Principal Sources for the Identification of Tacit Knowledge Within an IT Company, as Part of an Intelligent System

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Abstract. This article aims to present principal sources for the identification of tacit knowledge within an IT Company, as part of an intelligent system. It is stated, that knowledge workers have the specialised knowledge to come up with or formulate new ideas and that this specialised knowledge is the product of targeted education, experience and competences. Using our personnel usefulness function (Evaluation of Personnel as an Asset – EPS method), a base of knowledge workers, within an IT company is created and then, by using the FAHP method, the main sources of tacit knowledge (MTKS) from this base of knowledge workers are identified. Finally, the implementation of our approach in an information system is presented.

Keywords: Identification of tacit knowledge · EPS method · An intelligent system · An IT company

1 Introduction

The profitability of an IT company depends to a large extent on intangible resources [7]. Companies can ensure their long-term competitiveness by the acquisition, storage and transferring -or sharing- of internal knowledge. According to Chen et al. [3] a company's employees are valuable capital in the creation and acquisition of internal knowledge.

The process of knowledge management consists of three, interconnected areas: (1) the acquisition and creation of knowledge, (2) the dissemination of knowledge, (3) the use of knowledge [11]. According to the research literature, we can distinguish knowledge sources depending on stages in the knowledge management process [1, 6, 8, 14, 15, 17]. In this article, we have paid special attention to the identification of the main sources of tacit knowledge in an IT company, namely, the critical kind of knowledge which is related to employees in the first stage of the process of knowledge management. Our research methodology is based on two stages: (1) the identification of knowledge workers, (2) the identification of the principal source of tacit knowledge, using the Fuzzy Analytical Hierarchy Process (FAHP) method, implemented in our intelligent system. Knowledge workers may be practitioners, designers and commanders. Nonaka

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and Takeuchi [9] furthermore, they combine intellectual powers with substantial competences [4]. We argued with Nonaka and Takeuchi and with Davenport, stating that knowledge workers have the specialised knowledge to come up with or formulate new ideas and that this specialised knowledge is the product of targeted education, experience and competences. Using our personnel usefulness function: Evaluation of Personnel as an Asset method – EPA method, we first create a base of knowledge workers, within an IT company and then, by using the FAHP method, we are then able to identify the main sources of tacit knowledge from this base of knowledge workers.

The motivations for writing this paper are, firstly, IT companies because their value is based on their employees' knowledge. Secondly, this study aims to identify the most crucial source of tacit knowledge within an IT company, as this is the first step in the acquisition and storage of the unique knowledge of that company. Finally, the article presents the implementation of our methodology in an information system, as part of an intelligent system.

The structure of the article is as follows: Sect. 2 presents the results of research in the literature, vis-à-vis identification of the knowledge sources within an IT company. Section 3 explains our methodology, while Sect. 4 presents the implementation of our research results in an information system. Finally, Sect. 5 states the main conclusions and presents future research work.

2 Related Tacit Knowledge Sources in an IT Company

The managers of an IT company should pay special attention to the identification of the source of knowledge if they want to be in control of the knowledge management process. We make the distinction between knowledge which is explicit which can be presented within a company in the form of company documents, patent, reports and such like and knowledge which is tacit, that is, knowledge which is related to the employees in a company. Tacit knowledge plays a crucial role in an IT company [16]. Based on the premise, that tacit knowledge is employee-based, this paper discusses how the use of a dedicated information system can support identification of the main source of tacit knowledge in an IT company. Sources of tacit knowledge, like feedback from customers and suppliers, consultation, analysis-simulation results, observations conducted in real time, analysis of records, demonstrations and training, knowledge audits and audio or video recordings of activities by experienced employees, can all be defined [2, 5, 11].

According to the results of our research (see Fig. 1) we know that managers in IT companies are fully au fait with the importance of the sources of tacit knowledge in the context of the identification of -and capitalisation on- their know-how in completed IT projects. The research data was collected from the managers and chief executive officers of seventeen IT companies as a result of direct meetings/interviews in April-May of 2015. The importance of knowledge sources was assessed by the use of the five-point, Likert Scale in which 1 = strongly disagree and 5 = strongly agree. Figure 1 presents the principal sources of tacit knowledge in manufacturing companies and is based on the results of the research.

