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Developing a Measure of Intellectual Capital Fit: An Approach to Improve Business Processes

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Abstract: Accounting standards acknowledge the importance of Intangible Assets in evaluating a Company Value. In this period of turbulent markets, the capacity of a company to resist is strictly connected to its ability to leverage and develop its Intellectual Capital. This article makes a point in the literature about Intangible assets as a strategic asset for companies' development. We will show how the adoption of proper Knowledge Management practices can help the exploitation of the intangible asset as a key competitive factor. Intellectual capital is an asset difficult to measure. However, the intellectual capital is relevant when producing value for an organization. The approach that we have developed at Corvinus University, and we are testing in different business contexts is promising to provide an indication of the real fit of competencies between individuals and the required knowledge necessary to run an organization.

Keywords: Knowledge Management, Intellectual Capital, Business Processes, Role Fit.

1. Introduction

When Facebook went public in 2012 it was quoted at 104 billion dollars, however at that time it did not have any revenue. (Olney, 2012) In a famous conference, Bill Gates CEO of Microsoft said: "Our primary assets, which are our software and our software-development skills, do not show up on the balance sheet at all; this is probably not very enlightening from a pure accounting point of view." (The Economist, 1999) At the end of the last century, the economic society realized that the values of a company are not related only to its physical assets but in particular in the so-called "Intangible assets." The protection of such valuable asset is key for the resilience of the knowledge intensive companies. In this article, we start by illustrating different meaning and interpretations of the intellectual capital in the literature. Furthermore, we will describe how smart companies that are resisting to the competitive market environment uses or may use Knowledge Management Practices to develop and focus their intellectual capital. Finally, we will introduce the Prokex Approach developed at Corvinus University to develop and retain the corporate knowledge with particular emphasis to the techniques for measuring the Knowledge fit within an Organization.

2. Understanding the roots of the Intellectual Capital

In this chapter, we make extensive use of the consideration of Jashapara in the definition of the Intellectual Capital (Jashapara, 2011) and from the Oxford Handbook of Human Capital (Burton-Jones & Spender, 2011)

A simple definition of intellectual capital (IC) is the difference between the Market value of a company and its net book value. (Svieby, 1997). This discussion highlights the necessity of justifying the value of a company that was not resulting from the ledger of the physical assets. From that definition, we can identify this difference all that intellectual material such as knowledge, information, intellectual property, which can create wealth. (Stewart, 1997) It is clear that the concept is complex and may not be characterized univocally. Different models explain different connotation and phenomenology.

A typical general description of the IC is the one expressed by the Danish Confederation of Trade Unions (Danish Confederation of Trade Unions, 1999) or the one expressed by Petrash. This approach links the Intellectual Capital to the creation of value. That can be conducted to the maximization of three dimensions: Customers, Human Resources and Organizations (Petrash, 1996).

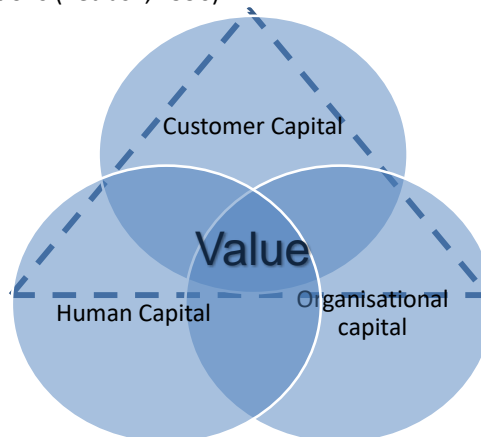


Figure 1: Intellectual Capital

In this classification of the various theories, I will refer to the general model by Góran and Johan Roos that extend Petrash's approach. (Roos & Roos, 1997) Please note that some theories do not follow the same classification, but I will refer back to it for easy reading.

According to the definition given by OECD, ¹ IC is the economic value of two categories of intangible assets of a company: organizational («structural») capital and human capital. (OECD, 1999) This definition helps understand that Intellectual Capital is not equivalent to intangible assets but is a subset of those. An intangible asset can qualify as IC only when to create value for the organization. This definition also clarifies that in a company, the IC is partially a structural and tangible asset of the organization (such as software, codified knowledge, patents, databases). Those are partially embedded in the human resources as professional competence.

