Collective intelligence technology in business processes of the organization

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Abstract

The purpose of this work is to describe the possibility of using the process approach in the conditions of creative activity of employees. The problem relates to the fact that the time for solving creative problems is not defined, and therefore the description of processes, following each other, becomes meaningless. It is shown on several models that it is possible to achieve reduction of uncertainty in the solution of creative tasks if in their decision one involves groups of employees. Employees should differ not only in knowledge, but also in ability to analyse or create. It is the combination of people with different competencies that leads to the effect of synergy. It was shown that the division of tasks by competencies allows for reducing effectively the time of their solution. In addition, it is shown that the Association of specialists with creative and analytical skills can reduce the time to solve problems in due time, and the uncertainty of the completion time will be small. A similar effect is observed when at the final stage of solving a problem an employee with creative abilities helps to finish task. Thus, collective activity and competence-based approach should become additional dimensions in the description of processes, and collective intelligence technologies should become part of business process management systems. Likely, the use of collective intelligence technologies will be in demand soon in the development of knowledge management systems. However, there is still a long way to go in implementing collective intelligence technologies in practice. It might need more attention to social responsibility, to succeed.

Keywords: collective intelligence, business processes, synergy, knowledge management, competency, social responsibility.

Tehnologija kolektivne inteligence v poslovnih procesih organizacije

Povzetek

Namen tega dela je opisati možnost uporabe procesnega pristopa v pogojih ustvarjalne dejavnosti zaposlenih. Problem se nanaša na dejstvo, da čas za reševanje ustvarjalnih problemov ni opredeljen, zato opis procesov, ki sledijo drug drugemu, postane nesmiseln. Na več modelih je prikazano, da je mogoče doseči zmanjšanje negotovosti pri reševanju ustvarjalnih nalog, če v svoji odločitvi sodelujejo skupine zaposlenih. Zaposleni se morajo razlikovati ne le v znanju, ampak tudi v sposobnosti analiziranja ali ustvarjanja. Kombinacija ljudi z različnimi kompetencami vodi v sinergijo. Pokazalo se je, da delitev nalog po kompetencah omogoča učinkovito zmanjšanje časa njihove rešitve. Poleg tega je prikazano, da lahko Združenje strokovnjakov z ustvarjalnimi in analitičnimi sposobnostmi pravočasno skrajša čas za reševanje problemov, negotovost časa zaključka pa bo majhna. Podoben učinek opazimo tudi, ko na zaključni stopnji reševanja problema zaposleni s kreativnimi sposobnostmi pomaga dokončati nalogo. Kolektivni pristop, ki temelji na dejavnostih in kompetencah, bi tako moral postati dodatna dimenzija v opisu procesov, tehnologije kolektivne inteligence pa bi morale postati del sistemov za upravljanje poslovnih procesov. Verjetno bo uporaba tehnologij kolektivne inteligence kmalu zahtevana pri razvoju sistemov za upravljanje znanja. Vendar pa je še veliko dela pri izvajanju tehnologij kolektivne inteligence v praksi. Morda bo potrebovala za uspeh v praksi več pozornosti do družbene odgovornosti.

Ključne besede: kolektivna inteligenca, poslovni procesi, sinergija, upravljanje znanja, kompetenca, družbena odgovornost

1 Introduction

The concept of collective intelligence in the scientific literature began to be used since the end of the XIX century and is associated with the studies of French sociologists of the time, Emile Durkheim (Durkheim, 1997) et al. The term Collective Intelligence (collective intelligence) apparently was first introduced by David Wechsler, the Creator of the so-called Wechsler scales of assessment of intelligence (Wechsler, 1971). The Internet has turned the issues of collective intelligence into a real practice. F. Heylighen wrote that self-organization in the network should promote collective intelligence, so that its intellectual capabilities were greater than the sum of the minds of Internet users (Heylighen, 2007).