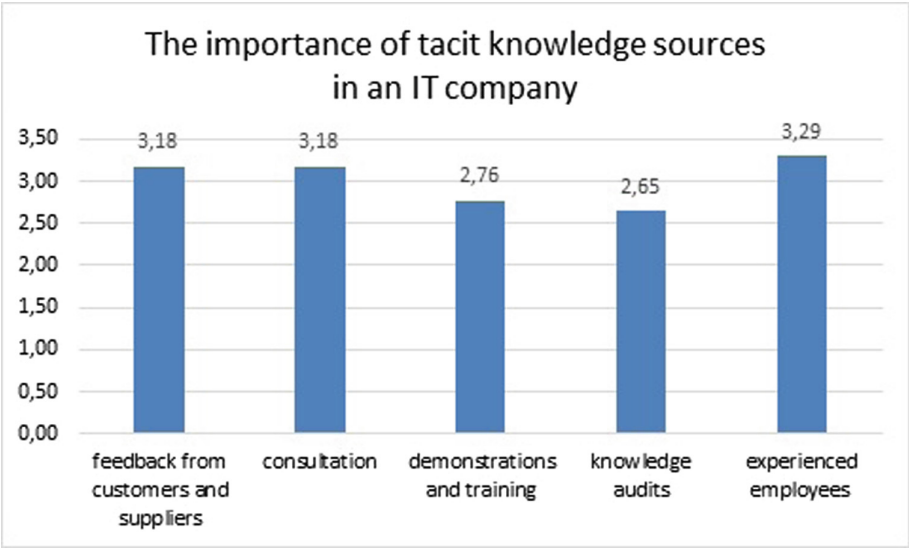

Fig. 1. The importance of tacit knowledge sources in an IT company - results of our own research

We can observe that experienced employees are most important for managers of IT companies, as a source of tacit knowledge; to this end, we have developed a two-stage framework for identifying the main source of tacit knowledge: **(1)** the identification of knowledge workers using the Evaluation of Personnel as an Asset method – EPA method, **(2)** the main source for the identification of tacit knowledge using the Fuzzy Analytical Hierarchy Process (FAHP) method.

Our work also highlights the acquisition of knowledge in IT projects, by employees who are engaged in IT projects within an IT company.

We design and develop an intelligent systems for IT companies that enable the storage and exchange of expert knowledge. In this paper, we have presented part of this system but have included the main sources for the identification of tacit knowledge. This part is based on the use of the EPA method, in order to identify knowledge workers in an IT company and select the main sources of tacit knowledge from this base of IT company knowledge workers, using the FAHP method.

3 Model of the Principal Sources in the Identification of Tacit Knowledge – The MTKS Model

The first stage involved in the proposed MTKS model is based on identification of the knowledge workers in an IT company, using the personnel usefulness function (Evaluation of Personnel as an Asset method – EPA method) [13]:

$$F_n = GK + PK + A + E + CI, \text{where } n \in N \text{ and where} \quad (1)$$

GK = the general knowledge of the nth worker in the company.
PK = the professional knowledge of the nth worker in the company.
A = the professional abilities of the nth worker in the company.
E = the experience of the nth worker in the company.
CI = the capacity for innovation of the nth worker in the company.

To obtain values for each component of the EPA method, the employees in an IT company are required to complete web-based questionnaires.

Based on the results and on algorithmic solutions, values are created for each of the components:- $1 \leq GK \leq 5; 1 \leq PK \leq 5, 1 \leq A \leq 5, 1 \leq E \leq 5, 1 \leq I \leq 5$ for each employee [12].

Based on the solutions, each employee can then be identified as a knowledge worker, if he/she obtains $F_n \geq 17$ grading and is accepted as such, by the company's managers.

According to the second step of our MTKS model, managers in an IT company will then determine the importance of each component of the EPA method for each knowledge worker vis-à-vis their knowledge of IT projects completed in a company, according to the following rules:

- His/her general knowledge is equally important, moderately more important, much more important, most important, compared with his/her professional knowledge.
- His/her general knowledge is equally important, moderately more important, much more important, most important, compared with his/her professional abilities.
- His/her general knowledge is equally important, moderately more important, much more important, most important, compared with his/her experience.
- His/her professional knowledge is equally important, moderately more important, much more important, most important, compared with his/her professional abilities.
- His/her professional knowledge is equally important, moderately more important, much more important, most important, compared with his/her experience.
- His/her professional abilities are equally important, moderately more important, much more important, most important, compared with his/her experience.
- His/her capacity for innovation is equally important, moderately more important, much more important, most important, compared with his/her general knowledge.
- His/her capacity for innovation is equally important, moderately more important, much more important, most important, compared with his/her professional knowledge.
- His/her capacity for innovation is equally important, moderately more important, much more important, most important, compared with his/her professional abilities.
- His/her capacity for innovation is equally important, moderately more important, much more important, most important, compared with his/her compared with his/her experience.

