

A concept of the knowledge strategic resource network (SknowNet) for SMEs

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Abstract. This paper presents concept of the strategic knowledge resource network for SMEs. A strategic-knowledge resource in a company represents the knowledge, skills and capabilities of the individuals who make up the workforce of that company. In the paper we present a network for the transfer as well as storage of knowledge in enterprises in order to make sure every post is covered by an employee (seen as a strategic knowledge resource) who efficiently completes the respective tasks of an organisation. This is especially important in a network of SMEs easing the exchange and transfer of employees. The structure of the SknowNet consists of (1) sets of business processes in SME, (2) sets of values of personnel usefulness function (strategic knowledge resource), (3) a games theory approach, especially natural games, is used, which facilitates decision taking in hesitant situations.

Keywords: strategic knowledge resource, personnel usefulness function (value of a strategic knowledge resource)

1. Introduction

Small and medium sized enterprises have a decisive role in creating working places and, more generally, they are social stability and economic development factors. However, they often encounter difficulties in getting capital or credit, given the limited guarantees which they can offer, as well as limited access to information, concerning especially new technologies and possible markets. Companies, which have access to external resources for their development, may gain a competitive advantage in the new era of networked enterprises and flexible relationships, based on the Internet [Chesbrough, 2003].

Strategic knowledge management is understood as a relation between the overall organisation's strategy and human resources management strategy. Human resources are assumed as strategic knowledge resources and are defined as unique enterprise's

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potential in the form of knowledge and experience [Barney J., 1995]. In the process of knowledge resources management in a company on a strategic level, it is necessary to use appropriate methods and tools which support decision making. This is especially important in a network of SMEs easing the exchange and transfer of employees. In such a view a network of SMEs can also be seen as a means for transferring and storing knowledge in order to make sure that every position is covered by an employee (human resource) who efficiently completes tasks of the organisation.

In this context we aim to measure the value of strategic knowledge resource using a so-called personnel SME usefulness function W_{nm} (for the m -th employee in the n -th SME). It is defined based on following factors: GK - general knowledge of the m -th employee, PK - professional knowledge of the m -th employee, A - professional abilities of the m -th employee, E - experience of the m -th employee, P - patents of the m -th employee, C - clients of the m -th employee, P - personality of the m -th employee; $n, m \in \mathbb{N}$ [Patalas-Maliszewska J., 2009].

The process of selecting the right persons is an important and strategic decision for SME that may determine the further development of the enterprise; thus, this decision has to be taken "correctly". A relevant framework to this issue is based on a database containing the values of the above defined usefulness function W_{nm} for each m -th employee. Given such a database one could feed a strategic knowledge resource allocation efficiency model for small and medium sized enterprises. The paper describes such an approach.

The structure of the paper is as follows: The next chapter presents the description of allocation of human resources in an organisation and the methods assessing the efficiency of decisions on acquiring knowledge, known from literature. The third chapter presents the author's network of strategic knowledge resource (SknowNet) for SMEs, consisting of a database of values of knowledge resource in SMEs. This is based on (1) a reference SME model, (2) employees (description of workplaces - business processes), (3) value of personnel usefulness function, and (4) the games theory (natural games) which facilitate taking a decision in hesitant situations. Using a real world case study we show how using this approach can be used in context of an SMEs network to maximize the knowledge value for an SME. Finally, the summary presents directions of further works.

2. Background and related work

Nowadays enterprises perceive knowledge as a strategic resource which may mark the competitive dominance of an enterprise. We may assume that the superior aim to manage an enterprise is a skilful use of strategic knowledge resource.

Small and medium enterprises in an especially flexible way adjust to the market requirements and clients' needs by changing activity's profile, products (services) assortment and by forming work time and activities' forms. The connection of

resource of many co-operating enterprises makes it possible to concentrate on key skills (competences) of the company [Patalas-Maliszewska J., Krebs I., 2010].

