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Modeling Strategic-knowledge-resource Management in SMEs Based on Individual Competencies

1. Introduction

Nowadays, enterprises perceive knowledge as a strategic resource which contributes to the competitive dominance of an enterprise. Small and medium-sized enterprises (SMEs) play a critical role in creating work places and, in a more general sense, they also constitute factors in social stability and economic development. However, given the limited guarantees they can offer: SMEs often encounter difficulties in obtaining capital or credit, as well as the fact that they typically have limited access to information concerning new technologies and potential markets.

A number of publications have dealt with the correlation between knowledge-management capability and competitiveness. Liu et al. (2001) suggested that taking advantage of knowledge management could stimulate employee potential and accelerate the integration of employee knowledge. Introducing knowledge management has become inevitable for enterprises which need to survive in a competitive environment. The respect and adoption of the intelligence of each employee is the key to continuous company management (Davenport and Prusak, 1998). Nonaka and Takeuchi (1995) defined tacit knowledge as a kind of personal characteristic that is too abstract to transfer, one which cannot be express using words.

Many studies have focused on knowledge-management strategies from an organizational perspective (Barthelme et. al., 1998), (Basu A., 1998), (Carayannis EG, 1998), (Drew S., 1999), (Purser and Pasmore, 1992) and (Studer et. al., 1998). Sirmon and Hitt (2003) suggest the primary processes for the effective management of resources in an organization. The first process is the structuring of the resource portfolio. This requires firms to engage in the acquisition and development of resources and, when necessary, remove less valuable resources. The second process entails bundling resources together in order to build unique and valuable capabilities.

Thus, describing human resources as strategic-knowledge resources is motivated by:

- the concept of effective management of resources in an organization (Sirmon and Hitt, 2003),
- an enterprise's unique potential in the form of knowledge and experience (Barney J., 1995),

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- the concept of competence management (Hamel and Prahalad, 1994).

A strategic-knowledge resource in a company represents the knowledge, skills and capabilities of the individuals who make up the workforce of that company. Such resources are usually reflected by a person's education, experience and specific identifiable skills (Hitt et al., 2001). Yet, how can resources be managed to create added value for enterprise?

Makadok (2001) presented several stages in the management of a firm's resources. Sirmon and Hitt (2003) expanded Makadok's work to develop a model of how resources could be managed to create value. We can use their model to examine five stages in the management of a firm's strategic-knowledge resources. The stages involve: identification, analysis, evaluation, configuring and forecasting (see chapter 3).

Therefore, the following research problem has been formulated:
There are SMEs with a defined functional area and set of business processes. There is a set of values of the strategic-knowledge resources of a given company. What is needed is a model of strategic knowledge-resource management which creates added value for enterprise.

Besides determining a model of strategic-knowledge-resource management in SMEs, the following steps are required: (1) a description of competence management and a description of resource management, (2) a description of an SME-reference model.

This study describes competence and resource management, sharing in the collaborative development and implementation of strategic-knowledge-resource management in SMEs. In this context, strategic-knowledge resources are defined in such a way as to be incorporated into a model of strategic-knowledge-resource management.

2. Strategic-knowledge Resources

Resources are clearly important to the performance of a firm. Yet, according to resource management; the issue of whether or not an organization gains a competitive advantage and any associated returns, depends on the strategic planning used to leverage those resources (Chrisman et al., 2003; McGrath and MacMillan, 2000).

Therefore, a firm's level of strategic planning may impact the degree to which altruism and human and technological resources affect performance. Specifically, strategic planning may improve the positive effects of technological and human resources on the performance of a firm because the long-term nature of SMEs (especially small–family firms) allows them to strategically plan the dedication of resources required for innovation and risk taking (Zahra et al., 2004).

To define a company's strategic-knowledge resources it is essential to understand the characteristics of competence and resource management.

2.1 Competence Management

The significance of competence management in knowledge-intensive businesses is well established. As a subdivision of knowledge management, competence management deals with the knowledge of individuals, i.e. their competencies. The capabilities of individuals to accomplish a task are often referred to as qualifications, skills, competencies or other similar terms. However, in literature there is an explicit difference between these concepts. The concept of a competence is represented by a combination of knowledge, behaviour and skills that give an individual the potential to perform a task effectively (Draganidis and Mentzas, 2006).

