form - 120 letters
Add details where to do this:	Form - 120 letters
The task is in the field of:	List of options: {choose, finance, human resources, logistic, management, marketing, products and services}
The task is:	List of options: {choose, important, quite important, not important}
The task is:	List of options: {choose, urgent, quite urgent, not urgent}
The task appeared:	List of options: {suddenly, expected}
The task belongs to:	List of options: {strategy, operations}

Source: Own elaboration.

The experiment consisted of two stages. Therefore the project planning was done twice: firstly - on sheets of paper and, secondly - using online management tools (the goaler and the tasker described above). Both versions of the project planning were done during the 2-hour session. An important thing is that the second version of project planning was done without using notes made on the paper during the first stage of the experiment. At the end participants of the experiment filled a questionnaire (a survey techniques in qualitative issues) about differences in project planning with and without management tools. Finally, 10 managers (leading 10 groups) participated in the research.

As it was mentioned above, in the research two aspects of project management were measured: setting goals and describing tasks. Results of these actions – goals and tasks – had certain features presented in Tab. 2 and Tab. 3. The online management tools were connected to each other and their functions were depended on each other. The real examples of management tools used for the purposes of the experiment are available on http://transistorshead.com and may be viewed after having logged on with the username: john.smith, password: smith.

5. Quantitative Findings about Project Planning

Tab. 4 shows numerical values describing the work of managers. Characteristic of managers' work presented in Tab. 4 derived from numeric data gathered by the online management tools used by managers to plan the project. It let draw quantitative conclusions about the managers work and relations between created goals and tasks.

As it was mentioned above, the experiment was conducted in one session of 120 minutes. Despite the fact all managers spent different amount of time working with the tools. The longest login took 81 minutes, the shortest one only 37 minutes. The number of minutes influenced on the number of actions done by managers. Generally, the more minutes a manager spent with the tools, the more actions he created (i.e. created more goals and tasks, checked if they are correct, tested the functionality of tools etc.). The interesting finding is that all managers were given the same project to describe by tasks and goals. Despite this fact they chose completely different ways of doing it. These results must elicit a question if the management science is a real science [42].

There were also big differences in a number of goals and tasks created by each manager. The exact numbers are shown in the rows B and C of the Tab. 4. In this area there are also differences in managers' approach to planning. Some managers created a few goals and many tasks (such as the third manager - 7 tasks per 1 goal). The others chose another proportion of goals and tasks – 7 to 18 (the first manager) or 2 to 9 (the tenth manager). However, it does not seem to be some dominant rules of proportions between goals and tasks. It seems that every manager had a different style of project planning.

It is worth adding that numbers of objects (goals and tasks altogether) were also different. The second manager established 28 objects, the forth manager created 7 of them. Despite the fact that the duration of their teamwork was also different (81 and 47 minutes), the time of work does not seem to be the only explanation of different numbers of tasks per goals.

As we can see in the row G (Tab. 4), the fastest in planning was the first manager. The slowest planning process was the seventh manager. His speed was a quarter of the first manager's speed. What is more interesting, slow-planning managers (the seventh and the fourth ones) did not edited goals. Probably they preferred longer thinking sessions over setting goals rather than making next and next versions of the goal. They did not prototype

too much and they tried to create accurate objects at once. This conclusion can be compared with other results of prototyping thing in management [43].

Tab. 4. Quantitative findings about project planning

		Managers									
		1	2	3	4	5	6	7	8	9	10
No.	Measures										
A	duration of teamwork (minutes)	81	64	57	47	52	64	53	58	37	57
B	number of goals	7	10	2	1	2	2	4	1	1	2
C	number of tasks	18	18	14	6	12	7	15	13	8	9
D	number of created objects (goals and tasks)	25	28	16	7	14	9	19	14	9	11
E	number of actions	124	41	40	27	40	53	21	44	22	45
F	number of created objects (goals and tasks) per minute	0,30	0,43	0,28	0,14	0,26	0,14	0,35	0,24	0,24	0,19
G	number of actions per minute	1,53	0,64	0,70	0,57	0,76	0,82	0,39	0,75	0,59	0,78
H	number of goals editions	13	1	0	0	0	2	0	4	0	0
I	number of tasks editions	7	7	2	5	3	2	2	2	0	0
J	number of editions by object (goal)	1,85	0,10	0	0	0	1,00	0	4,00	0	0
K	number of editions by object (task)	0,38	0,38	0,14	0,83	0,25	0,28	0,13	0,15	0	0

Source: Own elaboration

A comparison of goals' and tasks' numbers of edition is really unexpected. Generally, goals were edited only by 4 managers and the tasks were edited by 8 managers. Only 2 managers were focused on setting goals and establishing tasks without correcting them in any way. It seems that managers who took part in the experiment took care for the goals more than tasks trying to think them over very deeply and set them without changes in the future. On the contrary, the tasks were edited many times by twice much of managers comparing to editing goals (compare the rows J and K). It seems that managers treated the

tasks as something which could be changed and the goals as something much more stable. This finding derived from the research lays on the aim-oriented perspective of modern project management and in some extend it derives from Management by Objectives [44].