The FAHP (Fuzzy Analytic Hierarchy Process) method was then implemented and used. The FAHP method allows the relative dominance of a particular component of the EPA method to be determined from elements which cannot be measured in the context of the selection of an employee, as the most important source of knowledge in an IT company. According to Nydick and Hill [10], a linguistic variable can be

described by a fuzzy number $\tilde{a} = (l, m, u)$ of a triangular fuzzy membership function. The triangular fuzzy number $\tilde{a} = (l, m, u)$ is defined in the set $[l, u]$, and its membership function takes a value equal to 1 at the point m. The fuzzy scale of preferences is strictly defined by Nydick and Hill [10].

The model allows the identification of the main sources of tacit knowledge in an IT company from within a group of knowledge workers, in the context of the selection of those employees having appropriate knowledge regarding completed IT projects. The MTKS model, presented as part of an intelligent system for an IT company is implemented; the next section is then presented.

4 Implementation of the MTKS Model, as a Part of an Intelligent System for an IT Company

Below is an extract from the intelligent system, based on the proposed MTKS model.

Web-questionnaires on knowledge for each component of the EPA method are defined, firstly (see Fig. 2).

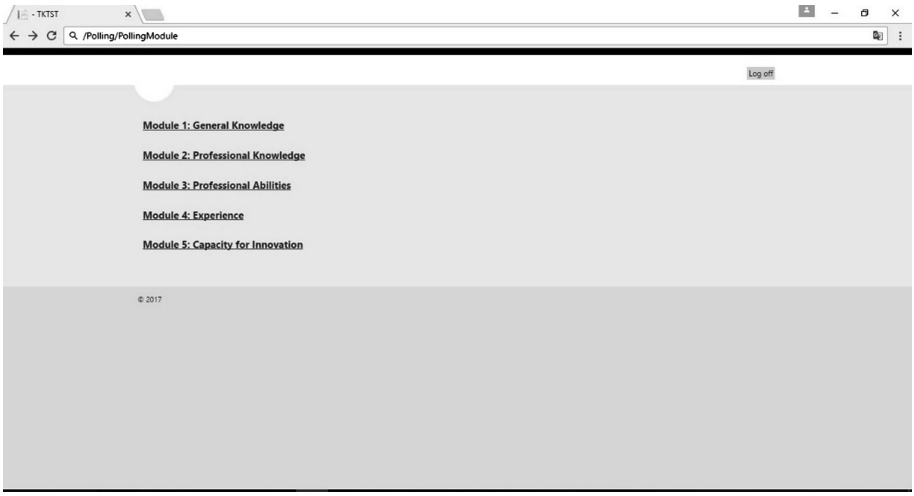

Fig. 2. Components of the evaluation of personnel as an asset method – EPA method, own research

Each employee in the IT company completes the knowledge web-questionnaires for each component of the Evaluation of Personnel as an Asset method – EPA method (see Figs. 3, 4, 5, 6, and 7). Our EPA method concept, necessitates the formulation of a different knowledge questionnaire for the various employees, according to the business processes in each company. Currently, we have created web-questionnaires according to the following business processes defined in an IT company:

- Preparation of new projects.
- Definition of the scope of new projects.
- Creation of new products.
- Improvement to existing products.
- Provision of market analysis.
- Provision of market research.
- Provision of technical research.
- Designing the concept of a new product.
- Creation of a prototype.
- Creation of the final product.
- Strategies to gain market share and best practices.
- Preparing the firm's strategy.
- Planning the firm's development.
- Management of human resources.
- Risk management.
- Control.
- Finding new projects.
- Decision making.
- Provision of support and benefits.
- Participation at meetings.
- Learning.
- Training.
- Administrative Work/Reporting.