When talking about the concepts of collective intelligence many researchers mean only existing global network projects (see, for example, Aaron Weiss review article "The Power of collective intelligence", published in the journal "Collective intelligence" in 2005 (Weiss, 2005)). Based on the study of many network projects such as Linux, Wikipedia, InnoCentive, Threadless, etc., in 2009, Thomas Malone and colleagues tried to identify the "genome of the collective mind" (Malone, Laubacher, & Dellarocas, 2009), (Woolley, Aggarwa, & Malone, 2015).

However, Jerome Glenn, Director of the Millennium Project, who said in 2009 that collective intelligence would be the next era for information technology, believes that network projects are not examples of systems with collective intelligence (Glenn, 2015). Similarly, the German scientist J. Lamaster, commenting on the work of Malone and colleagues, also writes about the need to learn practical tools and application of development technologies of collective intelligence using the approaches of engineering, business and information systems (Leimeister, 2010). And such works already appear (see, for example (Gregg, 2010)).

Today there is a clear trend when the share of creative work is growing in the activities of ordinary organizations. This situation is associated with the automation of routine activities and the constant introduction of innovations in the work of the organization. The growth of the share of creative work in the organization requires the introduction of appropriate technologies. Collective intelligence technologies are designed to improve the efficiency of group creative work (Slavin, 2018). However, today there are almost no recommendations on how to use the technology of collective intelligence in usual business processes. Creative work is usually not regulated, and process management – on the contrary, is based on strict regulations.

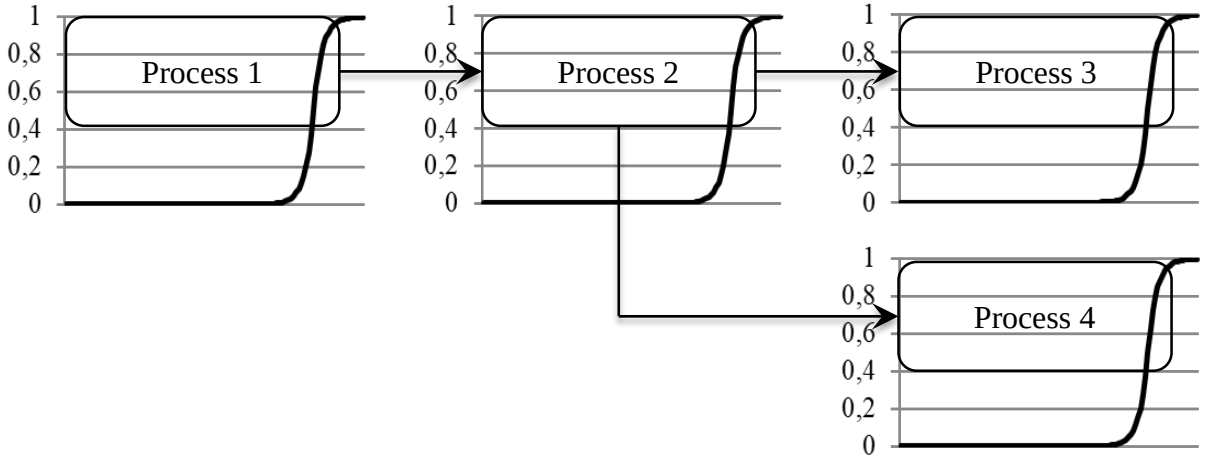
This paper describes an approach that will implement the collective intelligence technology in the standard business process management of the organization. It is the ability to significantly improve the efficiency of creative activities (including innovation) within the framework of standard processes of the organization that can give today a competitive advantage. It can be said that collective intelligence technology forms the human-oriented management of organization.