Also, or especially, small and medium – sized enterprises have the necessity to planning and reporting about their capital value in the face of market globalization, strong and intensified competition. In this context they have to choose the right and the most appropriate method (or tool) for knowledge (or employee) allocation. However, evaluating the value of knowledge is complicated – and nearly impossible – task.

As regards research, there are methods of intellectual capital assessing based on investment of staff's development or transfer of knowledge of employees. However, there are no generally agreed methods assessing the efficiency of decisions on acquiring knowledge. The process of managing intellectual capital should consist of two stages: identifying and measuring. Literature distinguishes qualitative measures (e.g. Danish project of IC measurement, 'Scandia' navigator, intangible assets monitor, IC model –TM Rating, VCSTM, balanced result sheet, report by Saratoga Institute) and methods of valuating intellectual capital (e.g. MV/ MB, q-Tobin, CIV, KCE, VAICTM, economic added value, IAV model, Strassmann's method, IAMVTM, technology broker); see [Dudycz T., 2005], [Edvinsson L. and Malone S., 2001], [Fitz-enz J., 2001], [Kasiewicz S. et al., 2006], [Mikuła B., 2002]. Attempts are continuously made to find methods for knowledge resource allocation increasing the efficiency for the small and medium enterprises. Allocation of human resources in an organisation is a process of shaping employment by means of different personnel action, which include, e.g., winning employees, their internal and external selection as well as employees' resignations and dismissals. This is done to make sure that every post is covered by an employee who efficiently completes the respective tasks of an organisation [Pawlak, 2003]. Skilled personnel and versatile enterprise are key factors in the knowledge competition [Patalas-Maliszewska J., Krebs I., Stryjski R., 2010].

However, it is difficult to find a method allowing keeping all mentioned principles in the selection of employees. The recently used method of employees selection is personnel marketing – reliable informing candidates about a company, using clear principles and criteria in employees selection, which ensures subjective and identical treatment of all candidates [Król H. and Ludwicyński A., 2007]. However, there is no method found, which enables keeping objectivity and uniformity principles at the employees selection.

Since there is no overall agreed method to allocate human resources in an organisation and for assessing the efficiency of decisions on acquiring knowledge, in the following

We present our approach to choose an outside employee for an enterprise (SknowNet for SME) at the condition of maximalisation of the knowledge value for SME; it consists of elements: (1) a database of strategic values of knowledge resource in SMEs, (2) the games theory (natural games) which facilitate taking a decision in hesitant situations.

3. SknowNet for SME

For the SME to meet different demands and stand up to the international and local market competition it is necessary to proceed with the oncoming tasks in an efficient and reasonable way, which can be achieved by the systematic analysis of the undertaken tasks in relation to the company organizational and economical ability of their completion. In economy practice making a decision in enterprise is conditioned by competitors' action, changing factors of environments, eg. technical progress and results of the research works [Haas-Edersheim, 2007]. Added value for SME can be determine as knowledge, employees' skills and abilities, social relation, know-how, and particularly effective investing in intellectual capital. The enterprises which invest in human capital and systems of work are achieved competitive advantage because of their workers' readiness to learning and qualifying themselves and also thanks to effective information and communication transfers.

3.1 The database of values of strategic knowledge resources in SMEs

The personnel function in enterprises encompasses all the issues concerning employees, e.g. recruiting workers, managing them, their professional development etc. Forming a personnel function is a simplified picture of a given part of reality, in which features, relations and other unimportant elements for a given period are eliminated [Król H., Ludwicyński A., 2007]. Authors attempt a trial of defining the SME database of values of a personnel usefulness function W_{nm} (the value of strategic knowledge resources for m -th employee in the n -the SME) in the aspect of formulating a strategy of knowledge management.