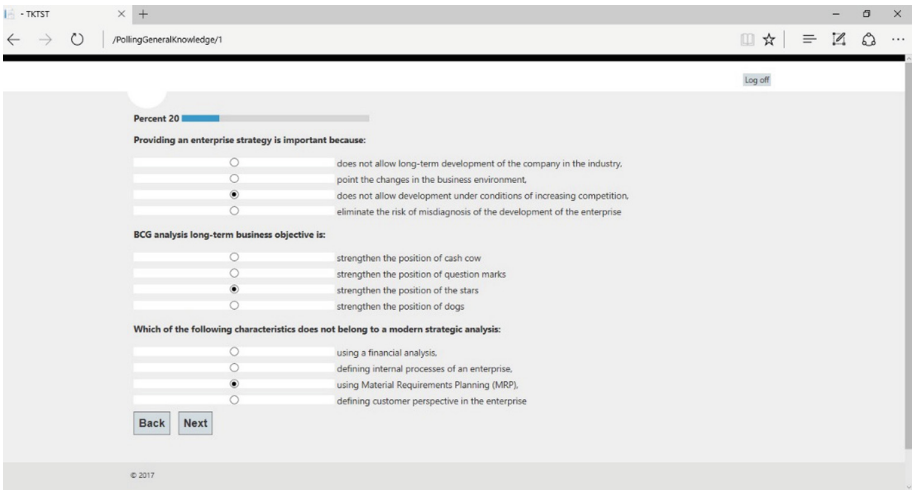

Fig. 3. A part of web-questionnaire for the component general knowledge for the implementation of the EPA method, own research

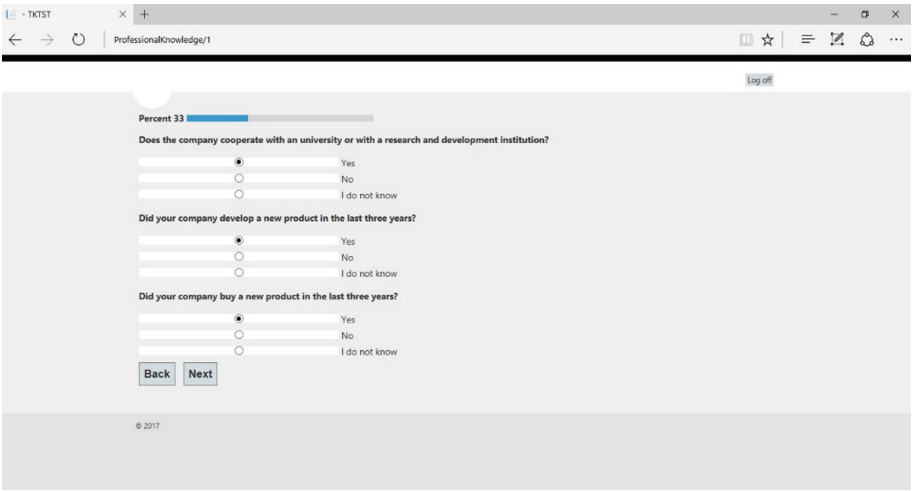

Fig. 4. A part of web-questionnaire for the component professional knowledge for the implementation of the EPA method, own research

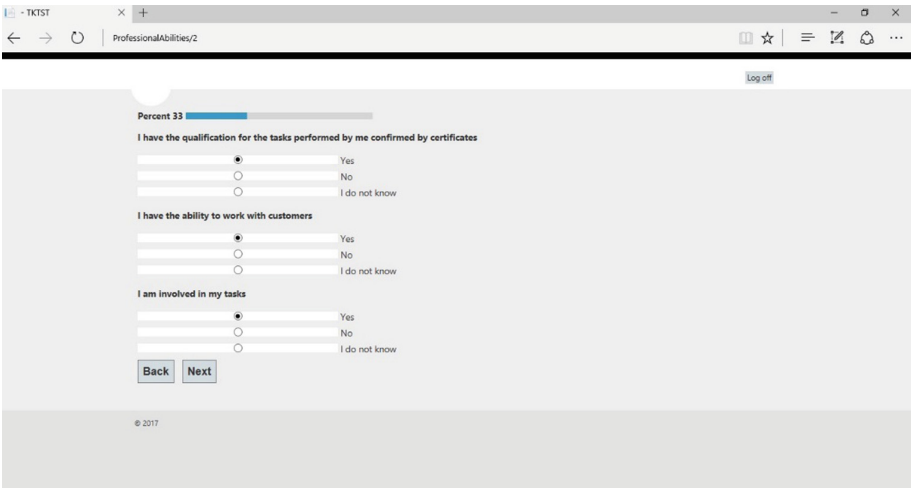

Fig. 5. A part of web-questionnaire for the component professional abilities for the implementation of the EPA method, own research