2.1 Human capital

Schultz and Becker give the earlier definition of Human Capital as the activities that influence monetary and psychic income by increasing the resources in people. (Schultz, 1961) (Becker, 1964) This definition highlights the importance of increasing the resources related to humans in the organization as an enabler for the creation of value for the organization. The success of any company lies in the optimal utilization and development of its core competencies indeed. Core competencies consist of a combination of intangible assets that flourish in a given culture. (Hamel & Prahalad, 1994)

We shall clarify that when we refer to Intellectual capital in the domain of Human Resources we should distinguish between competence and competency. Competencies can be defined as knowledge, skills, mindsets and, thought patterns resulting in successful performance (Dubois, 1998).

Those are the overall competence present in the company and not necessarily represent an asset for the company. On the other hand, competence refers to the critical skills, knowledge, and associated best practices specific to definite tasks leading to optimal accomplishment of organizational goals or enhanced organizational performance (Gilbert, 1996).

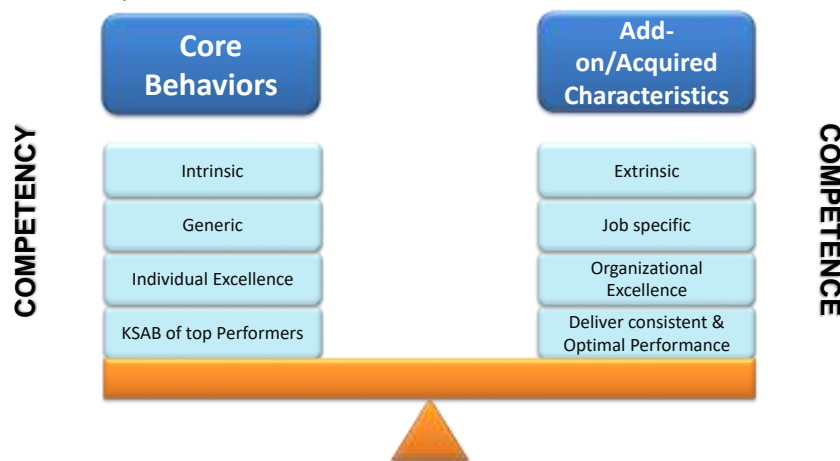


Figure 2: Competency vs. Competence (Warier, 2014)

It is clear that a company more than developing the competencies in the company need to maximize the competence. The possibility, to measure the IC, is strictly connected to the problem of improving the internal competence. Unfortunately, the economic theory does not reflect the knowledge creation theory; in fact, human capital is more discussed from an organizational learning only. (Reinhard, 2002).

In general, the evaluation of competencies and competence is very sophisticated and include analyzing the human resources from several point of view. An interesting model is the one designed by Lowendahl. This model focus on the different nature of the intangible assets (in particular those that we define here Human Capital). It distinguishes the hard (Competence) from the soft (Relational) nature and the Individual from the collective. (Lowendahl, 1997)

¹ The Organisation for Economic Co-operation and Development (OECD) is an international organization that has as mission to promote policies that will improve the economic and social well-being of people around the world. - <http://www.oecd.org/>

