

Competence-Based Language Expert Network for Translation Business Process Management

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Abstract—Nowadays large companies have a lot of business processes that cannot be automated by existing information systems on the market. Some processes require development of smart methods and approaches to support them and reduce the human interaction. The paper considers a translation business process. The idea is that translation has to be implemented by the translation agency but it has to be approved by the local company experts. The business process requires task to find the expert group that can approve the translation, organize their communication during the work as well as to motivate them to implement the task in time. The presented approach allows increasing the motivation and improving the efficiency and productivity of employees without significant company expenses. Also, the competency management technology is widely used, and it provides efficient use of the employees and organizations strengths.

I. INTRODUCTION

Scientific research aimed at increasing the organizations efficiency to obtain competitive advantages in the market becomes more and more important in the era of capital market globalization. This goal can be achieved through the automation of project management tasks that makes them more effective.

The paper considers a translation business process for a large production company. There are a lot of translations that need to be implemented every day for 23 languages to meet the customers requests. Translations are implemented by translation agencies, however, local company experts have to approve them. So, it is needed to support timely delivery of tasks to the right experts at the right time with the right competencies through the use of expert profiles and communication type as well as supporting work of experts on translation verification tasks through a motivation system and key performance indicators (KPI). Therefore the translation business process requires the following tasks.

- Describe expert profiles that allow automating the formation of expert groups for translation task performing,
- Propose the model for expert estimation based on key parameters,
- Find the expert group that can approve the translation,
- Organize expert group communication during the work (e.g., Portuguese experts can interact with Spanish experts since the languages are similar),

- Implement the motivation strategy to provide the experts with rewards that allow to motivate them to implement tasks in time.

The presented approach allows increasing the motivation and improving the efficiency and productivity of employees without significant company expenses. Also, the competency management technology is widely used, and it provides efficient use of the employees and organizations strengths.

Despite the prevalence of knowledge management systems aimed at improving knowledge sharing within the organization, employees may not use these systems due to technical, organizational, or individual barriers. Instead of using the systems as a platform for knowledge sharing, they communicate directly in good case or refuse to share knowledge in worth ones. It is the task of corporate management to establish a corporate culture that is characterized by openness and fairness and values knowledge management. One of the most important aspects that have to be considered is employee motivation [1]. Less than 10% of the knowledge you need to do your job is in your head. The other 90% is in other peoples' heads. Knowledge Management allows accessing the information that only resides in someone else's brain or memory [2]. According to the McKinsey Global Institute [3], by using social technologies, companies can raise the productivity of knowledge workers by 20 to 25 percent by improving collaboration and communication among and across teams.

The empirical study has proven that dynamic motivation seems to yield high levels of engagement, learning, and of performance and effectiveness in organizational implementation processes. In addition, dynamic motivation also seems to positively contribute to collaborative work and team performance [4]. A good example of the dynamic motivation that is used by the retailer companies are: the best sellers boards, scores in the corporate systems and etc.

The proposed approach in the paper is aimed at applying the dynamic motivation approach to increase the project management efficiency based on the competency management system described earlier in [5], [6]. The approach presented in the paper is based on the research developed earlier and described in [7], [8], [9]. The reference and mathematical models of language expert network have been developed. These models can be used for the automated organization's

personnel distribution to projects, which cover various professional competencies. In this work, experts and tasks are considered as the organization's personnel and projects, respectively. Using the proposed models will formalize not only the individual employees' skills, but also their achievements, including joint, and strengths. In addition, the dynamic motivation approach will further motivate employees without significant material costs from the company.

The rest of the paper is organized as follows. Section II considers the related work in the area of knowledge management and motivation. Section III is devoted proposing the developed reference model of language expert network. The mathematical model of a human resources management system used for the automated organization personnel distribution to projects is represented in detail in Section IV. Implementation is presented in Section V. The conclusion summarizes the paper.