The aim of competence management is to plan, implement and evaluate initiatives that ensure that the proper competencies are available to a company which needs them to achieve its business objectives (Nordhaug, 1993). In order to support this task, Berio and Harzallah (2005) define four processes for competence management:

1. competence identification; to define the required competence,
2. competence assessment; to determine if a competence has been acquired,
3. competence acquisition; to plan how required competencies can be acquired,
4. competence usage; to systematically utilize knowledge about competencies for the benefit of an organization.

To preserve a company's competitive edge, it is an inevitable necessity that a competence-management system be developed. In general terms, competence management operates on two levels: the macro and the micro. The former is concerned with core competencies and is controlled by business management. Thereby, a core competence is understood as the total collective knowledge and capabilities that reside in an organization (Hamel and Prahalad, 1994). On the micro

level, led by human-resource management, the focus lies on the competencies of individual employees. The competencies a company required to meet its strategic goals are transformed from the macro to the micro level. Inversely, existing competencies on the micro level are exchanged via business management to support strategy design.

2.2 Resource Management

Resource management is critical to the management of a firm and the gaining of a competitive advantage (Chrisman et. al., 2003). In particular, a human resource can act as an important strategic resource that can lead to a distinct advantage. According to a resource-based view, firms can develop unique characteristics that allow them to gain a sustainable competitive advantage, thus positively affecting their performance. A further element of the resource-based view is that resources alone do not confer a competitive advantage. Firms must also allocate resources for strategic activities, deploy them effectively to obtain a sustainable competitive advantage and accomplish strategic objectives. Therefore, in order to succeed, firms must develop resources that cannot be easily imitated and are firm-specific, embedded in the organization and non-transferable (Makadok, 2001).

Enterprises functioning in a market economy have to implement changes in the systems of organization and management that they use. In economic practice, making a decision in an enterprise is typically conditioned by the actions of competitors and changing environmental factors, e.g. technical progress and the results of research. Added value for SMEs can be defined as knowledge, the skills and abilities of employees, social relations, know-how, and effective investment in intellectual capital. Enterprises which invest in human capital usually achieve a competitive advantage because of their workers' readiness to learn and qualify, and also thanks to effective information and communication transfer (Edvinsson and Malone, 2001).

While resources are important to the performance of a firm, according to a resource-based view, whether or not an organization gains a competitive advantage and any associated returns, depends on the strategic planning used to leverage those resources (Chrisman et al., 2003; McGrath and MacMillan, 2000).

The need to describe a strategic-knowledge resource is motivated by the concept of resource management (Sirmon and Hitt, 2003) as well as competence management (Berio and Harzallah, 2005) – see Fig. 1.

How we can create added value for SMEs?
(focus on human resources)

The use of concept of resource management: management of unique resources which allow SMEs to gain a sustainable competitive advantage

The use of the concept of competence management: managing the competencies of individual employees which allow SMEs to gain a sustainable competitive advantage

Resources:
critical resources in a company represented by the knowledge, skills and capabilities of individuals (Hitt et al., 2001).

Resource:
collective knowledge and capabilities that reside in the organization (Hamel and Prahalad, 1994).

Strategic Knowledge Resource in SMEs:
unique resources of individual employees which allow SMEs to gain a sustainable competitive advantage

Strategic Knowledge Resource: personnel SME usefulness function W_{nm} for the m-th employee in the SME (Patalas-Maliszewska, 2009):

$$\mathbf{W_{nm} = f_1(GK) + f_2(PK) + f_3(A) + f_4(E) + f_5(P) + f_6(C) + f_7(P),}$$

where: n, m$\in$ N,

- $f_1(GK)$ – the general knowledge function for the m-th employee in SME, where: GK$\in$R, and $0 \leq f_1(GK) \leq 5$,
- $f_2(PK)$ – the professional knowledge function for the m-th employee in SME, where: PK$\in$R, and $0 \leq f_2(PK) \leq 5$,
- $f_3(A)$ – the professional abilities function for the m-th employee in SME, where: A$\in$R, and $0 \leq f_3(A) \leq 5$,
- $f_4(E)$ – the experience function for the m-th employee in SME, where: E – is a synthetic index of experience for the m-th employee in SME binding the factors di:

  $E = \frac{\sum_{i=1}^{3} di}{3}$ where: d1- year of work, d2- age of employee, d3- number of realized projects. Each indicator $f_4(E)$ is assessed on a point scale (0 – 5) and $0 \leq f_4(E) \leq 5$,
- $f_5(P)$ – the patents function for the m-th employee in SME, where: P - synthetic index of patents for the m-th employee binding the factors ie: $P = \frac{\sum_{i=1}^{4} ei}{4}$ where e1- number of patents, e2 - value of investment of new patents, e3 – value of copyright, e4- number of project, which are waiting for patents. Each indicator $f_5(P)$ is assessed on a point scale (0 – 5) and $0 \leq f_5(P) \leq 5$,
- $f_6(C)$ – the clients function for the m-th employee in SME, where: C - synthetic index of clients for the m-th employee binding the factors ki: $C = \frac{\sum_{i=1}^{3} ki}{3}$ where: k1- number of all clients, k2- number of permanent clients, k3– number of transactions. Each indicator $f_6(C)$ is assessed on a point scale (0 – 5) and $0 \leq f_6(C) \leq 5$,
- $f_7(P)$ – the m-th employee's personality in an SME, where: P$\in$R, and $0 \leq f_7(P) \leq 5$.

The use of the model of strategic-knowledge resource-management (see chapter 3)

3 Modeling Strategic-knowledge-resource management

To facilitate the use of the model of strategic-knowledge-resource management in SMEs, we build a reference model. For SMEs which belong to the reference model we can define the value of strategic-knowledge resources (the so-called *personnel usefulness function*).

3.1 A Reference SME model

The business processes to be modeled are activities which focus on sales in SMEs. We can distinguish the description of workplaces and the value of strategic-knowledge resources: the so called *personnel usefulness function*. This function is defined for each employee who realizes a determined set of business processes.

Company SMEs

1-Employee
m_1 - Sales Director

P_1 = {p_3- market possibilities and penetration degree analysis, p_4 - target markets description, p_6 - creating customer's decision process map and its import ant factors, p_8 - establishing organisation people who influence purchase decisions, p_9 - establishing customer contacts type, p_{19} - informing about product's qualities, p_{14} - direct talks with a client in company's premises, p_{15}- direct talks with a clients in client's premises, p_{16} - telephone conversations with a client, p_{17} - developing products/services presentation and offer, p_{18} - drives to a customer, p_{21} - co-operation in solving customer's problems, p_{22} - persuading, negotiating and setting sales conditions, p_{24} - presenting final offer, p_{25} - finalising transaction, p_{37} - conducting market analysis for the needs of a customer, p_{38} - presenting new products and technologies, p_{40} - meeting participation, p_{41} - administrative work, p_{42} - trainings participation, p_{43} - supervision of completing the sales schedule, p_{47}- sales prognosis, p_{48}- customers segmentation}

Value of personnel usefulness function: W_{11}

2-Employee
m_2 - Sales Specialist

P_2 = {p_1- looking for contacts, p_2 - potential customers' classification, p_4 - target markets description, p_5 - customer's situation and needs examination, p_6 - creating customer's decision process map and its import ant factors, p_7 - preparing sale conditions, p_8 - establishing customer contacts type, p_{10}- searching and describing potential customers, p_{11} - providing clients with information on company's products and services, p_{14} - direct talks with a client in company's premises, p_{15} - direct talks with a clients in client's premises, p_{16} - telephone conversations with a client, p_{17} - developing products/services presentation and offer, p_{18} - drives to a customer, p_{19} - informing about product's qualities, p_{20} - comparing company's offers with competitive offers, p_{21} - co-operation in solving customer's problems, p_{22} - persuading, negotiating and setting sales conditions, p_{23}- formulating proposals in writing and creating documentation, p_{24}- presenting final offer, p_{25} - finalising transaction, p_{26} - writing orders and complementary orders, p_{27} - registering order for a supplier, p_{26} - purchase registering,p_{27} - sales and delivery registration, p_{30} – invoicing, p_{31} - registering returns and value corrections of commercial documents, p34 - stocktaking, stock control, p35 - stock monitoring, p36 - developing marketing programmes, p_{38} – presenting new products and technologies,p_{39} - production problems solving, p_{40} - meeting participation, p_{41} - administrative work, p_{42} - trainings participation}.

Value of personnel usefulness function: W_{12}

3-Employee
m_3 -Marketing Specialist

3-Employee
m_3 -Marketing Specialist

P_3 = {p_{12}- commissioning advertising in media, p_{13} - developing setting and graphic form of an advert in media, p_{20} - comparing company's offers with competitive offers, p_{40} - meeting participation, p_{41} - administrative work, p_{42} - trainings participation}.