As it was presented in Tab. 4 and in a description above, among a group of 10 managers there was no dominant, quantitative route of project planning. There are some similarities in numbers of goals and tasks, in speed of planning or an approach to a division issues into goals and tasks. Nevertheless, it seems that in this group there was not any dominant style of project planning which could be described by numbers.

5. Conclusions

Theoretical foundations presented above aimed to define terms of a management technique and a management tool in the project management approach. There was also a description of the methodology of the research and the online management tools which were in the same time research tools during the experiment.

The quantitative results of the experiment showed that managers used the same management techniques and tools differently. Numbers of created goals, tasks and their edition as well as periods of work show that there are many different approaches to planning. On one hand there is a strong necessity and a progress of management automation, including decision making [45] and planning [46] in organizations. On another hand the results of the experiment show that in 10 groups which were given the same simple project to plan there were different approaches to project planning and there was no clear mutual pattern of such activities. However, this gap in conclusions needs further research to be proved using the system of organizational terms and other online management tools.

References:

1. Stowarzyszenie Project Management Polska: Zarządzanie projektami. Podręcznik. Wydawnictwo pm2pm, Warszawa, 2009, pp. 19-20.
2. Dąbrowski W. (ed.): Podstawy zarządzania projektami. Wydawnictwo PJWSTK, Warszawa, 2014, p. 14.
3. Strzelecki T.: Zarządzanie projektami. Wydawnictwo WSM, Warszawa, 2009, p. 10.
4. Trocki M., Grucza B., Ogonek K.: Zarządzanie projektami. PWE, Warszawa, 2003, p. 47.
5. Flak O.: Zawód: menedżer projektu. Cz. 2., www.treco.pl/wiedza/artykuly-szczegoly/id/853/zawod-menedzer-projektu-cz-2
6. Pietras P., Szmit M.: Zarządzanie projektem. Wybrane metody i techniki. Wydawnictwo „Horyzont", Łódź, 2003, pp. 35-55.
7. Wirkus M., Roszkowski H., Dostatni E., Gierulski W.: Zarządzanie projektem. PWE, Warszawa, 2014, pp. 45-46.
8. Atkinson R.: Project Management: Cost, Time and Quality, two Best Guesses and a Phenomenon, its Time to Accept Other Success Criteria. [in:] International Journal of Project Management, Vol. 17, Issue 6, 1999, pp. 337–342.
9. Mantel S. J., Meredith J., Shafer S. M., Sutton M. M.: Project Management in Practice. New York, Wiley, 2001.
10. Rook P.: Controlling Software Projects. [in:] Software Engineering Journal, Vol. 1, No. 1, 1986, p. 716.