II. RELATED WORK

Paper [10] considers the possibility of increasing the human resource management efficiency and the aspects that influence this. The authors identify two main groups of factors for establishing human resource management streamlining: factors aimed at the mentality changes, and factors that amplify the motivational support. The conclusions made in the paper confirm the value of human resources and the need for their competent management. This work contains principles to organize effective human resource management.

Paper [11] considers both factors affecting the performance of employees, and those factors by which this performance can be appraised. To ensure effective performance, the authors propose to consider factors, such as organizational culture, organizational support, the quality of the exchange (relationship) between members and the leader. To ensure the employees' effectiveness, the authors propose to consider factors, such as flexibility in rapport to changes occurring to the specific organizational context, being aligned to company's vision and main objectives. These factors should be considered when developing models used in human resource management.

Paper [12] presents a study on the possible consequences of financial crises, as a result of which the company's value decreases due to external factors, and how to prevent or overcome them. The study mainly focuses on the aspect of human resource management strategies for crisis management. It compares classic and modern ways of overcoming the effects of crises on human capital. The principles used in these methods are useful when developing models for managing human resources, regardless of the crisis presence or absence.

Paper [1] is devoted to the study on the motivation and knowledge sharing behavior, and it is aimed at applying the principles of dynamic motivation and employee motivation. This paper analyzes the effects of game mechanics on motivation and knowledge sharing behavior. In addition, advantages and risks of implementing game components in knowledge managements systems are illustrated. The aspects of dynamic motivation applying in knowledge management

outlined in this paper can also be applied to human resource management.

Papers [4], [13] are also devoted to a study on the dynamic motivation approach. The authors of paper [4] analyzed the available literature about why dynamic motivation is important in work and human resources management, how it can be guided, and which are the examples of dynamic motivation in this domain. The article concludes that, despite a large number of studies on the dynamic motivation approach and its usefulness, there is a need to develop tools, which use this approach and are applicable by companies for their work and human resources management.

Paper [13] is a systematic survey on the use of dynamic motivation in published theoretical reviews and research papers involving interactive systems. The authors present a multidisciplinary review of dynamic motivation in action, focusing on empirical findings related to purpose and context, design of systems, approaches and techniques, and user impact. The authors note the need to identify how dynamic motivation affects various aspects of control systems. Developing models that use this approach in a human resource management system will help clarify this issue.

Analysis of the work in the field of human resource management showed the need for scientific research aimed at increasing the motivation of employees and the effectiveness of their work. Application of the dynamic motivation approach allows to increase the involvement of employees and to motivate them to maximize their abilities. Thus, the combination of the dynamic motivation approach with technologies that ensure the efficient personnel distribution and the use of employee competencies increases the efficiency of human resource management.

III. REFERENCE MODEL OF LANGUAGE EXPERT NETWORK

The proposed reference model of language expert network is presented in Fig. 1. Employees are represented in the form of experts; each of them has a set of competencies. Competence involves the possession of certain professional skills at a given professional level. Every expert is pleased getting any kind of recognition by his/her boss.

Every proofreading task has a set of requirements. The requirement implies that possession of a certain professional skill at a certain level is required to complete a task. Manager assigns a task to experts or experts groups. When the task is performed, the expert that is responsible for its performing sends a report with results data that is accessible to the manager. The manager checks the task performing and can reward the participated experts. A reward is a combination of one or more motivations assigned to an expert. Motivation is an incentive given to employees. They can be both material (for example, gift or discount coupons, tickets), and non-material (for example, recommendation to the boss, official thanks). Moreover, motivations are defined by expenses for the company, estimated value for an expert, and monetary benefit for the expert. Setting monetary benefit is important since the limits are defined for every country related to presents for employees. In this case the overall monetary benefit is calculated for the expert during the year.