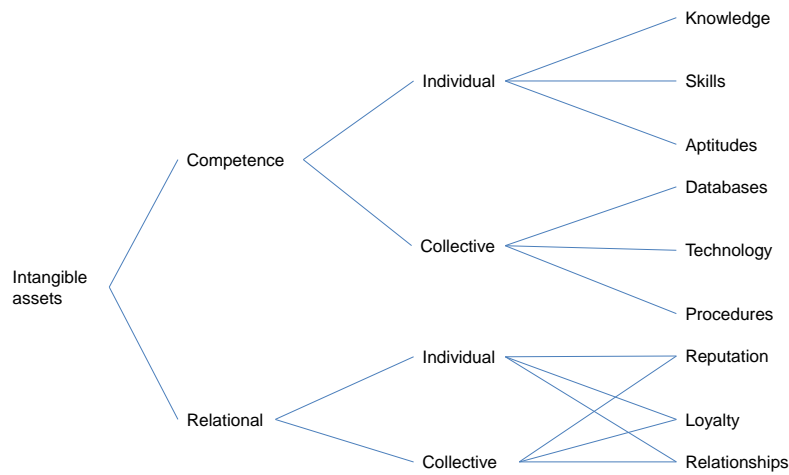


Figure 3: Lowendahl approach

According to Warier, the so-called Core competencies are the most important constituent of the “competency quotient”. However, it contributes to 14% of the overall score. (Warier, 2014)

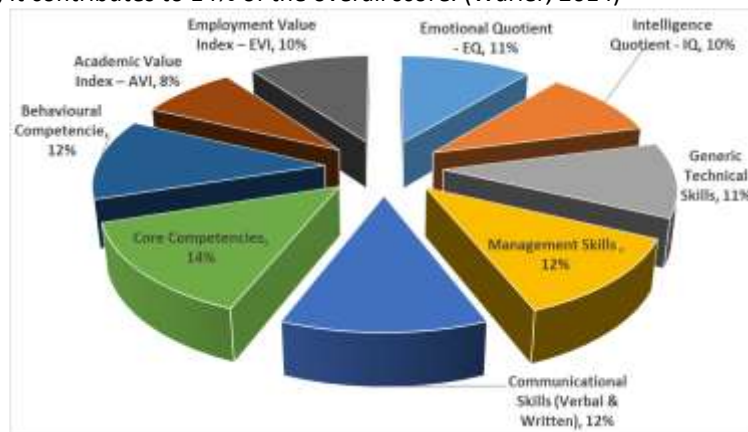


Figure 4: Primary constituents of the Competency quotient

Even if their contribution is limited, core competencies are the straighter forward to measure. At the Corvinus University of Budapest, we are developing, an approach and a methodology to identify those knowledge elements that are assets for the organization. The underlying concept is that each person in the company plays one or more roles. That role is attributed to a process but need competence to be performed. The competence is, therefore, the element of the knowledge that fit the role. In fact, it is necessary to implement an activity of the process. The ProKEx system map competencies stored in the domain ontology with the representation in Business processes. In that way, identify for each role the required competence and provide an approach to measuring it. (Arru, 2014)

2.2 Organisational capital

According to the OECD model, the Organizational capital is part of the Structural capital.

With the Organizational capital, we are referring to the optimization capability of the organization where there is suboptimal human capital. Tomer distinguishes two organizational capitals:

- Pure form (organizational structure)
- Hybrid form (embodied in individuals' through investment in socialization)

According to Tomer, the investment in Organizational capital is finalized to increase the productivity of the firm. (Tomer, 1987) The concept of the Organizational capital as an enabler for creating value is present in other models. For instance, the Balanced Scorecard (BSC), which is the most prominent model for performance management in business, put the Innovation and learning perspective as the foundation layer of each company strategy. In this framework, the business results are connected to Core measurements of the organizational capital that are enabled by the Staff Competencies, Infrastructure, and Climate. (Kaplan & Norton, 1992)

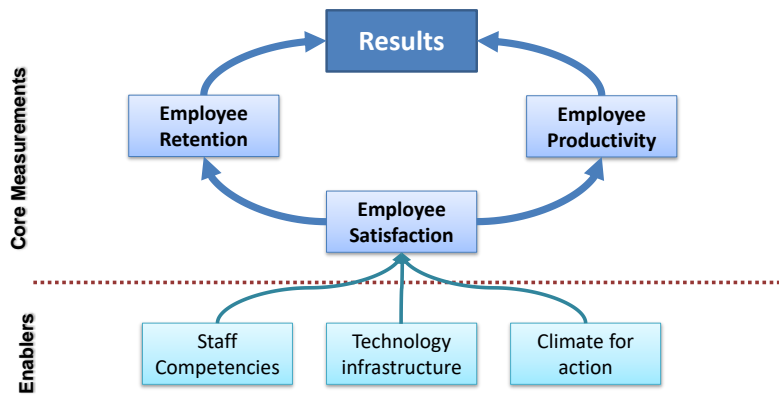


Figure 5: The Learning and Growth Measurement Framework of the Balanced Scorecard.