Value of personnel usefulness function: W_{13}

4-Employee
m_4 - Regional Assistant

P_4 = { p_{11}- providing clients with information on company's products and services, p_{15} - direct talks with a client in company's premises, p_{16} - telephone conversations with a client, p_{17} - developing products/services presentation and offer, p_{18} - drives to a customer, p_{19} - informing about product's qualities, p_{21} - co-operation in solving customer's problems, p_{23}- formulating proposals in writing and creating documentation, p_{26} - writing orders and complementary orders, p_{27} - registering order for a supplier, p_{28} - purchase registering, p_{29}- sales and delivery registration, p_{30} - invoicing, p_{31} - registering returns and value corrections of commercial documents, p_{40} - meeting participation, p_{41} - administrative work, p_{42} - trainings participation}

Value of personnel usefulness function: W_{14}

5-Employee
m_5 - Product Manager

P_5 = { p_1- looking for contacts, p_2 - potential customers' classification, p_3 - market possibilities and penetration degree analysis, p_4 - target markets description, p_5 - customer's situation and needs examination, p_6 - creating customer's decision process map and its import ant factors, p_7 - preparing sale conditions, p_8 - establishing organisation people who influence purchase decisions, p_9 - establishing customer contacts type, p_{10} - searching and describing potential customers, p_{11} - providing clients with information on company's products and services, p_{14} - direct talks with a client in company's premises, p_{15} - direct talks with a clients in client's premises, p_{16} - telephone conversations with a client, p_{17} - developing products/services presentation and offer, p_{18} -drives to a customer, p_{19} - informing about product's qualities, p_{20}- comparing company's offers with competitive offers, p_{21} - co-operation in solving customer's problems, p_{22} - persuading, negotiating and setting sales conditions, p_{23} - formulating proposals in writing and creating documentation, p_{24}- presenting final offer, p_{25}- finalising transaction, p_{26} - writing orders and complementary orders, p_{27} - registering order for a supplier, p_{38} - presenting new products and technologies, p_{39} - production problems solving, p_{40} - meeting participation, p_{41} – trainings participation, p_{43} - supervision of completing the sales schedule, p_{44} - quantity and quality claims servicing, p_{45} - gathering data in a database on clients, potential clients, markets etc.., p_{46} - delivery notification, p_{47} - sales prognosis, p_{48} - customers segmentation, p_{49} - customer contact centres}

Value of personnel usefulness function: W_{15}

Fig. 2. Identification of business processes and their characteristics in SMEs – a reference model of SMEs

Each employee in a functional area can participate in more than one business process. For each employee in the functionality area we can define a personnel usefulness function: W_{nm}, $n,m \in N$.

3.2 Identification of a strategic knowledge resource

A personnel usefulness function in enterprises encompasses all the issues concerning employees, e.g. recruitment of new employees and support of their professional development. 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 (KrólandLudwiczyński ,2007). Authors attempt a trial of creating a personnel usefulness function in the aspect of formulating a model of strategic knowledge resource management, i.e. as a chain of decisions describing behaviour in a given period of time.

The personnel usefulness function describes the strategic knowledge resource in SMEs. We distinguish the strategic knowledge resource in the sale are in SME based on the identification of business processes and their characteristics in SMEs (see Fig. 2):

- m_1 - Sales Director
- m_2 - Sales Specialist
- m_3 -Marketing Specialist
- m_4 - Regional Assistant
- m_5 - Product Manager

We can determine the value of each employee based on the personnel SME usefulness function W_{nm} for the m-th employee in the n-th functional area in the SME (Patalas-Maliszewska, 2009):

$W_{nm} = f(GK, PK, A, E, P, C, P)$, where $n, m \in N$ and:

- GK - General knowledge of the m-th employee. The value of this parameter is received as the result of tests for employee, which was evaluated within the range from 0 to 5, where 0 is a bad and 5 is a very good level of general knowledge.
- PK - Professional knowledge of the m-th employee. The value of this parameter is received as the result of tests for employee, which was evaluated within the range from 0 to 5, where 0 is a bad and 5 is a very good level of professional knowledge.