In this context we define the personnel SME usefulness function, W_{nm} for the m -th employee in the n -th SME [Patalas-Maliszewska, 2009]:

$W_{nm} = f(\text{GK}, \text{PK}, \text{A}, \text{E}, \text{P}, \text{C}, \text{P})$, where $n, m \in \mathbb{N}$, and the following parameters are received as the result of tests for employee, which was evaluated within the range from 1 to 5, where 1 is a bad and 5 is a very good level and:

- GK - General knowledge of the m -th employee.
- PK - Professional knowledge of the m -th employee.
- A - Professional abilities of the m -th employee.
- E - Experience of the m -th employee.
- P - Patents of the m -th employee.
- C - Clients of the m -th employee.
- P - Personality of the m -th employee.

The linear form of this function W_{nm} is chosen because all elements are independent and equally important to assess the effectiveness and efficiency of investment in knowledge.

It is possible to receive indispensable data for account of value personnel SME usefulness function for the m-th employee in the companies belonged to reference model of SME (see Fig. 1). The survey has done by interview in 10 companies (in 10 selected SMEs) in line with the reference model. Each employee completed the questionnaire. On the basis of an algorithm for testing solutions for each employee it was possible to receive a specific value of the personnel usefulness function and each of the parameters of this function. Based on the result research in SMEs (the research group consisted of 10 companies, conformed to concrete model of enterprise – see Fig. 1) the values of personnel usefulness function for the two employees ($m=2$), who can realize the defined business processes in SME, in the each SMEs of 10 (Table 1) are created.

The structure of database is given (see Fig. 1). Please note that this reference model an SME is seen as a set of processes, and modeled accordingly.