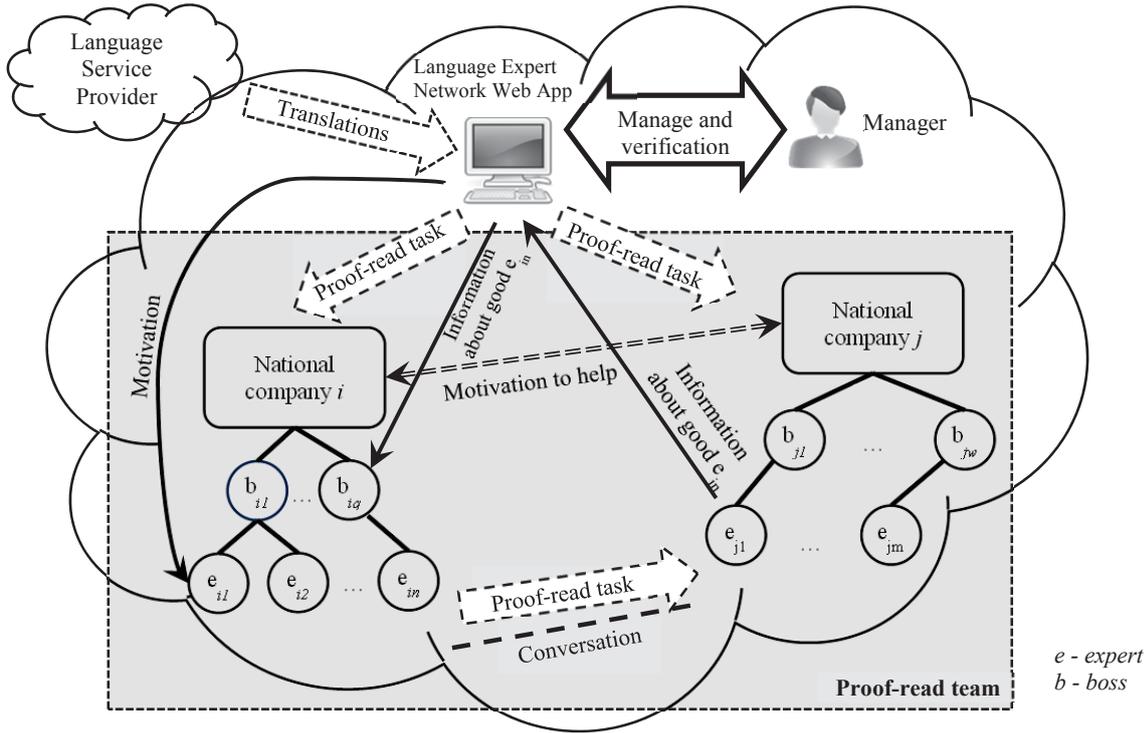


Fig. 1. Reference model of language expert network

An individual professional assessment is calculated for each expert based on the assigned and completed tasks, as well as on the rewards given. This assessment can be used both to predict employee performance and to increase employee motivation by compiling ratings and an honor board for the best employees.

IV. MATHEMATICAL MODEL OF LANGUAGE EXPERT NETWORK

To formalize the concepts used, a mathematical model of the language expert network was developed. The list of skills that experts can have is a set, see (1).

$$S = \{S_n, n = 1..N\}, \tag{1}$$

where N is the number of skills. The list of available experts is a set, see (2).

$$E = \{E_m, m = 1..M\}, \tag{2}$$

where M is the number of experts. The experts are given the following characteristics. Experts' competencies are represented as follows, see (3).

$$L = \begin{pmatrix} l_{11} & \dots & l_{1N} \\ \vdots & \ddots & \vdots \\ l_{M1} & \dots & l_{MN} \end{pmatrix}, \tag{3}$$

where l_{mn} is the proficiency level on skill S_n of expert E_m . The skill proficiency level can range from 0 to S_i (maximum skill proficiency level). A zero value in this case implies that this expert does not possess this skill. The list of the assigned and completed tasks is a set, see (4).