11. Zmud R. W.: Management of Large Software Development Efforts. [in:] MIS Quarterly, Vol. 4, No. 2, 1980, pp. 45-55.
12. Fox P.: Tapping the Right Tools. [w:] Computerworld, Vol. 36, No. 17, 2002, p. 43.
13. Globerson S., Zwikael O.: The Impact of the Project Manager on the Project Management Process. [in:] Project Management Journal, Vol. 33, No. 3, 2002, pp. 58-64.
14. Gelbard R., Pliskin N., Spiegler I.: Integrating System Analysis and Project Management Tools. [in:] International Journal of Project Management, Vol. 20, No. 6, 2002, pp. 461-468.
15. Smith J.: Is Project Management Software Right for You? [in:] Plant Engineering, Vol. 56, No. 6, 2002, pp. 36-38.
16. Swink M.: Product Development-Faster, On-Time. [in:] Research Technology Management, Vol. 45, No. 4, 2002, pp. 50-58.
17. Ware R.: Project Management Software: Project Panacea? [in:] Journal of Information Systems Management, Vol. 8, No. 1, 1991, pp.79-83.
18. Griffin R. W.: Podstawy zarządzania organizacjami. PWN, Warszawa, 2001, p. 26, 38.
19. Kurnal J. (ed.): Teoria organizacji i zarządzania. PWE, Warszawa, 1979, p. 15.
20. Pszczołowski T.: Mała encyklopedia prakseologii i teorii organizacji. Zakład Narodowy im. Ossolińskich, Wrocław, Warszawa, Kraków, Gdańsk 1978, p. 288.
21. Szarucki M.: Model of Method Selection for Managerial Problem Solving in an Organization. [in:] Business, Management and Education, 11 (1), 2013, pp. 168-187, p. 171.
22. Jerzak M. W.: Organizatoryka inżynierska. Wydawnictwo Politechniki Częstochowskiej. Częstochowa 1994, p. 91-92.
23. Flak O.: Rola metod ilościowych w budowaniu narzędzi menedżerskich. [in:] Rola informatyki w naukach ekonomicznych i społecznych. K. Grysa (ed.), Zeszyty naukowe 5a, Wyższa Szkoła Handlowa, Kielce, 2007, pp. 402-409, p. 404.
24. Antoszkiewicz J. D., Pawlak Z.: Techniki menedżerskie. Skuteczne zarządzanie firmą. Poltext, Warszawa, 2000, pp. 33-39.
25. Mikołajczyk Z.: Techniki organizatorskie w rozwiązywaniu problemów zarządzania. PWN, Warszawa, 1998, p. 39
26. Szymczak M. (ed.): Słownik języka polskiego. Tom II. L-P, PWN, Warszawa, 1979, p. 286.
27. Penc J.: Leksykon biznesu. Agencja Wydawnicza Placet. Warszawa, 1997, p. 447.
28. Curtis B, Kellner M, Over J.: Process Modeling. [in:] Communications of the ACM, 35 (9), 1992, pp. 75–90.
29. Flak O.: Concept of Managerial Tools Based on The System of Organizational Terms. [in:] Innovation in Management and Production Engineering. R. Knosala (ed.), Oficyna Wydawnicza Polskiego Towarzystwa Zarządzania Produkcją, Opole, 2013, pp. 187-197.
30. Flak O.: Theoretical Foundation for Managers' Behavior Analysis by Graph-Based Pattern Matching. [in:] International Journal of Contemporary Management, 12 (4), 2013, pp. 110-123.
31. Glykas M.M.: Effort Based Performance Measurement in Business Process Management. [in:] Knowledge and Process Management, Vol. 18, Number 1, 2011, pp. 10–33, p. 11.
32. Chopraa P. K., Kanji G. K.: On the Science of Management with Measurement. [in:] Total Quality Management, Vol. 22, No. 1, 2011, pp. 63–81, p. 63.

33. Lazenby S.: How to motivate Employees: What Research is telling us. [in:] Public Management, Vol. 90, No. 8, 2008, pp. 22-25.
34. Skalik J (ed.): Zarządzanie projektami. Wydawnictwo UE we Wrocławiu, Wrocław, 2009, p. 92.
35. Grajewski P.: Organizacja procesowa. PWE, Warszawa, 2007, p. 55.
36. Tosi H.L., Rizzo J.R., Carroll S.J.: Setting Goals in Management by Objectives. [in:] California Management Review, Vol. XII, No. 4, 1970.
37. Williams T.M., Samset K. (ed.): Project governance. Palgrave Macmillan, London 2012, p. 165-166.
38. Doran G. T.: There's a SMART Way to write Management's Goals and Objectives. [in:] Management review, Vol. 70, 1981, pp. 35-36.
39. Fox T. L., Spence J. W.: The Effect Of Decision Style on the Use Of A Project Management Tool: an Empirical Laboratory Study. [in:] The Data Base for Advances in Information Systems, Vol. 36, No. 2, 2005.
40. Wilson J. M.: Gantt Charts: A Centenary Appreciation. [in:] European Journal of Operational Research, Vol. 149, Issue 2, 2003, pp. 430–437.
41. Bieniok H. (ed.): Podstawy zarządzania przedsiębiorstwem. Cz. I. Wydawnictwo AE w Katowicach, Katowice, 1999.
42. S. Sudoł: Main Dilemas of Management Science. [in:] Organization and Management, No 1, 2010, pp. 7-22.
43. Bolland E., Fletcher F.: Problemy biznesowe. Rozwiązania. PWN, Warszawa, 2014, p. 304.
44. Schur M.: Upon further review. [in:] PM Network, 28 (3), 2014, pp. 38-43.
45. Nechansky H.: Cybernetics as the Science of Decision Making. Kybernetes, Vol. 40 Issue 1-2, 2011, pp. 63-79.
46. McAfee A.: Artificial Intelligence meets the C-suite. [in:] McKinsey Quarterly, September 2014, http://www.mckinsey.com/Insights/Strategy/Artificial_intelligence_meets_the_C-suite

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