Decision Model for the Use of the Application for Knowledge Transfer Support in Manufacturing Enterprises

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Abstract. This article elaborates a decision-making model for the effective use of the application for knowledge transfer support in manufacturing enterprises by using the GMDH method. It focuses on the set of the characteristics of knowledge workers in manufacturing companies and is based on a survey and data obtained from 119 Polish manufacturing enterprises. This article develops a framework of how knowledge workers can determinate the knowledge transfer in a manufacturing company and further discusses the research results.

Keywords: Knowledge transfer · Knowledge workers · Manufacturing company · GMDH

1 Introduction

Knowledge workers need to transfer a useful knowledge to execute their business processes. Moreover, according to Drucker, they need to acquire a variety of this knowledge [1]. Liu and Phillips [2] stated, that company's competitive advantages can be increased by encouraging workers to transfer knowledge. Knowledge transfer process focuses on transferring a specific type of knowledge from one unit to another [3]. Knowledge workers may support the transfer of knowledge. But, they can transfer their knowledge only if they have the competency, skills and language efficiency [4]. Moreover, the power influence of individuals plays dominant role in the process of knowledge transfer [5].

In this study, the characteristics of knowledge workers of the effective use of the application for knowledge transfer support in a manufacturing company is investigated via a simulation of a hypothetical model using the Group Method of Data Handling. This study tries to ascertain what the effects are of the each characteristics of knowledge workers on the effective knowledge transfer with the use of the application in a manufacturing company. The proposed decision model supports the selection of appropriate characteristics of a knowledge worker according to their acceptable levels of the effective use of the application for knowledge transfer support.

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The remainder of this paper is organized as follows. Section 2 presents the theoretical background of the study. Section 3 describes the research model. Section 4 explains the research methodology, discusses the results and provides a conclusion of the research. Section 5 summarizes the research results.

2 Theoretical Background

Workers can effectively obtain knowledge from the knowledge sources to execute their tasks [6]. The company should improve knowledge flows between individual knowledge workers within the organization [7]. The knowledge transfer usually imply the use of technology. In order to provide effective knowledge transfer support organization adapt the IT tools.

According to Kuk [8] knowledge sender plays a crucial role in knowledge transfer. A knowledge transfer can be illustrated by knowledge-flow among knowledge workers from different departments in a manufacturing company. So it is stated that appointed characteristics of a knowledge worker can determinate the effective use of the application for knowledge transfer support. This study focuses on the development of a decision model of obtaining information about the determinants of the a knowledge worker for the effective use of the application for knowledge transfer support in a manufacturing company.

In this study the following characteristics of a knowledge worker in a manufacturing company are defined [9–16] general knowledge (GK), specialized knowledge (SK), competence (C), work experience (WE), Contact with Customers (CC), formal education (FE), Internal Communication (IC), Troubleshooting (T). Each worker in a company evaluate himself with five-point scale (5- excellent, 4 – very good, 3 – good, 2 – sufficient, 1 – not sufficient).

The procedure of determination of knowledge worker in a manufacturing company is proposed (PD-KW):

Procedure PD-KW:

INPUT: characteristics of a knowledge worker CHKW = < GK,SK,C,WE,CC,FE, IC,T > , where GK $\in \leq 1;5 \geq$; SK $\in \leq 1;5 \geq$; C $\in \leq 1;5 \geq$; WE $\in \leq 1;5 \geq$, CC $\in \leq 1;5 \geq$; FE $\in \leq 1;5 \geq$; IC $\in \leq 1;5 \geq$; T $\in \leq 1;5 \geq$

OUTPUT: knowledge workers set KWS = < KW1,…, KWn > , n∈N

begin

select a KW1

(GK ≥ 3 ∧ SK ≥ 4 ∧C ≥ 4 ∧WE ≥ 3 ∧CC ≥ 3 ∧FE ≥ 3 ∧IC ≥ 4 ∧T ≥ 3)

select a KW2

(GK ≥ 3 ∧ SK ≥ 4 ∧C ≥ 4 ∧WE ≥ 3 ∧CC ≥ 3 ∧FE ≥ 3 ∧IC ≥ 4 ∧T ≥ 3)

select a KWn, n∈N

(GK ≥ 3 ∧SK ≥ 4 ∧C ≥ 4 ∧WE ≥ 3 ∧CC ≥ 3 ∧FE ≥ 3 ∧IC ≥ 4 ∧T ≥ 3)