The manager subsequently evaluates the results of the tests for each employee and determines the importance of each component of the EPA method according to the defined rules – see Sect. 3. By using the FAHP method, the manager is thus able to

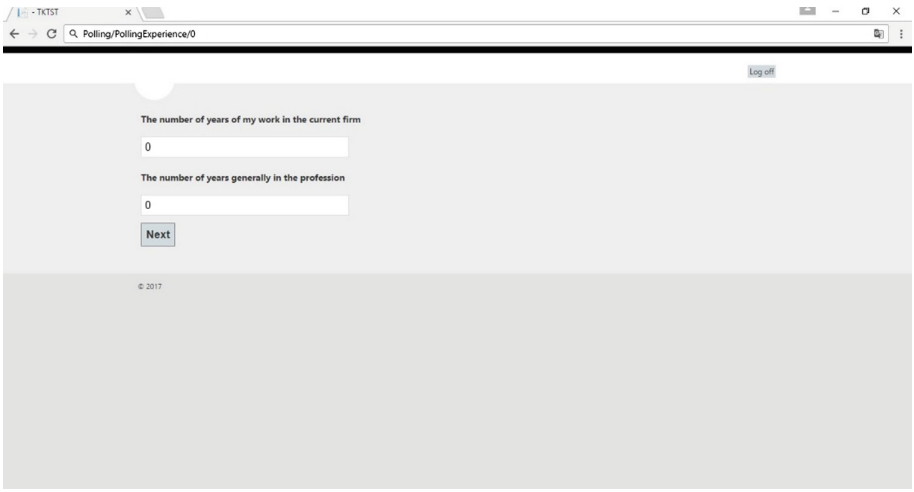

Fig. 6. A part of web-questionnaire for the component experience for the implementation of the EPA method, own research

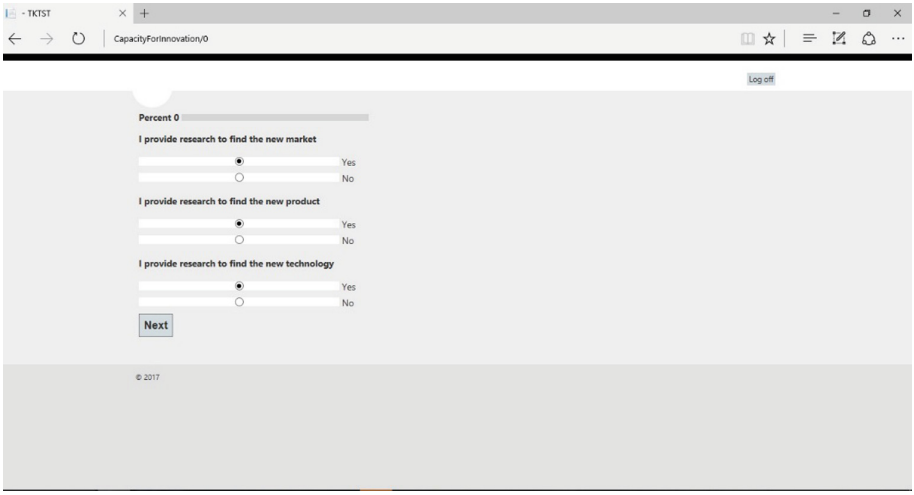

Fig. 7. A part of web-questionnaire for the component capacity for the implementation of the EPA method, own research

evaluate each component of the EPA method with regard to each employee and consequently, is then able to track/define the main sources of tacit knowledge according to the statement: $F'_n \geq 3$, where

$$F' = w_{GK}GK + w_{PK}PK + w_A A + w_E E + w_{CI}CI, \text{where} \quad (2)$$

- w_{GK}GK - the amount of general knowledge x the values of general knowledge of each company employee.
- w_{PK}PK - the amount of professional knowledge x the values of professional knowledge of each company employee.
- w_{A}A - the number of professional abilities x the values of professional abilities of each company employee, or of a given company employee.
- w_{E}E - the experience x the values of the experience of each company employee.
- w_{CI}CI -the capacity for innovation x the values of the capacity for innovation of each company employee (see Figs. 8 and 9).