2 Problem definition

The process approach in the organization is possible, if each process is implemented by its executor in approximately the same period. Since the completion of any operation is probabilistic in nature, we can say that the requirement of process management is that the spreading of the completion time of each process should be significantly less than the time of the process itself. Usually, the time regulated for the process execution is chosen equal to the

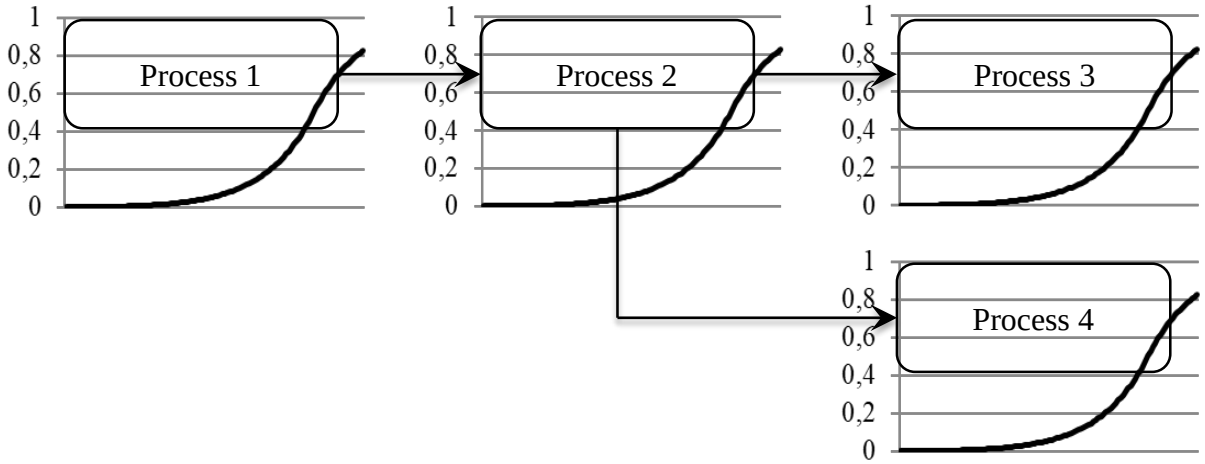
average time required for its execution, with the addition of the probability spread time. Thus, the probability that a separate process will be completed on time is quite high. Picture 1 shows an example of processes and the probability of their execution.

Picture 1: Probabilities of realization of usual tasks in process management



However, in the case of creative activity, the probability of performing the task has a significant spread. A creative problem can be solved much earlier than the average time of its solution, but it can be solved much later. This is so, since creative tasks are unique. If you try to build a process management of creative tasks, the overall result will be unpredictable. Picture 2 shows the probability distributions of completion of processes typical of creative tasks.

Picture 2: Probabilities of realization of creative tasks in process management



From the above we can conclude that the process approach is not applicable in creative work. This means that in the innovative era, organizations will not be able to use the process approach. However, such a conclusion would be wrong. It is necessary to modify the process approach, which will allow you to manage the processes, even in the case of intellectual activity. This modification involves adding a new dimension to the process description which is associated with employee competencies. Also, as will be shown below, it is necessary to organize group work within each process.

3 Requirements for the management of creative activities

The main idea of methodology of creative process management is to involve a group of employees for solving the problems. It is the collective work that is designed to reduce the spread of the probability of solving the problem on time. Formally, you can invite employees to do the same creative work parallelly, and then the probability of its execution on time can be simply increased by the increasing of number of employees. But this approach is extremely inefficient. It will be more effective to solve problems together. But for this it is necessary to properly distribute the work in the group using a competence-based approach.

3.1 Competence approach

The competence approach has been developed in numerous studies (Elliot & Dweck, 2005), (Tidd, 2006) and has become the basis for the reform of education and personnel management. Competence approach involves the development of a classification of competencies of employees, on which the company's activities depend. If there is a new activity in the organization, there should be new competencies – through training or hiring new employees. Competence-based approach to creative activity can significantly improve productivity. Let's show it on a simple example. Table 1 shows an example of a group of four employees.