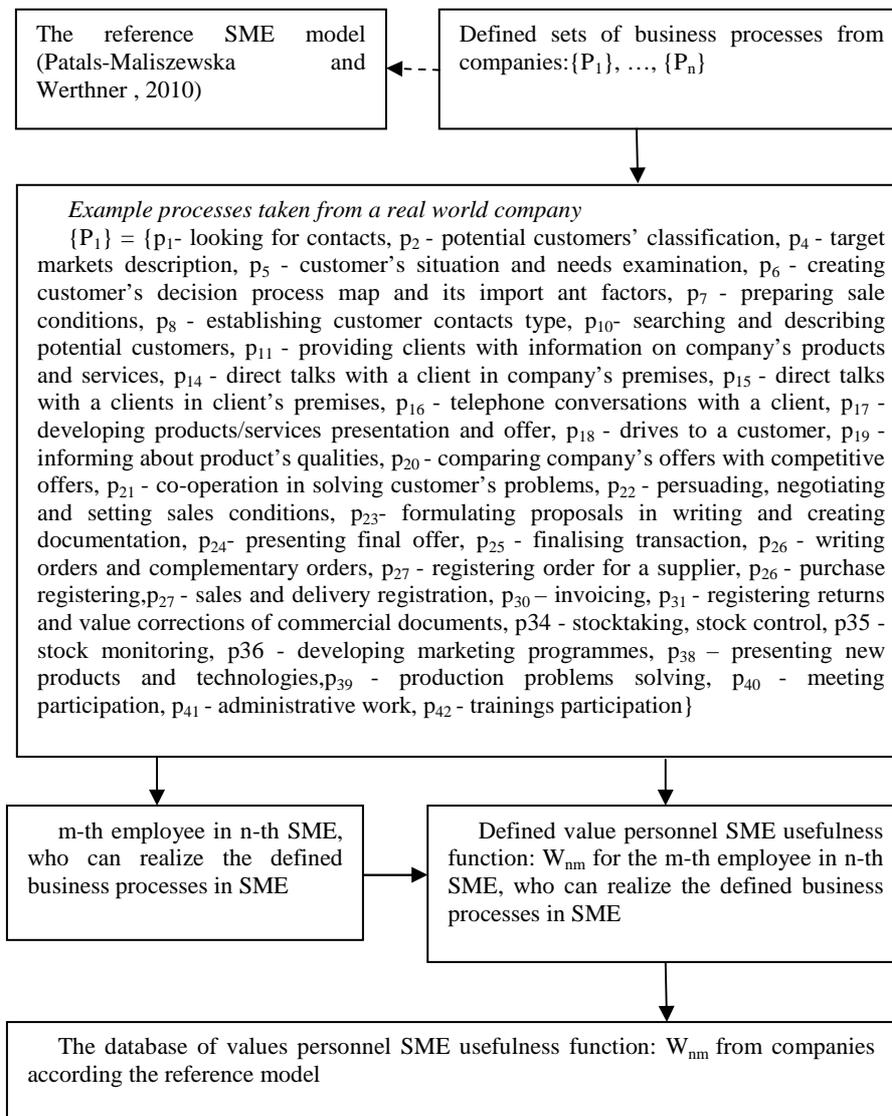


Fig. 1. The structure of the database of strategic values of knowledge resources in SMEs

Table 1: The database of values of strategic knowledge resources in SMEs, (Patalas-Maliszewska and Werthner, 2010)

Companies	Values of personnel SME usefulness function for first employee, who can realize the defined business processes in SME (see Fig. 1)	Values of personnel SME usefulness function for second employee, who can realize the defined business processes in SME (see Fig. 1)
SME ₁	W ₁₁ = 25	W ₁₂ = 4
SME ₂	W ₂₁ = 19	W ₂₂ = 13
SME ₃	W ₃₁ = 21	W ₃₂ = 15
SME ₄	W ₄₁ = 15	W ₄₂ = 12
SME ₅	W ₅₁ = 12	W ₅₂ = 17
SME ₆	W ₆₁ = 17	W ₆₂ = 9
SME ₇	W ₇₁ = 21	W ₇₂ = 13
SME ₈	W ₈₁ = 21	W ₈₂ = 18
SME ₉	W ₉₁ = 15	W ₉₂ = 12
SME ₁₀	W ₁₀₁ = 23	W ₁₀₂ = 19

Figure 2 represents the structure, concepts and sequence of actions of SknowNet.

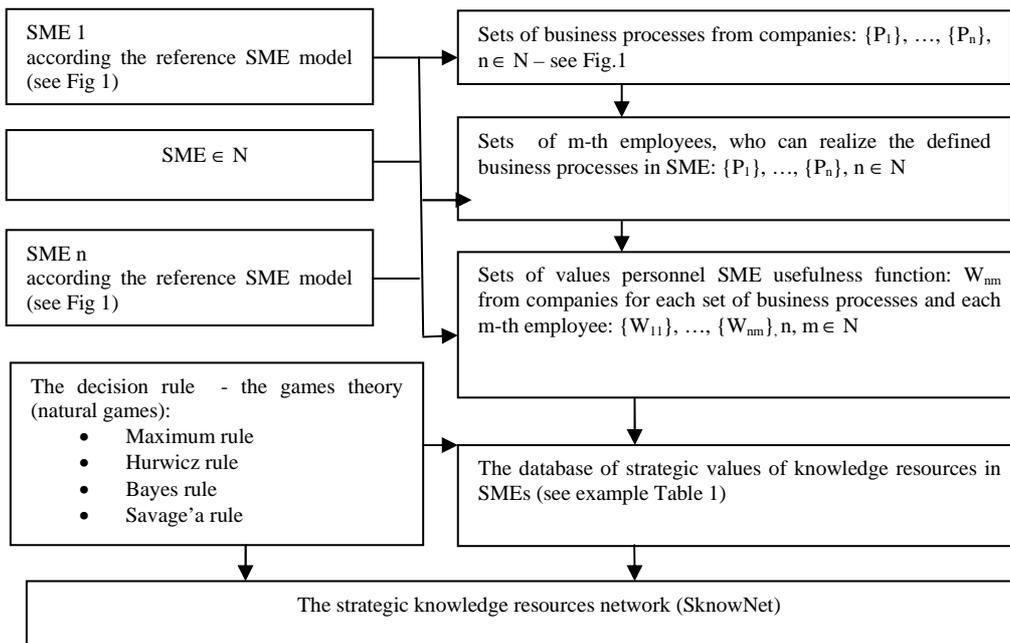


Fig. 2. The structure of SknowNet

The games theory (natural games) creates a model class, which the task facilitate taking a decision in hesitant situations [Luce R. D. and Raiffa H, 1964]. Using such a decision rule would enable SME choosing of strategic knowledge resource ascribed to company's needs. They view game theory as providing an explanatory account of