do

until KWS = < KW1(GK ≥ 3, SK ≥ 4, C ≥ 3, WE ≥ 4, CC ≥ 3, FE ≥ 4, IC ≥ 4, T ≥ 3, OC ≥ 3), …, KWn(GK ≥ 3, SK ≥ 4, C ≥ 3, WE ≥ 4, CC ≥ 3, FE ≥ 4, IC ≥ 4, T ≥ 3), n∈N

end

This study posits that knowledge (both explicit and tacit) is sent by the sender(s) to the receiver(s) by the use of a mobile technology among knowledge workers in a manufacturing company. The conceptual model shown in Fig. 1 and depicts the relationships that it is examined:

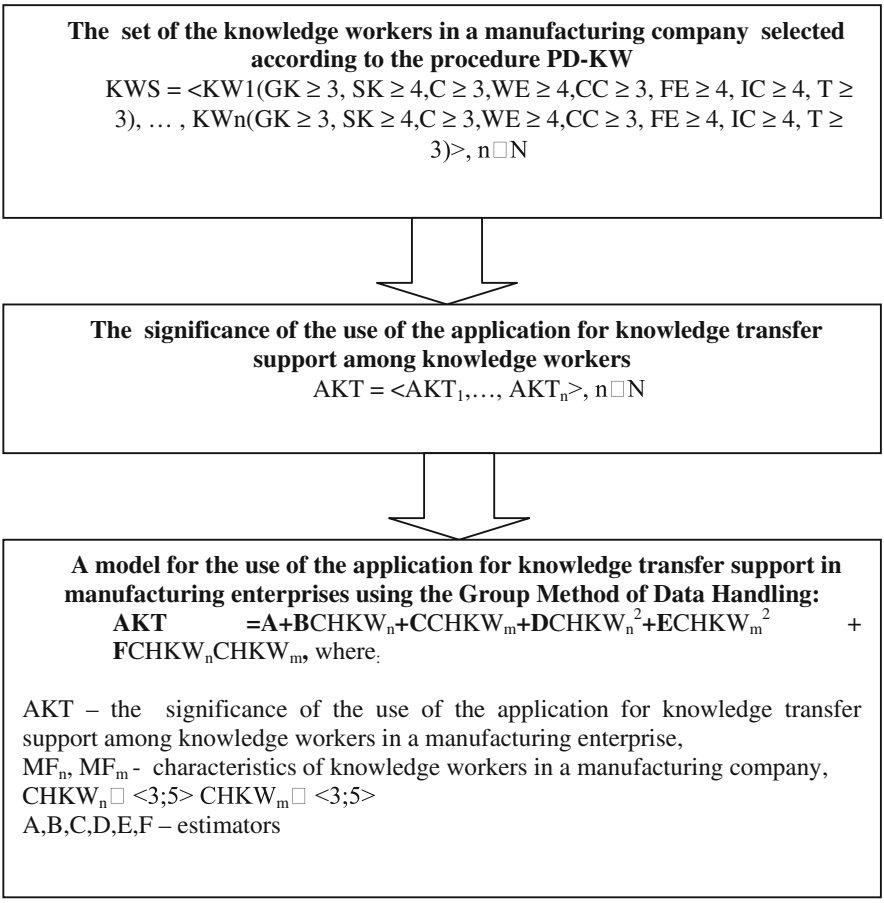

Fig. 1. The conceptual model.

In order to facilitate the description of the defined relationships, the use of the application for knowledge transfer support among knowledge workers in manufacturing enterprises should be organized in a standardized way, shown as follows:

$$AKT_1 = \begin{bmatrix} AKT_1 \\ AKT_2 \\ \cdots \\ AKT_n \end{bmatrix}, \text{ where } n \in N \tag{1}$$