Table 1: Competencies of employees

	Person 1	*Person 2*	*Person 3*	*Person 4*
Competency A	1	0	1	0
Competency B	1	0	1	1
Competency C	0	1	0	0
Competency D	1	1	0	0
Competency E	0	1	1	0
Competency F	0	0	1	1

Let the work of this group involve 6 competencies (table rows). Moreover, employees have the different competencies (1 if employee have competency and 0 if he or she has not). Then, if such a group is given 4 sets of tasks (4×6=24) to solve which requires different competences, only half of the tasks (3+3+4+2=12) will be solved. If the tasks are distributed between employees in a certain way (see Table 2), it is possible to solve all the tasks. This distribution is named the collaboration matrix.

Table 2: Collaboration matrix

	1	*2*	*3*	*4*
A	3	0	1	0
B	0	0	1	3
C	0	4	0	0
D	3	1	0	0
E	0	1	3	0

F	0	0	1	3

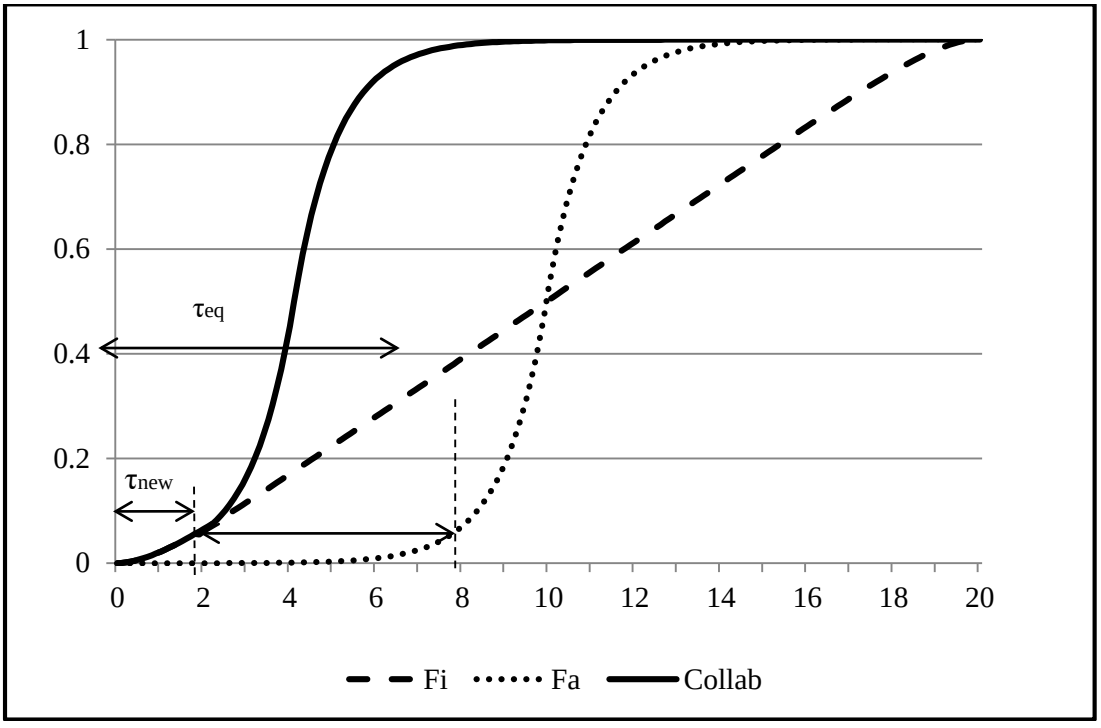
In the case of many participants and competencies, the collaboration matrix is calculated numerically. The distribution of tasks by competencies is not something special. However, if the competency approach is considered for collaboration, it is possible to achieve a synergetic effect.

3.2 Need for collaboration

We will show two examples where group work can lead to efficiency improvement through a combination of competencies.

Suppose. we have an employee in the organization who has analytical skills. The probability of solving the problem is shown in Picture 3 by a line of dots (F_a). The analyst solves the problem at a certain time. Suppose we have also a creative person, who can solve a problem much faster than an analyst, but can also solve it more slowly. The probability of solving the problem by a creative employee is shown in the figure with a dashed line (F_i).