strategic reasoning. It is possible to transfer or choice of the proper knowledge resource (a right employee) for SME from the database of strategic values of knowledge resources in SMEs (see Table 1) based on the rules:

- Maximum rule: $v = \max_i \{ \min_j a_{ij} \}$, where a_{ij} – element of a matrix (element of the database of strategic values of knowledge resources in SMEs - see example Table 1)
- Hurwicz rule: $v = \alpha \min_j (a_{ij}) + (1 - \alpha) \max_j (a_{ij})$, where $\alpha (0 \leq \alpha \leq 1)$, where a_{ij} – element of a matrix (element of the database of strategic values of knowledge resources in SMEs - see example Table 1)
- Bayes rule: $v = \frac{1}{n} \sum_{j=1}^n a_{ij}$, where a_{ij} – element of a matrix (element of the database of strategic values of knowledge resources in SMEs - see example Table 1)
- Savage'a rule: $v = \min_i \{ \max_j \Delta_{ij} \}$, where $\Delta_{ij} = \max_i a_{ij} - a_{ij}$, where a_{ij} – element of a matrix (element of the database of strategic values of knowledge resources in SMEs - see example Table 1)

So, the company A, that is described following reference SME model (see Fig. 1), can receive (transfer) the knowledge resource described to its needs and budget from SKnowNet using the decision rules. The procedure of supporting a decision maker about allocating the knowledge resources (i.e., employee) in an organisation is proposed in Fig. 3.