In this definition, AKT_i is the i-th AKT, 'and also included in the matrix are the indicators which describe the significance of the use of the application for knowledge transfer support in each of the 119 Polish manufacturing companies by knowledge workers examined in this study according to the procedure PD-KW. Each AKT_i is associated with characteristics of knowledge workers. Therefore, characteristics of knowledge workers in a manufacturing company base (CHKW) provides a set of indicators, noted as:

$$CHKW = \begin{bmatrix} GK_1 & SK_1 & C_1 & WE_1 & CC_1 & FE_1 & IC_1 & T_1 \\ GK_2 & SK_2 & C_2 & WE_2 & CC_2 & FE_2 & IC_2 & T_2 \\ \dots & \dots & \dots & \dots & \dots & \dots & \dots & \dots \\ GK_n & SK_n & C_n & WE_n & CC_n & FE_n & IC_n & T_n \end{bmatrix} \quad (2)$$

where n ∈ N and

general knowledge (GK), specialized knowledge (SK), competence (C), work experience (WE), Contact with Customers (CC), formal education (FE), Internal Communication (IC), Troubleshooting (T).

A decision support model for the use of the application for knowledge transfer support in a manufacturing company was built using the Group Method of Data Handling [17]. The elements of the algorithm are defined arbitrarily by the author. In this study the elements are defined as:

- statement of the use of the application for knowledge transfer support among 67 knowledge workers in each of the 119 Polish manufacturing companies,
- significance of the characteristics of 67 knowledge workers in each of the 119 Polish manufacturing companies.

3 Research Results

Before the survey was carried out, it was assumed that those companies which took part in the research would have a knowledge transfer strategy, use within a company a mobile technology among workers.

The list of factors for the significance of the use of the application for knowledge transfer support among knowledge workers in each of the 119 Polish manufacturing companies was based on feedback surveys and its sources are listed here:

the effective use of the mobile technology for knowledge transfer support: the expected results from the use of the mobile technology in a company has been at least 70 % achieved after a period of time of two years from the adoption of the application.

ASK-factor: Yes, I agree that the expected results from the use of the mobile technology in a company has been at least 70 % achieved after a period time of two years from the adoption of the application (1 point – if you agree/0 points if you do not agree).

The characteristic of a knowledge worker: The degree to which an employee believes that he or she is a knowledge worker by the use of t five-point scale survey items.

The data for this study were collected from 119 Polish manufacturing companies between January to September, 2014: polish manufacturing companies (Industry: 88 companies: 74 %, Construction: 16 companies: 13 %, Others: 15 companies: 13 %). The respondents were managers (95 companies: 80 %) and chief executive officers (24 companies: 20 %).

According to the procedure PD-KW were selected the knowledge workers in Polish manufacturing companies to the further research. Of the 119 respondents managers and chief executive officers were defined 67 workers, they are knowledge workers in Polish manufacturing companies, also those employees who have, share, transfer or apply knowledge within their tasks. Almost 57 % of managers and chief executive officers are knowledge workers according to the defined procedure PD-KW. However this classification was based on self-assessment of employees. In further studies will be carried out questionnaires describing each of the following characteristics to verify the assessment of knowledge workers.

So this study includes a statement of the significance of the application for knowledge transfer support based on an empirical analysis of the 67 knowledge workers from 119 Polish manufacturing companies.

Finding the value of the significance of the application for knowledge transfer support, as expressed by the defined characteristics of knowledge workers, is part of the decision-making model. In accordance with the data received from 67 knowledge workers form 119 Polish manufacturing companies, all the variations of the GMDH algorithms were investigated in the author's Consulting IT computer software system [13].

As a result of the implementation of the algorithm, the best possible polynomial was obtained; this was characterized by the lowest value criteria for regularity assigned to the pair object. The algorithm evolution process was completed on the second iteration.

In this way, the best polynomials are chosen; which is the one with the smallest error of modelling:

Decision Model:

$$AKT = 1.28 - 0.40xWE - 0.18xFE + 0.75xWE^2 + 0.15xFE^2 - 0.60xWExFE \quad (3)$$

where,

WE - the significance of the characteristics of knowledge worker: work experience, WE = ≤ 3,5 ≥

FE - the significance of the characteristics of knowledge worker: formal education, FE = ≤ 3,5 ≥

AKT - the statement of the use of the application for knowledge transfer support among knowledge workers, AKT = 0 ∨ 1.

Therefore, it is possible to simulate the effect of the use of the application for knowledge transfer support among knowledge workers in manufacturing company depending on the characteristics of workers according to the proposed ASK model.