Picture 3: Probabilities of tasks solving by analyst and creative



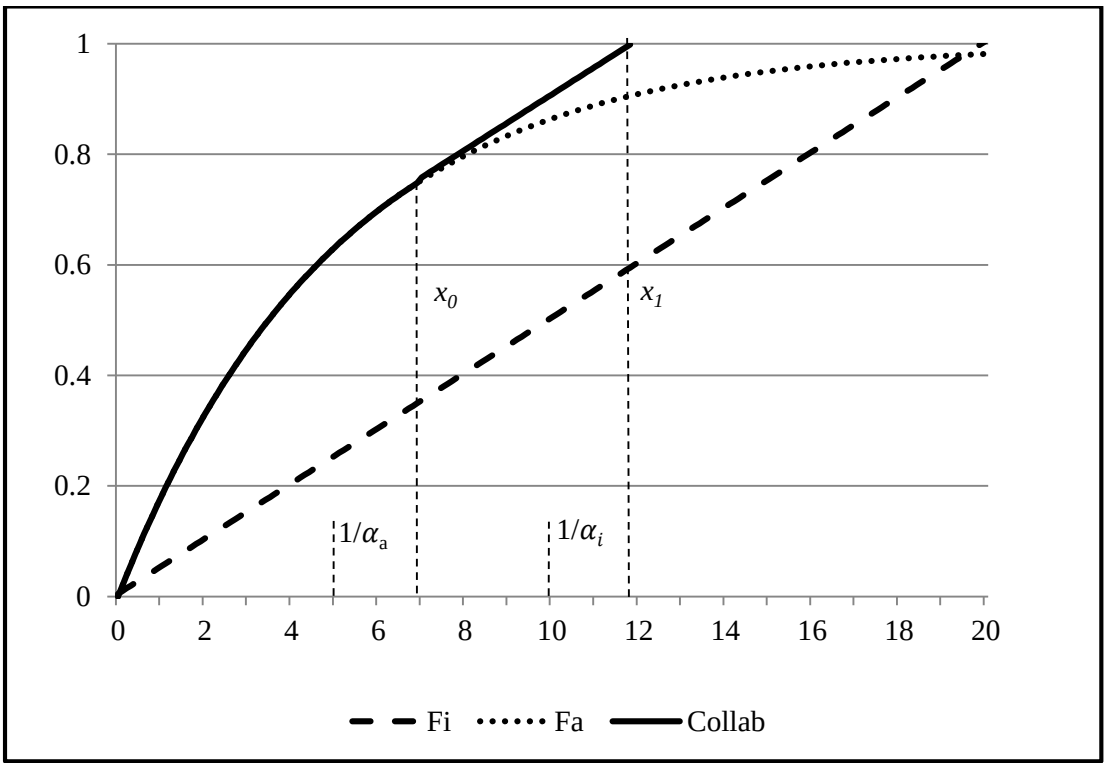
If they can solve problems together, they can significantly reduce the solution time due to the fact that the idea will be expressed by a creative employee, and the final decision will be received by the analyst. The probability of a joint solution is shown in the figure by a solid line (Collab). It is seen that the probability becomes suitable for the process approach. It can be shown that the reduction of time in such joint work is determined by the formula:

$$\frac{\tau_{new}}{x_0 - (\tau_{eq} - \tau_{new})} \approx \frac{1}{ln(\alpha_a x_0) + 1}$$

where x_0 is the average time to solve the problem, and the value $\alpha_a x_0 >> 1$ shows the spread of time for solving the problem by the analyst.

Here is another example of collaboration, which increases the efficiency of creative work. As a rule, in creative work, the completion time exceeds the time of solving the problem. This is shown in Picture 4 of the curve with dots (F_a). To speed up it is advisable at the last stage to solve the problem by connecting another employee, preferably with creative competence, whose probability of solving is shown by a dashed line (F_i). The result of collaboration is shown as a solid line (Collab).