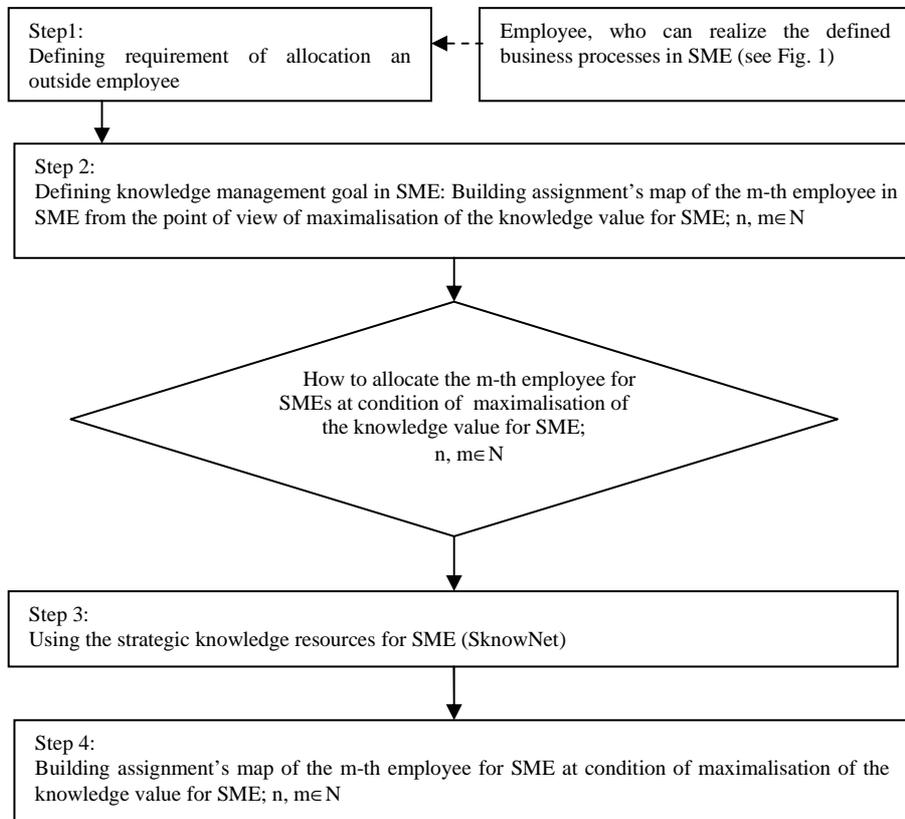


Fig. 3. The procedure of supporting a decision maker about allocation of human resources in an organisation

3.2 Case study

In order to illustrate the procedure supporting a decision maker (see Fig. 2) let me consider the SME that is about to make decision concerning the allocation of an outside employee.

Consider the company A (the object), that is described following reference SME model (see Fig. 1), that is about to make decision concerning the allocation of an outside employee in the sale area. The main areas of the company correspond to following functions supporting: the sale, the supply, orders scheduling, the service, the accounting, human resources management, export/import transactions. The firm

employs 16 employees; in the sales area are 5 employees. All four employees in the sales area, without the manager, can realize the same business processes.

The allocation of an outside employee should be done in such a way that the company will receive (transfer) the human resource described to its needs and budget. The finally decision is connected with the allocation of an outside employee (strategic knowledge resource). The presented SME network (see Fig. 3) enables us to make the decision about chosen the strategic knowledge resource ascribed to the company's needs. In order to illustrate this problem let us consider a particular step of the procedure supporting a decision maker.

1. Defining the company A: the sets of business processes (see Fig. 1)
2. Defining requirement of transfer an outside employee:
(employee, who can realize the defined business processes in SME – see Fig. 1)
3. Using the SknowNet (see Fig. 2) to select the right persons for company A and aimed at maximalisation of the knowledge value for company A (value personnel SME usefulness function): W_{Am} , for the m-th employee.

So, we have 10 SMEs, that are described following reference SME model (see Fig. 1) and the database of strategic values of knowledge resources in SMEs (see example Table 1). The values of personnel SME usefulness function (see Table 1) are treated as hesitant situations in the natural games.

So, we can make decision about transfer or chosen external strategic knowledge resource (company A can receive the employee described to its needs and budget) based on result of decision rule:

- Maximum rule: $v = 19$ (SME 10)
- Hurwicz rule: for $\alpha = 0,8$, $v = 19,8$ (SME 10)
- Bayes rule: $v = 21$ (SME 10)
- Savage'a rule: $v = 6$ (the smallest loss for SME 10)

Company A should make decision about chosen external strategic knowledge resource from SknowNet:

- based on the maximum rule: transfer an employee from SME10 to company A will provide at least knowledge value for the new employee in the company A: $W_{A1} = 19$.
- based on the Hurwicz rule: transfer an employee from SME10 will provide at average knowledge value for the new employee in the company A: $W_{A1} = 19,8$.
- based on the Bayes rule: transfer an employee from SME10 will provide at average knowledge value for the new employee in the company A: $W_{A1} = 21$.
- based on the Savage'a rule: transfer an employee from SME10 will provide at the smallest loss average knowledge value for the new employee in the company A: $W_{A1} = 6$ relatively to highest knowledge resource value in company.

4. Concluding remarks

The procedure which has been introduced in this paper gives more possibilities in the area of allocating external knowledge resources. A decision model of employee's assignment to a given task is suggested, from a point of view of maximization of the knowledge value in a company.

A universal character of the suggested SME network is worth emphasizing. Depending on defining business processes in the enterprise and on precise verification of constituent elements of SknowNet, this allows to receive more detailed planning results as basis for the strategy of knowledge resources management.

The research in progress is focused on the development of the SME database of strategic values of knowledge resources in SMEs, which would be similar in terms of business processes as well as defined the reference SME model.

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