The European Foundation for Quality Management (EFQM), in its excellence model, describe the Innovation and learning the process. It involves a certain number of enabler to produce results. (Eccles & Nohria, 1992)

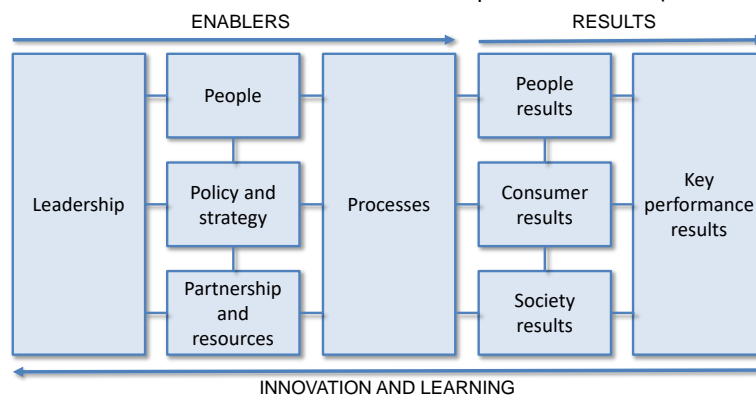


Figure 6: EFQM Excellence Model

Edvison and Malone locate Organizational Capital within the structural capital. In their approach, an Intellectual capital is related to the processes and their optimization. A different capital is the one able to generate innovation.

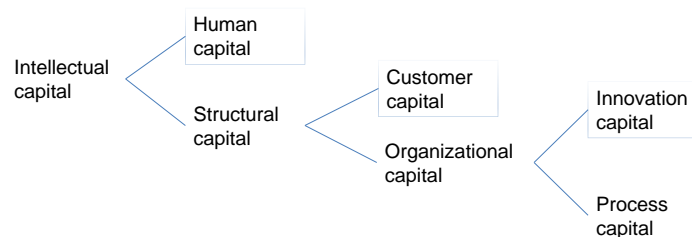


Figure 7: (Edvison & Malone, 1997)

The concept of innovation is crucial: in the next chapter, we will discuss the strategic role of innovation for the smart companies. In the literature in the area of the Structural Capital and about the Organizational Capital, several experts discuss the level of codification of those capital assets by the theory of knowledge creation theory. (Nonaka & Takeuchi, 1995) This is the case of Brooking that focuses on the asset nature of the IC. According to Brooking Market Assets, Human-centered Assets, Infrastructure assets and Intellectual property assets constitute the IC. (Brooking, 1996) Furthermore, Sullivan explains that those can be found in different stages of the knowledge creation. The tacit knowledge of Human Capital generates intellectual assets that may become Intellectual property. (Sullivan, 1998)

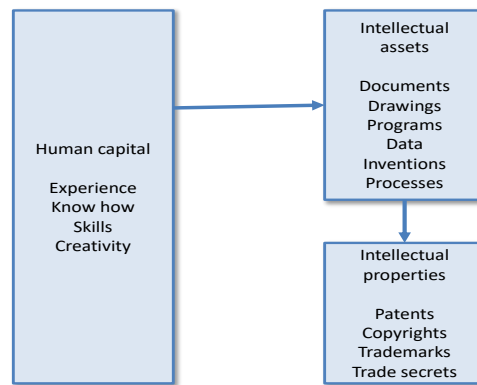


Figure 8: Sullivan's model

The Intellectual property is, therefore, a form of intellectual capital that is more resilient in an organization. The higher level of protection of the value embedded in the intellectual property is the patent. The company, to preserve its value, should promote the transformation of Human Capital in Intellectual property.