- A - Professional abilities of the m-th employee. The value of this parameter is received as the result of tests for employee, which was evaluated within the range from 0 to 5, where 0 is a bad and 5 is a very good level of professional abilities.
- E - Experience of the m-th employee. The value of this parameter is received as the result of tests for employee, which was evaluated within the range from 0 to 5, where 0 is a bad and 5 is a very goood level of experience.
- P - Patents of the m-th employee. The value of this parameter is received as the result of tests for employee, which was evaluated within the range from 0 to 5, where 0 is a bad and 5 is a very good level of patents.
- C - Clients of the m-th employee. The value of this parameter is received as the result of tests for employee, which was evaluated within the range from 0 to 5, where 0 is a bad and 5 is a very good level of clients.
- P - Personality of the m-th employee. The value of this parameter is received as the result of tests for employee, which was evaluated within the range from 0 to 5, where 0 is a bad and 5 is a very good level.

Effectiveness is measured by degree, it realizes system in that, it has been planned and efficiency is defined by degree, it system use of the resources in that. So, the parameter like E, P and C are related to effectiveness, the parameter like GK, PK, A and P are related to efficiency.

So, the following personnel SME usefulness function W_{nm} for the m-th employee in the SME: is proposed:

$$\mathbf{W_{nm} = f_1(GK) + f_2(PK) + f_3(A) + f_4(E) + f_5(P) + f_6(C) + f_7(P),}$$

where: $n, m \in N$,

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:

- $f_1(GK)$ – the general knowledge function for the m-th employee in SME, where: $GK \in R$, and $0 \leq f_1(GK) \leq 5$,
- $f_2(PK)$ – the professional knowledge function for the m-th employee in SME, where: $PK \in R$, and $0 \leq f_2(PK) \leq 5$,

- $f_3(A)$ – the professional abilities function for the m-th employee in SME, where: $A \in R$, and $0 \leq f_3(A) \leq 5$,
- $f_4(E)$ – the experience function for the m-th employee in SME, where: E – is a synthetic index of experience for the m-th employee in SME binding the factors di: $E = \frac{\sum_{i=1}^{3} di}{3}$ where: d1- year of work, d2- age of employee, d3- number of realized project. Each indicator $f_4(E)$ is assessed on the points scale (0 – 5) and $0 \leq f_4(E) \leq 5$,
- $f_5(P)$ – the patents function for the m-th employee in SME, where: P - synthetic index of patents for the m-th employee binding the factors ei: $P = \frac{\sum_{i=1}^{4} ei}{4}$ where e1- number of patents, e2 - value of investment of new patents, e3 – value of copyright, e4- number of project, which are waiting for patents. Each indicator $f_5(P)$ is assessed on the points scale (0 – 5) and $0 \leq f_5(P) \leq 5$,
- $f_6(C)$ – the clients function for the m-th employee in SME, where: C - synthetic index of clients for the m-th employee binding the factors ki: $C = \frac{\sum_{i=1}^{3} ki}{3}$ where: k1- number of all clients, k2 - number of permanent clients, k3– number of transactions. Each indicator $f_6(C)$ is assessed on the points scale (0 – 5) and $0 \leq f_6(C) \leq 5$,
- $f_7(P)$ – the m-th employee's personality in SME, where: $P \in R$, and $0 \leq f_7(P) \leq 5$.

It is possible to receive indispensable data for account of value personnel usefulness function from companies belonged to reference model of SME (see Fig. 2) by interview in each enterprise.

3.3 A Model of Strategic-knowledge-resource Management

In order to present our model of strategic-knowledge-resource management in SMEs we introduced the definition of strategic-knowledge resources (see Fig. 1). The framework is based on the premise that the focus should be placed on the way individual knowledge is used to build the critical capabilities a company needs in order to succeed—on the core processes and activities that enable it to compete.

The framework starts with the identification and the categorization of strategic-knowledge resources. Work can be evaluated along two dimensions. The first is the level of comparison and assessment, i.e. the degree to which employees need to collaborate and interact. The second is

forecasting — the degree to which employees need to contribute towards the growth of innovative firms. Using these two factors, we have identified the following model:

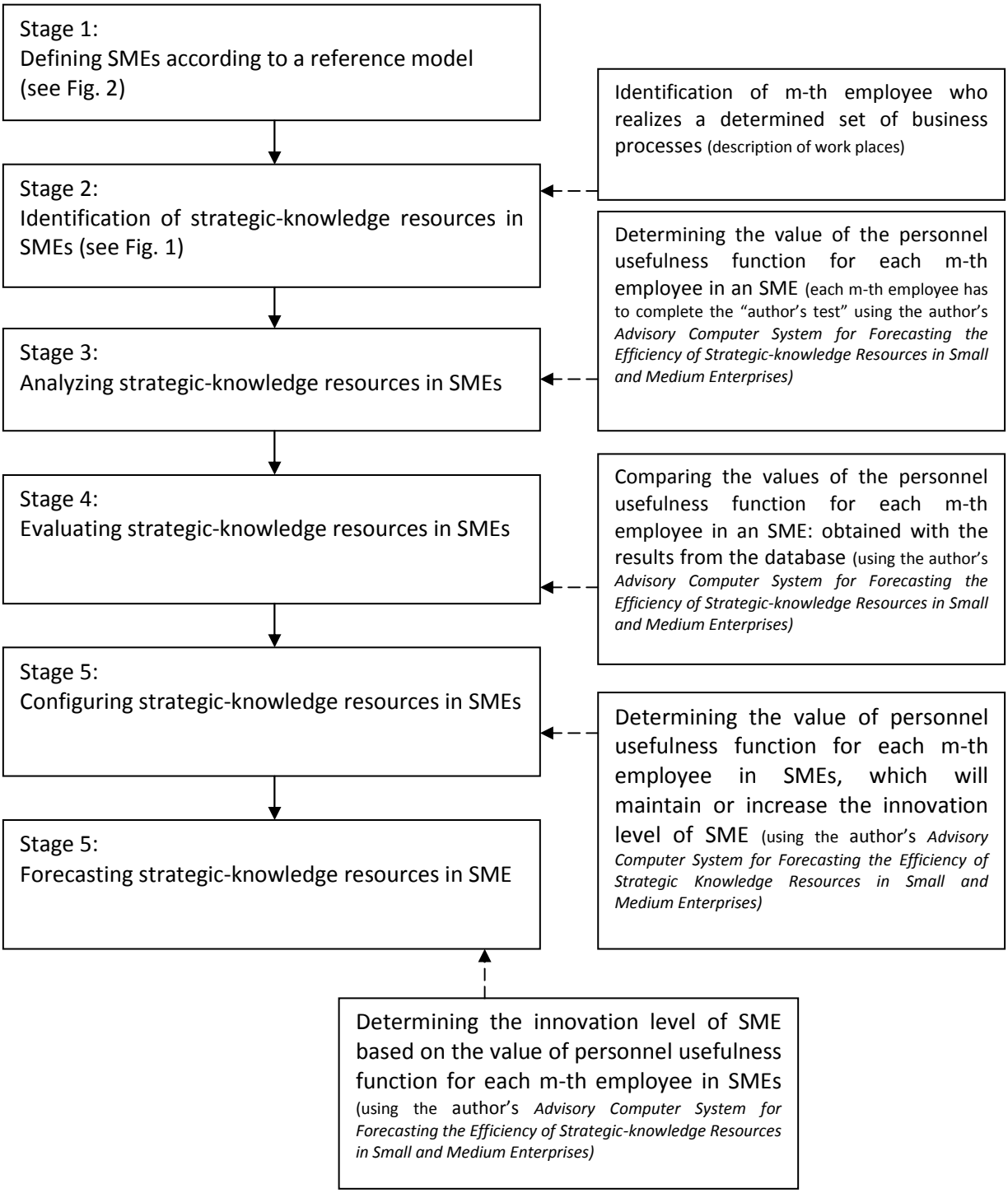

Fig. 3 A model of strategic-knowledge-resource management in SMEs.

Using the defined model is crucial in regards to the competitiveness of a company. Integration of resource and competence management in a company is the basis for its development strategy. In further works, the author's *Advisory Computer System for Forecasting the Efficiency of Strategic-knowledge Resources in Small and Medium Enterprises* will be presented.

4 Conclusions

The concept of strategic knowledge resources encompasses the employees of enterprises together with their education, experience, professional qualifications, work performance, interpersonal relationships and communication skills. Both resource and competence management can be conceived as complementary elements of the complex strategic-knowledge-resource management formation process.

This paper is aimed at new ideas to help determine knowledge resources in SMEs. SMEs should find special support for increasing and improving their knowledge. Such knowledge can then act as a driving force behind operational stability and the establishment of a permanent competitiveness in the market.

Research is necessary to create economic growth and social development. Creating the author's *Advisory Computer System for Forecasting the Efficiency of Strategic-knowledge Resources in Small and Medium Enterprises* will provide an advantageous tool which can be used to promote the practice of knowledge management.

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