4 Decision Model for the Use of the Application for Knowledge Transfer Support

In this study, the knowledge transfer approach is developed to select the best characteristics of a knowledge worker in order an improvement of effective use of the application for knowledge transfer support among employees. A modular decision-making process is implemented according to a procedure:

STEP1: Select the knowledge workers in a manufacturing company according to the procedure PD-KW.
STEP2: Trace an statement of the use of the application for knowledge transfer support among employees.
STEP3: Assign an influence of each characteristic of a knowledge worker on the use of the application for knowledge transfer support using the AKT model.
STEP4: Define priority of characteristic of a knowledge worker.
STEP5: Select the best characteristic of a knowledge worker for the effective use of the application for knowledge transfer support.

According to this procedure, by using the proposed AKT model it is possible to forecast the effective use of the application for knowledge transfer support in a manufacturing company, as presented in Fig. 2:

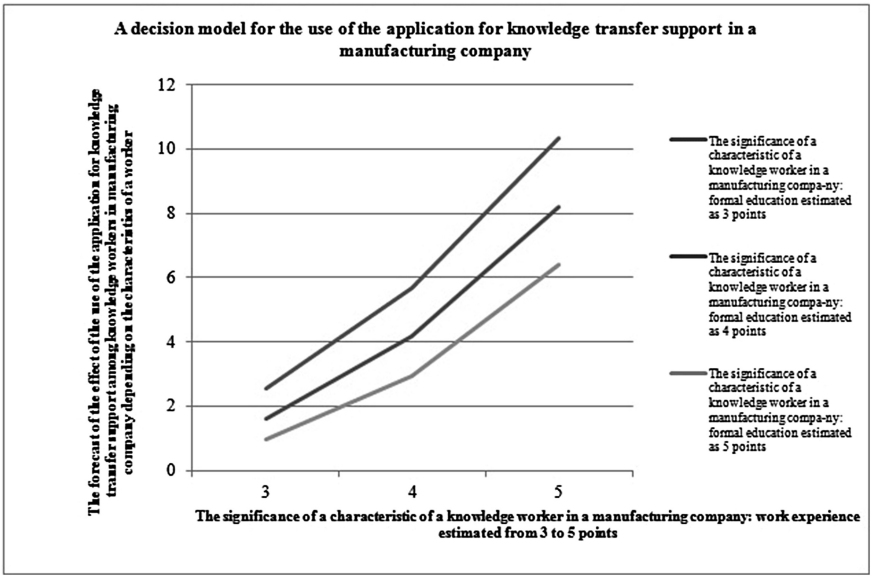

Fig. 2. A decision model for the use of the application for knowledge transfer support.

The highest values of the effect of the use of the application for knowledge transfer support among knowledge workers in manufacturing company depending on the

characteristics of a worker can be achieved if the significance of the characteristic of a knowledge worker: work experience is very high (5 points), and the second one is on the level good (3 points).

For example if the significance of the characteristic of a knowledge worker defined as work experience is assessed by 5 points, and formal education by 3 points, it may be possible to achieve the value of the effect of the use of the application for knowledge transfer support as 10.34. Unfortunately, if each characteristic of a knowledge worker is equally on the level: excellent; then the value of the effect of the use of the application for knowledge transfer support is decreased (if WE = 5 and FE = 5, than AKT = 6.38).

The results confirm that the most important employee who transfers knowledge, should be an employee with work experience on the very good level. He or she should play a dominant role in the process of knowledge transfer in a manufacturing company. But how the mangers can encourage such an employee to share his/her knowledge with other workers? How to acquire his/her tacit knowledge? Why the another characteristics of a knowledge worker are less important in a knowledge transfer process in a manufacturing company? So, it would be useful to provide such research over a longer time period and at different manufacturing company, i.a. German manufacturing company.

5 Conclusions

The present study aimed to make several contributions in order to better understand the factors, that influence on the knowledge transfer process in a manufacturing company. The results of this study present the measurable existence of a positive effect of the work experience of a knowledge worker of the effective knowledge transfer in a manufacturing company based on research results from 67 knowledge workers form 119 Polish manufacturing companies.

This study was undertaken in order to contribute a context for developing theory rather than to attempt to test any theory about knowledge transfer among knowledge workers in manufacturing companies. Such theory testing should be carried out on more examples of knowledge workers of manufacturing companies.

However, it is hoped, that the findings will be valuable for future research on the subject of knowledge transfer in networks of manufacturing companies.

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