Intellectual Capital and Corporate Performance

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Abstract: In this paper we offered a new approach towards analysis of Intangible Assets. The conceptual framework of our research was based on taxonomy proposed by Contractor (2000) and we focused our study on intangible assets that formed uncodified human capital. The aim of this research was to discriminate the most crucial intangible assets that were absolutely indispensible in the organisational value creation. On the basis of a questionnaire tool we constructed an Information Table according to Pawlak (1982). Next we applied Rough Sets method to analyse our data. The choice of the data analysis technique was determined by numerous advantages associated with Rough Sets that were not so obvious in turn when considering traditional statistical methods. Consequently we obtained a set of intangible assets that were absolutely necessary in the organisational value creation process. This set was form by 14 different indicators that embraced aspects related to training, competencies and culture. Nearly all of them had a qualitative character. In relation to training, apart from the training's frequency and quality, such aspects as knowledge dissemination and evaluation of the need for training were highlighted. Despite of being under in the area of Training, the aspect of cooperation was emphasized in the area of Competencies. In that section, apart from the requirement of particular knowledge necessary in each position, importance was placed on soft skills like motivation, team building and cooperation. In the area of organisational culture there were two elements of importance: the level of freedom when performing duties and the degree to which management attends to employee's problems. Consequently, we can conclude that despite belonging to various sections, all of the crucial intangible assets stressed the absolute importance of the active participation of employees in the organisational decision making. This constitutes clear evidence of the important role of Intellectual Capital in corporate value creation.

Keywords: intellectual capital, intangible assets, rough sets, measurement

1. Introduction

The globalization of economic activity, the increasingly sophisticated and demanding consumers, as well as recent, significant advances in Information Technology, have caused substantial changes in the perception of the corporate value creation process. Introduction of internet-based technologies into the business milieu has resulted in an obsolescence of the traditional factors of competitive advantage (such as land, labour or capital). Consequently, inherent in the new media opportunities have refocused attention to new, less tangible assets, harder to imitate by rivals, and thus more sophisticated drivers of corporate performance. Intangible Assets and consequently, Intellectual Capital have become buzz words in the academic and business setting. Numerous conferences, articles and debates were and still are focused on these concepts. However, despite considerable interest, empirical research in the area of intangibles poses a serious challenge. A perusal of the literature reveals that there is still unresolved discussion concerning the meaning of Intangible Assets (henceforth IA). This in turn is a consequence of the fact that the boundaries, constituents and definitions of IA vary according to the perspectives of the different interest groups. Likewise, measurement problems are resultant of the struggle related to the definition of the concept. Various valuation and measurement models have been proposed. While some authors concentrated on indices, others tried to propose some monetary value for intangibles. Unfortunately, none of the approaches has been free from criticism and thus none of them have been commonly accepted. Nevertheless, despite serious problems inherent in the valuation and measurement of intangibles, scholars still search for new, better methods and models. Consequently, this paper aims at providing a new outlook on intangibles and their impact on corporate performance. We base our investigation on the empirical data gathered through a questionnaire tool distributed among Polish companies. The purpose of our analysis is to discriminate between those intangible assets that are significant in the corporate value creation process and those that are irrelevant and thus redundant. The results of our research will be a set of intangibles that constitute the most important drivers of corporate value. We hope that this array will be of assistance to the companies that are investing significant money in the effective management of their intangibles and will enable them to gain competitive advantage. On the other hand these results will also constitute a foundation for a further empirical investigation.

2. Intellectual capital: Definitions and measurement problems

Despite much interest and research in the area of Intellectual Capital (IC) (Dumay, 2009), (O'Regan et.al. 2001); (Sriram, 2008), (Maciocha, 2007a), (Liu et.al, 2009); (Lee, Guthrie, 2010); (Choong,

2008); (Tan et.al. 2008) the disagreement among the academic community related to the definition of a firm's collection of intangible resources is still present in both scientific and professional milieu.