Picture 4: Probabilities of finishing task



It can be shown that the new time of the task is determined by the formula:

$$x_1 = \frac{1}{\alpha_a}(1 + ln\frac{2\alpha_a}{\alpha_i})$$

where the values α_a and α_i, as in the case above, determine the characteristic time of solving the problem by both collaborators.

4 New organization of process activities

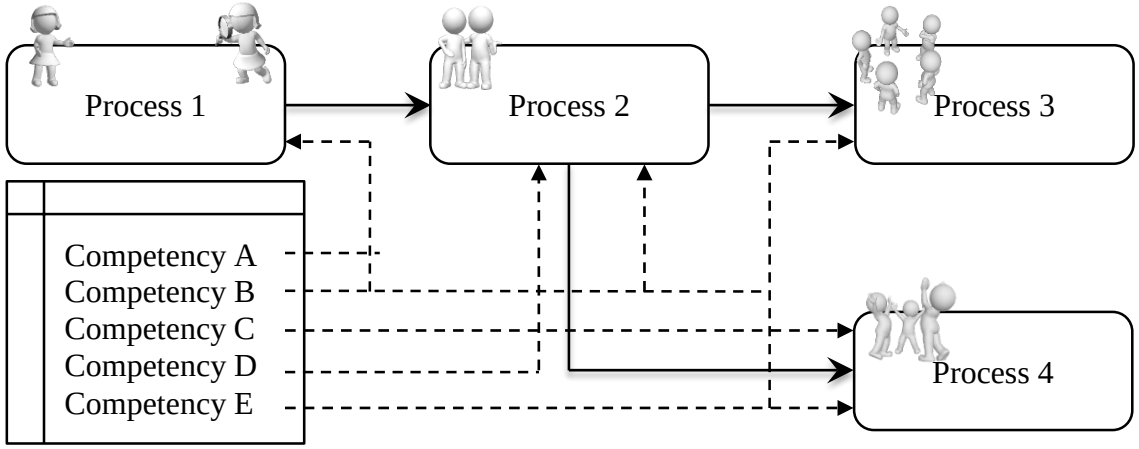
Thus, when organizing business processes for solves creative (innovative) tasks, it is necessary to use group work to solve each problem. At the same time, it is necessary to divide participants

by competencies, both by types of knowledge and by types of temperament, propensity to analysis or creativity.

Collective intelligence technologies are a link between information systems that automate the business processes of the organization, and between the employee of the organization, which has certain competencies. In the usual case, when one person is the executor of the process, you can immediately select the required employee and assign the process to him. In the case of teamwork, more flexibility will be necessary to select employees, conduct additional training, recruit new people.

This approach means that when describing business processes, it is necessary to assign them the competencies of employees required to solve each task. At least 2 employees should be involved in solving problems. Picture 5 shows how the simplest scheme of business processes will be transformed in the case of the use of technologies of collective intelligence.

Picture 5: Organization of creative tasks in process management



Another feature of the use of collective intelligence technologies to describe business processes is that the competence of a person must be confirmed all the time. This means that feedback should be added to each process to understand how much competence was enough to implement the task. The result is a system that not only sets up processes, but also defines training and development requirements for employees. That is, the information system describing the processes of intellectual activity should be human-oriented (Slavin B. , 2016).

5 Conclusion

The article formulates the main requirements for process management for intellectual activity. Competence-based approach and group activities are required. In fact, this means the emergence of two more dimensions (competencies and groups) in the process management. Competence management is usually implemented in the HR module of the information system, and process management in business process management systems. Integration of these modules is likely to be required. It might need more attention to social responsibility, to succeed.

Even though collective intellectual activity in organizations occupies more and more space, no one is measuring such activity. Soon we should expect the introduction of collective intelligence

technologies in knowledge management systems, where there is already intellectual activity, and where the processes of working with knowledge are described. However, it will be long before enough statistics are available to explore best practice.

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