2.3 Customer and relationship capital

Among the structural capital great emphasis, has been given by financial and marketing experts to evaluate the value of the relations that a company has with stakeholders and in particular with its customers. The customer and relationship capital is very often present in a tacit form of the human resources (sales, people, service people, customer service...). However, this is considered among the different categories of intellectual capital the one more connected to the value. In fact, if the IC can exist only when it produces a value for the organization, as previously stated, it is clear that the reason for the value, to exist is that there is a Customer to grant it. Companies introduce "customer relationship management" (CRM) practices to maximize the customer equity. In this approach, the client is a financial asset that firms and organizations should measure, manage, and optimize just like any other asset. (Blattberg, et al., 2001) Among the business strategies, the one of following the customer need it is one of the prominent giving a great advantage to those companies that implemented it. Other companies have evolved the CRM to become reactive to the shopping clients and customize the value proposition in real-time.

3. Knowledge management perspective for the future

KM supports smart companies (Griffiths, 2014) in leveraging their Intellectual Capital by working at three levels:

- Technology level (providing IT tools to resolve knowledge related issues)
- Human resources (providing models to assess and develop the human capital)
- Organization (providing processes and paradigm to transform competencies in competences)

In this chapter, we present some application trends where KM can provide support to the smart organization.

3.1 Support to core knowledge processes

Smart organizations work on the knowledge-intensive support processes to automatize and make core processes more light. However even in core processes, there is a strong human component. For instance, an area of research for KM is to automate knowledge-driven processes. A promising area of application and research is the application of semantic technologies to substitute or to support a human in the implementation of repetitive tasks.

3.2 Communication, elicitation, and codification tools

Several sets of application, from remote communication to workgroup facilities, provide support for knowledge transfer and elicitation. The challenge in this area is to be able to organize the knowledge acquired so that can be available to the people that can benefit from it. In this field, knowledge classification tools including ontologies and taxonomies will provide the formal background.

3.3 On-demand services

Technology is one of the most important factors that KM should be kept aligned with, to keep itself powerful and useful. KM can benefit from emerging Cloud computing for two aspects. It helps keeping it aligned with the new technological progress and providing an excellent means that can profoundly help knowledge sharing and acquisition in a highly distributed and dynamic environment. (Sedigheh Khoshnevis, 2012) In particular, for the new startup that may not afford significant infrastructure investment, this will allow them to benefit from those technologies. Furthermore, the pervasiveness of the cloud will be making physical proximity less important for cooperation improving the networking beyond the limit of the organizations. However, as KM is not only

technology but also more broadly management approach, the concept of KM as a service will become important to promote and sustain the new macroeconomic scenario.

3.4 Adaptive knowledge management

With the dramatic environmental changes and fierce competition that organizations are facing today, managing knowledge becomes critical for driving creativity and adapting to changing markets. Organizations lack direction on how best to develop an adaptive strategy for managing knowledge. The revelation of adaptive processes for managing knowledge in complex systems can lead to more effective KM practices and a higher rate of creativity and flexibility. (Sherif, 2006)

3.5 Analysis tools

New flexible business intelligence systems, help analyze the current performance of the companies and can improve the understand of the operational and strategic issue in the organization. Trough semantic interoperability those systems can be connected with third parties' systems and large data systems to provide market orientation. The integration with CRM² furthermore, can enrich the understanding of the customer value and orientate strategic decisions. The application of analytics and big data derived from the online social behavior is a very promising technological that can provide essential elements to orientate the innovation process of the smart organization.

Our research at the Department of Information Systems of the Corvinus University of Budapest focuses in particular on the analysis of the intellectual capital within the organization. The tools, which we are developing in our department, uses ontologies to develop tests and e-learning systems that can measure the knowledge of the staff of the organization about a particular job role.