From their different scientific and professional backgrounds, managers, accountants and information science researchers propose different descriptions of IC (Marks, 2001), (Dzinkowski, 2000) (Bontis, Serenko, 2009) (Andriessen, 2004) (Allard, 1997) (Miller, 1999) (Huang, 1998) (Sveiby, 1997). In its narrowest aspect, IC is depicted in terms of different elements of intellectual property plus so called 'other intangible assets' without any explanation of what the 'other assets' are (Marks, 2001), (Dzinkowski, 2000). A more clear definition trying to explain some of the elements of the 'other intangible assets' is offered by Miller (Miller, 1999): "…IC embraces much more than the patents, copy rights and other forms of the intellectual property rights. Here is also market presence and community influence. It is also the source of inspired innovation and wealth production- the precursor for the growth of financial capital…". On the other hand, it is possible to encounter definitions that are able to embrace all the aspects of IC, in this case however they are rather very imprecise and vague. One of these is suggested by Allard (Allard, 1997) who presents IC as the combination of the smart, visionary management, information-age, analytical talent, as well as proprietary models enabling profit maximization by closely fine-tuning products to consumer perception and valuation. Here we can place definition proposed by Karl Eric Sveiby (1997) who defines Intellectual capital as a type of intangible asset – invisible assets, which include employees' competencies, internal and external structure. Similarly, a quite vague definition was recommended by Huang (Huang, 1998) for who IC consists of information, know-how, experience, wisdom, ideas, object, code, models and technical architecture that are structured to enable sharing for reuse to deliver value to customers and shareholders. The state of the art in the field is very well portrayed by Mouritsen (2003, 18):

> *"…Intellectual capital (IC) is a drama, because even if it is presently very difficult to make distinct boundaries around it, IC is presented as the intangibles stuff, out of which "value" in a knowledge society and therefore knowledge organisations are created…".*

Unfortunately, this is not the only one problem for researchers in the IC field. A perusal of the literature reveals that IC is used interchangeable with other terms such as intangible assets, knowledge assets, organisational knowledge, strategic capabilities, information assets and so on (Kasiewicz, 2006), (Perechuda, 2006), (Arvidsson, 2003), (Martinez , 2006)).

For example, according to the International Federation of Accountants (1998) IC can be considered as the knowledge-based equity of a company. According to Tovstiga and Tulugurova (2009), IC consists of enterprise's strategic capabilities. Lonnqvist (2009), in turn, considers knowledge as the main form of IC and Peng (2007) perceives IC as a set of organisational critical resources. Finally, as Choong (2009) proposes to start a description of IC from the definition of intangible assets, Soler and Celestino (2007) claim that IC is constituted from a set of intangible assets that are available to the firm. Consequently, a number of authors (Sveiby, 1997) (Lev, 2001) treat all these concepts as idioms and that causes further confusion in the field (Ortiz, 2009); (Choong, 2008).

The above mentioned obstacles trigger serious difficulties for empirical research, especially in the areas of measurement and valuation of Intellectual Capital. The IC measurement difficulty is well explained by Contractor (2000). By taking into account the scope of control over the particular elements and the possibility of separating them from the other intangibles, he distinguishes three types of organisational intangible assets (fig. 1):

- **Formally registered assets** – formally registered Intellectual Property Rights
- **intellectual assets** as embracing the above-mentioned formally registered Intellectual Property Rights plus unregistered organizational knowledge codified in the form of drawings, software, databases, blueprints, formulae and written trade secrets
- **Uncodified human and organizational capital,** which includes such constituents as company reputation, customer loyalty, network links and other 'goodwill' type items.

He explains that as we move further from level I towards level II and consequently III – the discrimination and thus valuation of these assets becomes more difficult and becomes nearly impossible when dealing with uncodified human and organisational capital – the third type of intangible assets. This also relates to the spectrum of the IC definition that was mentioned earlier. The first level of intangibles is much easier to define and thus valuate; however, they constitute only a

fraction of all organisational intangibles. As we try to define the remaining assets we need to use much broader definition and thus it is harder to provide any correct and valid measurement method.