$$T = \{t_k, r_{ki}, \tau^{req}, \tau, k = 1..K, i = 1..N\}, \tag{4}$$

where K is the number of tasks. The tasks are given the following characteristics. Tasks requirements for experts are represented as follows, see (5).

$$R = \begin{pmatrix} r_{11} & \dots & r_{1N} \\ \vdots & \ddots & \vdots \\ r_{K1} & \dots & r_{KN} \end{pmatrix}, \tag{5}$$

where r_{kn} is the proficiency level on skill S_n , required to perform the task t_k . Task requirements can range from 0 to R_{ki} (maximum requirement level). A zero value in this case implies that this skill is not required in this task. Also, the task is characterized by the date τ^{req} , when the task should be completed, and by the date τ , when the task has been completed. If the task is not completed yet then $\tau = null$.

History of expert participation in projects is represented as follows, see (6).

$$H = \begin{pmatrix} h_{11} & \dots & h_{1M} \\ \vdots & \ddots & \vdots \\ h_{K1} & \dots & h_{KM} \end{pmatrix}, \tag{6}$$

where $h_{km} = 1$, if expert E_m participate in task T_k , otherwise $h_{km} = 0$. The list of available motivations is a set, see (7).

$$V = \{V_j, j = 1..J\}, \tag{7}$$

where J is the total number of motivations. Motivation is characterized by budget val_e , by value for the expert val_e , and by monetary benefit val_m .

To increase the employees' motivation and to enable comparisons of expert's productivity, the following formula has been proposed for professional assessment of experts.

$$GSL = \frac{Task(E_m) + Avl(E_m) + Sen(E_m) + Sk(E_m) + Re(E_m)}{4} \quad (8)$$

Thus, professional assessment of expert E_m is the arithmetic average of the ratings given to this expert by four criteria: *Task* (how successful the expert implement tasks), *Avl* (availability estimation of the expert for task performing), *Sen* (seniority estimation of the expert that is based in information about how long the expert works in the company), *Sk* (estimation about qualification of the expert), and *Re* (rewards the expert got from the manager). *Task* criteria for an expert E_m is calculated by the formula, see (12) and (13).

$$Task_i(E_m) = \frac{\sum_{k=1..K} t_k * h_{km} * x_k}{\sum_{k=1..K} t_k * h_{km}}, \quad (9)$$

$$x_k = \begin{cases} 1, \tau_i \neq null \text{ and } \tau_i \leq \tau_d \\ 0, \text{otherwise} \end{cases} \quad (10)$$

Thus, task performance assessment for the expert E_m is directly proportional to the number of tasks assigned to this expert that were completed on time and inversely proportional to the total number of tasks assigned to this expert. Availability criteria of the expert E_m is defined by him/her in the expert profile. Seniority criteria (*Sen*) for expert E_m is calculated by the following formula, see (14).

$$Sen(E_m) = 1 - \frac{1}{\alpha M + 1}, \quad (11)$$

where M is the number of months the expert worked in the company. α is the normalization coefficient. It is proposed that $\alpha = 1/4$, that means 75% the expert gets for seniority coefficient if he/she works at the company 3 years. Qualification assessment (*Skill*) for expert E_m is calculated by the formula, see (15).

$$Sk(E_m) = \frac{\sum_{n=1..N} l_{mn}}{y_m * SM}, \quad (12)$$

where y_m is the number of nonzero l_{mn} . Thus, competency assessment for expert E_m is the arithmetic average of skill proficiency levels of the expert divided by the maximum skill proficiency level. Reward assessment (*Re*) for expert E_m is calculated by the formula, see (16).

$$Re(E_m) = 1 - \frac{1}{1 + \beta * \sum_{j=1..R} val_e(V_j)}, \quad (13)$$

where R is the number of the rewards assigned to the expert. β is the normalization coefficient. It is proposed that $\beta = 0.3$, that

means average maximum value of expert reward is 10 (good experts have 10). Thus, reward assessment for expert E_m tends to 1 with a large number of rewards assigned to this expert, and with a great expert value of motivations included in these awards.