4. The ProKEx project

With the ProKEx project, in particular, starting from the representation of the firm processes by mean of BPM models (Gábor & Szabó, 2012). We identify a subdomain of an ontology that is covered with this process domain to provide context-specific tests. (Arru, 2014) The technology utilizes techniques of Process modeling, text mining (Gillani & Kó, 2014) and ontology matching. The application of adaptive testing provides an innovative approach to measuring the coverage of the required competence and at the same times results in a powerful tool for self-training. (Weber, et al., 2014) The applications of this approach may go beyond the e-learning but can be applied to a more comprehensive evaluation of the fit of resources to the required domain necessary to run the processes in an organization. It is common practice in the structured organizations to have a formal model of their processes using Business Process Management (BPM) practices. The formal representation and the documentation of such process is a valuable asset to promote the resilience of the organization to rotation of staff and to promote quality improvement. The main challenge in Business Process Management (BPM) is the continuous translation between the business requirements view and the IT systems and resources. The usage of Semantic Business Process Management (SBPM) allow enriching the potentialities of BPM, enabling automated translation between the two perspectives. (Török & Ternai, 2011) The approach adopted by this study will provide a paradigm to evaluate the degree of alignment between process requirements and domain requirements and providing input to the domain expert to revise critically the process and to enrich the Business Process Model. The goal of the proposed project is to develop a solution to extract, organize and preserve the knowledge embedded in organizational processes to:

- enrich organizational knowledge base in a systematic and controlled way,
- support employees to easily acquire their job-role-specific knowledge,
- Help to govern and plan the human capital investment.

ProKEx aims to address these issues through an IT solution and method that integrates:

- organizational process management tool,
- learning management tool (Kismihók & Vas, 2006),
- real-time data monitoring and processing tool,
- data and text mining tools for developing domain ontology (Gillani & Kó, 2014) and
- the interfaces that are responsible for the communication between these components.

4.1 How does it work

An explanation of the ProKEx architecture available in previous publications (Arru, 2014). The four major components constitute the technology and that implement the iterative translation from the process to the ontology domain.

- A process model
- Translation to a domain model

² Customer Relationship Management

- Content development and exploitation of the ontology
- Feedback to the process model

4.2 Knowledge deployment from process to job-holder

This paper would like to provide a possible measure of intellectual capital that in particular can measure that set of competencies that can support the operativity of companies processes. In particular, we would like to provide a framework to analyze the fit between the knowledge required and the knowledge available in an organization. To be able to understand the knowledge fit in the context of ProKEx is relevant to understand how the knowledge of the people is allocated to the processes through different entities. A process is a set of interrelated activities sequence of tasks that interact to achieve a result. In our work, we refer therefore to a task as an activity that is performed within a process. According to WorldAtWork, a Job is the total collection of tasks, duties, and responsibilities assigned to one or more individuals whose work has the same nature and level of work. (WorldatWork, 2007) In the context of ProKEx, we will use this definition to refer to a “job role”. According to this definition, we can say that a Job Role is associated with the work to be performed within one or more task. According to the same source, a “Position” is a group of specific duties, tasks, and responsibilities assigned to one employee. We, therefore, consider a Position as a set of roles that are identified for a particular job holder. A position exists despite its association to a given job-holder. This is the case when the position is used to advertise job opening or to standardize the management of different individuals (for example when there are a group of people performing the same set of roles in different shifts or different production lines).

To better clarify the difference between those entities let’s consider a nursing context. Examples of Task are: “Registering a new patient” or “Measuring Blood Pressure”. All those tasks can be performed by the same job role, for instance, a “General ward nurse”. In this hospital, for example, the “Nurse” position can be associated with both the “General ward nurse” and the “Postoperative Nurse”. Finally, in the same hospital can work at the same time filling the “Nurse” position Mrs “Mary Breckinridge” and Mr “Walt Whitman”.