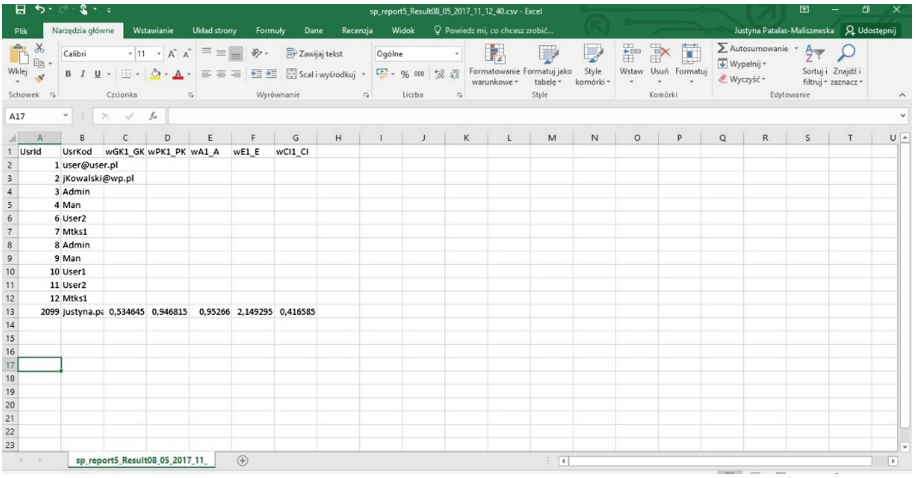

Fig. 8. The total of each component of the the EPA method for each employee, based on an evaluation of the work of a given employee

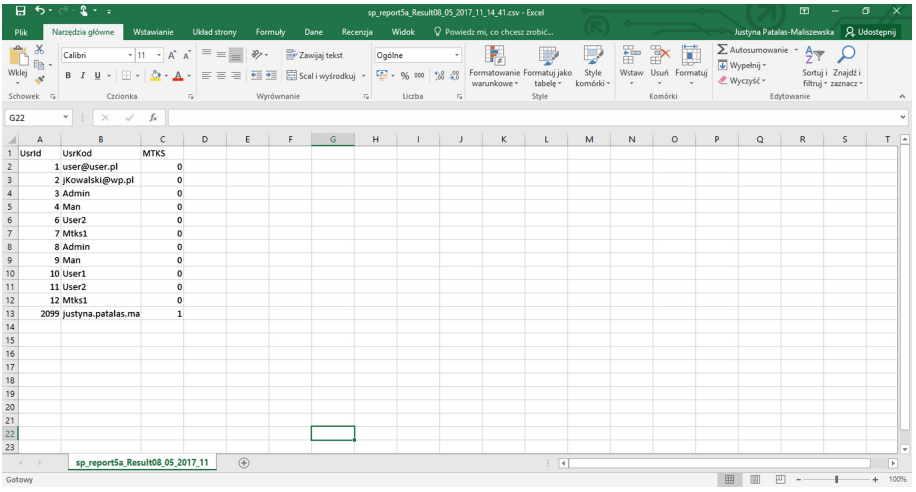

Fig. 9. The main sources in the identification of tacit knowledge in an IT company, as part of an intelligent system

The proposed approach to the identification of the main sources of tacit knowledge in an IT company allows the most important sources of tacit knowledge, in an IT company, to be defined. In a created intelligence system, the methods for acquiring tacit knowledge, vis-à-vis completed projects in a company, are implemented from the MTKS defined. These issues will be developed and discussed in our future work.

5 Conclusion

This study was motivated by the actual needs of managers of IT companies who have a strong desire to introduce new projects in order to be more innovative and competitive on the market. The object of this study was to investigate how managers can be supported in the process of the identification of the main sources of tacit knowledge in an IT company, using the MTKS model proposed. Our paper presents our approach to the identification of the main sources of tacit knowledge in an IT company as a part of an intelligent system. This concept will be further developed in our future work.

As with all studies, this study has certain limitations which further research should aim to overcome. Firstly, this study focusses on IT industries because the intention was to analyse the main sources of tacit knowledge within an IT company. It would be unwise to generalise this approach too broadly in respect of other enterprises. Furthermore, the knowledge web questionnaires were created for specific business processes. So, it would be useful to re-define these knowledge web questionnaires for other business processes. These conclusions and limitations suggest proposals for the direction of future research and the on-going development of our intelligent systems.

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