Since the value of all assessments is in the range [0; 1], then, for greater convenience, these assessments are proposed to present in percentages. These estimates can be used to select performers when assigning experts to tasks. Expert's assessment will reflect the expert's professional competence applicable to the requirements of the current task.

VI. IMPLEMENTATION

The reference model presented in the paper has been implemented and evaluated for the translation business process support of the productive company. A web based information system has been implemented that supports the language expert network management.

An example of generated skill tree that is used to describe experts competence profile as well as task requirements is presented in Fig. 2. The skill tree for developed language expert network consists of three main parts: dictionary, industry segment, and technical area that describes the mentioned problem domains.

The list of experts registered in the developed system is presented in Fig. 3. Every expert is described by the competence profile presented in Fig. 4. The expert profile contains: information about the expert, list of competencies according to the formula (2), and professional assessment (global skill level) that is calculated by the formula (8). At the presented example it can be seen that the expert has $GSL = 65.2\%$ that includes information how many successfully completed tasks this expert performs (0%), his/her availability estimation for task performing (100%), estimation of how long the expert works in the company (100%), qualification of the expert (100%), and rewards the expert got from the manager (92.8%).

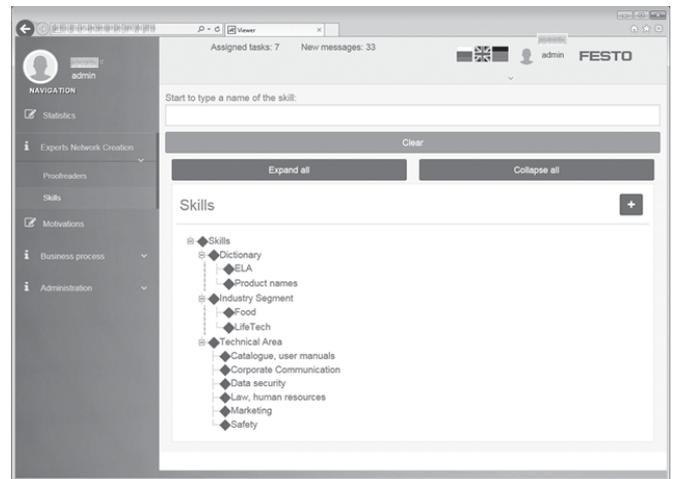


Fig. 2. Example of skill tree

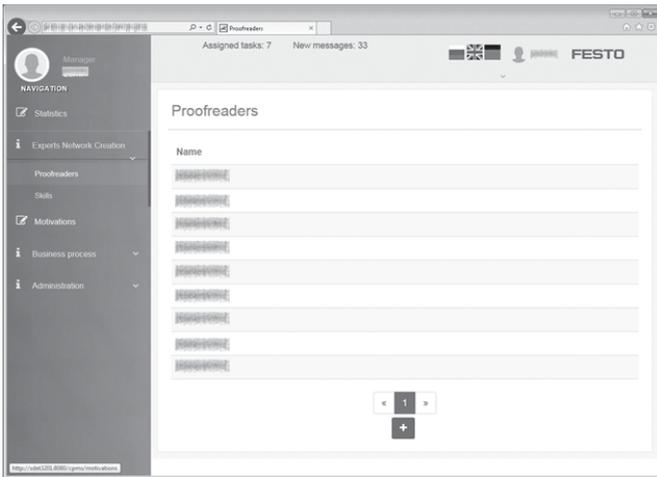


Fig. 3. Example of the experts registered in the system

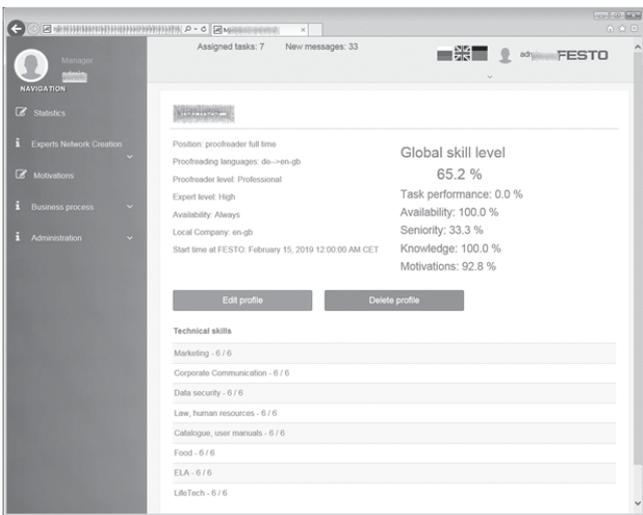


Fig. 4. Example of expert profile

For the definition of the proofreading task it is proposed to use the following structure (see Table I). A screenshot of the task example for translation of the term “Air Pump” from German to English is presented in Fig. 5. It includes the proofreading task structure presented in the table as well as the task discussion interface that allows proofreaders to exchange their knowledge about the term. A screenshot with motivation list is presented in Fig. 6. The list includes two main groups of motivations: material and non material. Every motivation is specified by budget, value, and monetary benefit as well as it can be supported globally or only by one or several local companies.