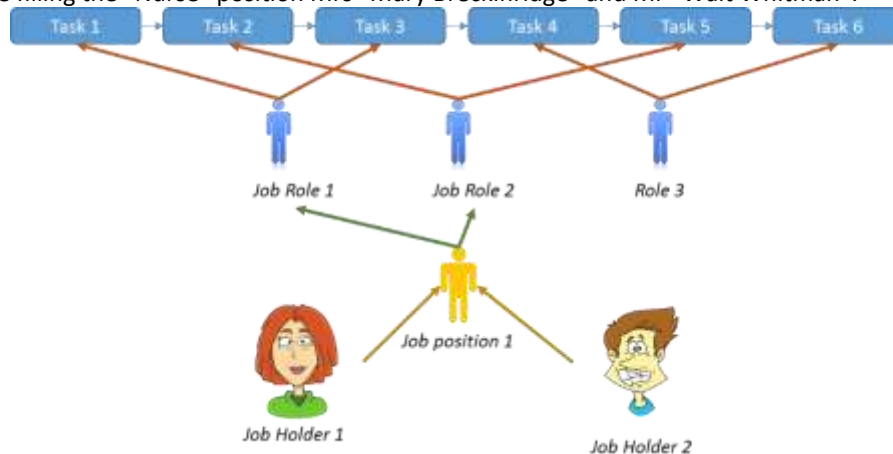


Figure 9: Elements of the ProKEx knowledge deployment

When an organization employs a Knowledge worker, it does for their capacity to fulfill specific roles. However, the knowledge of an individual goes beyond the knowledge necessary to fulfill his duties within the position.

4.3 Representation of the Knowledge required for a job

Given this preamble, the knowledge worker is hired by a company for his capacity of running its processes. Opposite to the way computers and machines work, the human needs to learn the knowledge related to a job, and they can also forget it. Furthermore, from humans being it is expected that they can make use of the knowledge not only procedural and take decisions in the implementation of their actions based on an extended knowledge that is not strictly formalized within the Business Process Model. Using ProKEx we provide a tool that can select from a vast domain (represented within an Ontology) the knowledge necessary to run a task also considering this knowledge that is not directly derived from the process model. Using ProKEx, we combine the knowledge required to execute the tasks to identify the knowledge that constitutes a role, and a specific Job positions.

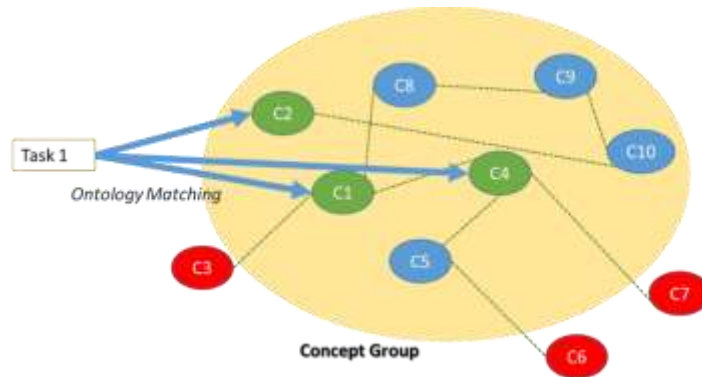


Figure 10: Ontology mapping to a Concept Group

In STUDIO, we define a “Concept group” as the part of the Ontology that describes the knowledge necessary to run a particular process task, or associated with a particular job role or position. The concept group represents the ideal map of the required knowledge for a specific task, job role or job position. A concept group can be used as a formal representation of the knowledge possessed by an individual in a particular domain. In Studio, in fact, we have the possibility to associate questions to each node and to run test through a dedicated platform. Within a “Concept group”, we define a set of the ontology nodes that represent the knowledge available or necessary at each level of the ProKEx knowledge deployment from Processes to Organization.

4.4 Different measures of the Knowledge Fit

The Fit is a measure of the overlap between two entities in this ProKEx knowledge deployment.

According to the different problem, we can decide to study the fit close to the domain of the problem or to enlarge the domain to the residual knowledge that is not related to the problem. We can therefore either focus the fit analysis to the problem itself or to the individual or a broad level of analysis.

Given R the set of knowledge ok knowledge elements in the Concept group related to a specific job role, we can decide to test an individual against the knowledge of R or to test her or him against the overall knowledge of the Domain D. In the most general case we can assume to do this against the largest knowledge D and the result of the test is represented by the concept group I.

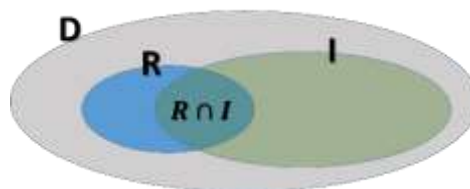


Figure 11: Knowledge Fit

The Knowledge Fit is always a measure that is related to a problem. If in our case the problem is how the knowledge of the individual fit the knowledge for a role, the Knowledge fit is given as ratio of the cardinality of the intersection of R and I and the cardinality of R: $f(R, I) = \frac{|R \cap I|}{|R|}$.

Of course If the domain of the test is broad enough to cover the concept group of several roles, for the same individual I can obtain different knowledge fit with different roles and the vector containing the fit with all different roles can represent a measure of the knowledge fit of the individual with the organization and can be used to derive indicators of flexibility of the individual within the organization.

If the concept groups related to an organization set is $O = \langle R_1, R_2, \dots, R_{n-1}, R_n \rangle$ the organization fit is the vector $f(O, I) = \langle f(R_1, I), f(R_2, I), \dots, f(R_{n-1}, I), f(R_n, I) \rangle$.

What we have discussed so far related to the knowledge tested with individuals can also apply to other entities, for instance, University Curricula and we can measure those against the Organization set.

The measure of the Knowledge fit, however, represents only one element of the fit analysis. Once identified a gap the fit analysis should bring the attention to the actual elements of distance, and, therefore, it opens to more qualitative investigations.

The knowledge fit analysis is a framework that can help organizations taking decisions. Using STUDIO, we aim to provide a measure of knowledge fit to support the analysis of the following problems:

Role	to what extent the availability of roles is sufficient to drive the processes		
Position	to what extent an organization has the right positions available to run its processes	to what extent the roles are correctly associated with the positions	
Job holder	to what extent the organization has enough job holder to run the processes	To what extent job holder is flexible to play several roles in the organization	to what extent a job holder has the knowledge to fit a particular job position
	Task	Role	Position

4.5 Benefit of the Model

Based on such measures the management may find ground justification to support several organizational decisions such as:

- Train the job-holder to improve their fit with the position
- Recruit new employees that have the proper knowledge fit.
- Re-allocate the roles to different positions
- Re-define the Roles to fit better the process and the Job holders
- Re-define retention and HR policies
- Re-engineer the processes or redefine the services that the processes supports

4.6 Applications

The ProKEx application has been applied in different business context:

- Insurance Business
- Food Safety Agency
- A European Funding Agency

The usage of ProKEx to measure the knowledge fit is now under testing in the context of Nursing professions. In Studio, we have developed an initial ontology starting from nursing academic material and manuals. This ontology constitutes a nuke of concepts that will facilitate the ontology matching.

We are identifying target clinical processes in some partner organizations where we would like to select the concept groups that relate to the main nursing roles within this processes. We will then ask an expert (possibly a senior nurse or an academic) to validate the ontology on the basis of the ontology matching process, and we will enrich the ontology accordingly.

We will, therefore, request nurses already operating in the ward of the target to be tested on the knowledge of the concept group. We will also test some nurse that are not working in the same ward or are still student and check if the differences in the fit are significant to draw one of the following conclusion:

- The knowledge of the operating people should be updated in certain subjects.
- The knowledge to operate in the process is fairly widespread in the organization that synergies can be identified with different wards.
- To be able to move from one ward to another there is a certain domain that is necessary to be reinforced with specific education or training.
- The curricula of the future nurses are in line with the requirements of the ward or should be adapted.

The last two, in particular, can lead to a further level of analysis: we can compare the curricula concept group with the process concept group and measure the match.

5. Conclusions

With the ProKEx approach, we would like to create a tool to connect the knowledge available with its exploitation within the processes of an organization. ProKEx may provide a framework for measuring the knowledge fit between the knowledge available and the necessary to run its processes that can serve different Organizational decisions. By analyzing the gaps and the difference between the knowledge included in the processes with the one formalized in the ontology, with the domain enrichment techniques and with the further analysis of the knowledge fits, we expect to identify a process to bring out this tacit knowledge that still is missing formalization.

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