TABLE I. PROOFREADING TASK DESCRIPTION

Name	Description
Due Date	Date when the task should be performed
Source Language	Source language of the term
Target Language	Target language of the term
Term	Term to be translated
Translation	Translation made by translation agency
Task Context	Context that helps an expert to perform the translation. It includes the project where the translation will be used, “in sentence context”, technical area, industry segment, and etc.

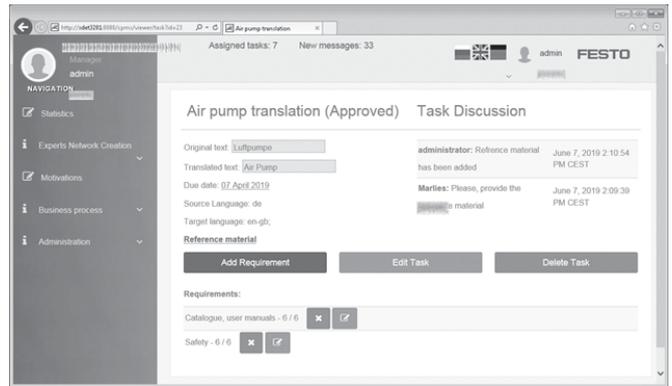


Fig. 5. Example of the proofreading task

For example, an expert can be motivated by shopping voucher (20 EUR). In this case spent budget will be 20 EUR as well as monetary benefit that determines the value of this present for the expert. This motivation compared with some recommendation to his boss could be evaluated by the expert as 4 compared with value 10 for the motivation “boss recommendation”. The value of this motivation is 10 (maximum value) but budget and monetary benefit is 0, since the motivation does not cost money for the company.

Screenshot with rewards example assigned to experts is presented in Fig. 7. The interface shows the expert(s) and a reward assigned to the expert(s) as well as date / time of the assignment. Fig. 8 shows an example with the new reward definition. The manager selects an expert(s) and reward. The system shows the left monetary benefit for every expert to this year.

VII. CONCLUSION

This paper presents an approach to language expert network management for the performing of proofreading tasks. The reference and mathematical models of the language expert network management system have been developed using competency management technology and dynamic motivation approach. Due to this, these models can be used for the proofreading task management and to increase the experts’ motivation to implement tasks in time. The main features of the proposed system are.

- Finding an available expert by the (1) proof-reading task definition (that includes task context); (2) context situation in language expert network (availability of experts, holidays in national companies and etc.); and (3) expert profiles that are generated initially manually by experts and are enhanced based on expert interaction with the language expert network and expert recognition.
- Organization of the competition between the national companies that are implementing translations.
- Positive ratings of good experts.
- One-click-recognition of an expert support.
- Material motivation support (up to 50 EUR per year for Germany).

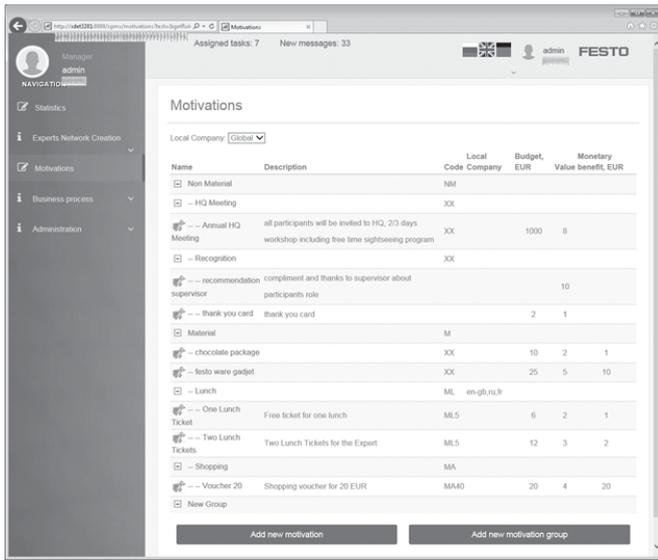


Fig. 6. Example of the motivation list

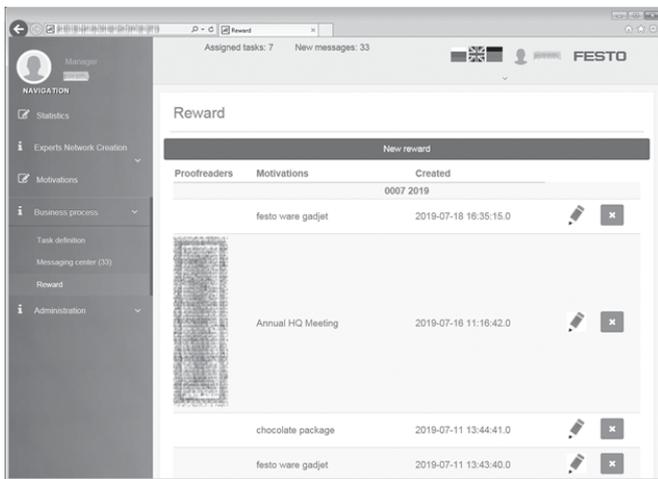


Fig. 7. Example of the rewards assigned to experts

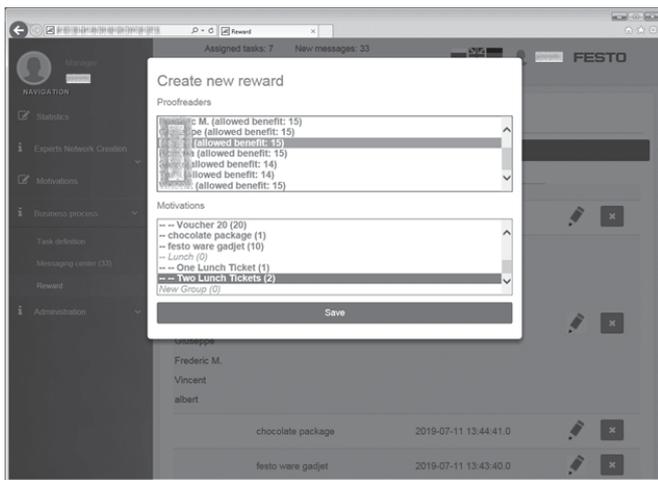


Fig. 8. Example of the new reward definition

Further work will be concentrated on evaluation of the developed system for translation business process with the attraction of 15 experts all around the world. The goal of the evaluation is estimation how the developed system automates the manager’s work. Additionally, the artificial intelligent methods will be used to automate the manager work. It is proposed to develop a method for automatically choosing process of proofreaders for the translation tasks.

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