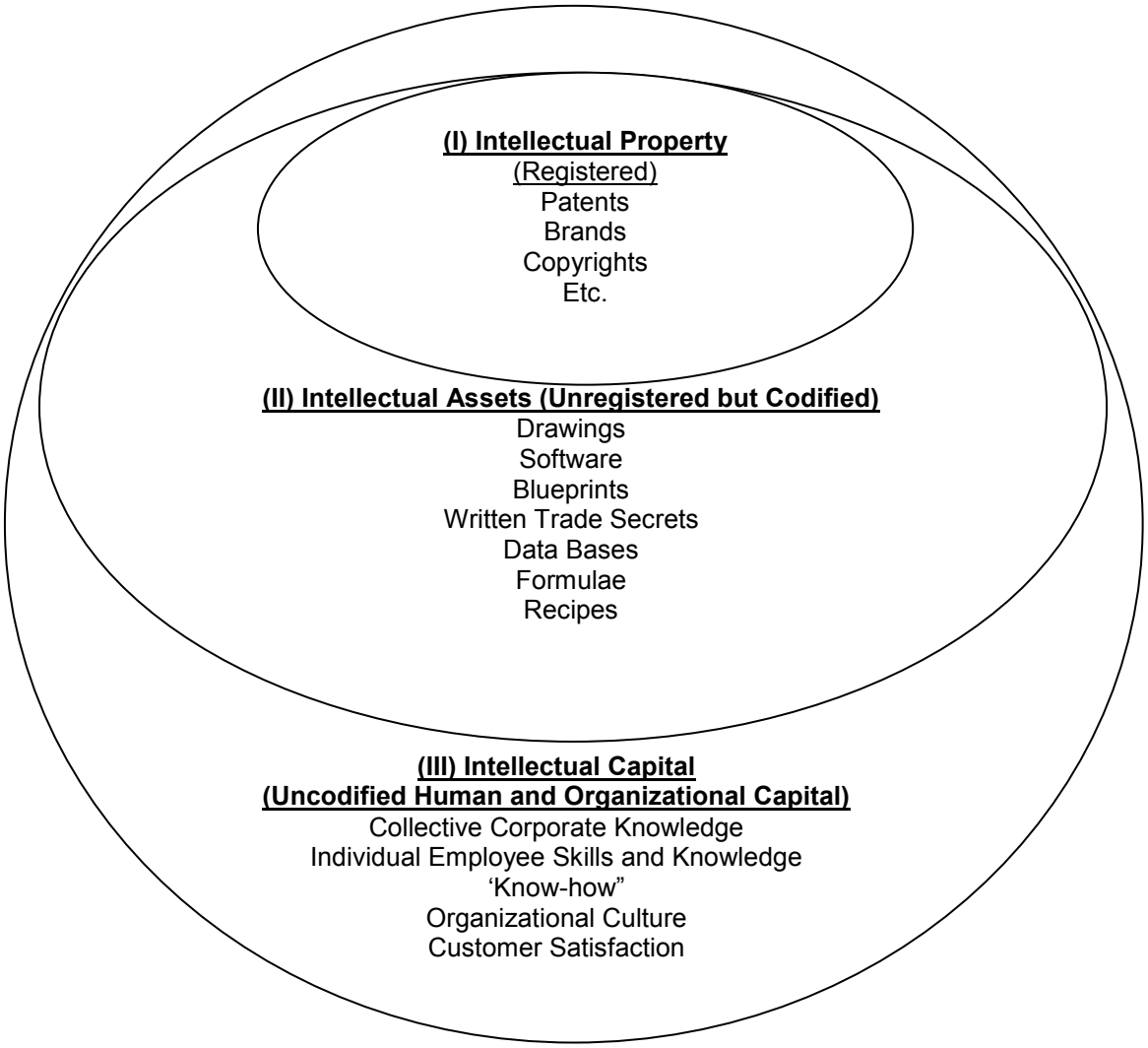

Figure 1: Intangible assets taxonomy (source: (Contractor, 2000))

3. Rough sets

Introduced in early 1980's by Pawlak (1982), the Rough Sets Theory involved methods for knowledge discovery and data mining (Beynon et.al. 2001). As such it provided a relatively new technique of reasoning from vague and imprecise data (Goh, Law 2003) and attracted the attention of a number of researchers and practitioners (Daubie 2002), (Ahn et al. 2000), (Bose 2006), (Tseng, Huang 2007). It was widely used in various areas ranging from finance (Dimitras et al. 1999), (Maciocha & Kisielnicki 2009), (Maciocha, 2007b), (Kyoung-jae & Ingoo 2001), (McKee 2000), (Beynon & Peel 2001) (Francis et al. 2002) (Shyng, Tzeng 2007) tourism (Goh & Law 2003) marketing (Beynon et al. 2001) production (Gento & Redondo 2003), (Lee 2002) and medicine, (Hassanien 2003) to just name a few.

Although somewhat similar to statistical probability theory and other soft approaches, such as fuzzy sets, the rough sets approach is significantly different. Fuzzy sets are useful for handling imprecision when objects in a data set do not exclusively belong to a single category. In turn, rough sets are useful when ''the classes into which the objects are to be classified are imprecise, but can nevertheless be approximated with precise (crisp) sets''.

Furthermore, the main advantage of rough sets theory is that it does not require any a priori information about the probability distribution of the data or any knowledge about the grade of membership in a class. It finds its use in ''data reduction (elimination of superfluous data), discovery of data dependencies, estimation of data significance, generation of decision (control) algorithms from data, approximate classification of data, discovery of similarities or differences in data, discovery of

patterns in data, and discovery of cause–effect relationships (Hassanien 2003). Further text contains a description of the steps involved in rough sets analysis.

3.1 Information system

The first step in a rough set analysis is to select data based on the attributes of predefined objects (Pheng, Hongbin, 2006). Then, information is transformed into a coded information table. One attribute in information table is designated as a decision attribute, and the rest of the attributes are called condition attributes. Rows of this table correspond to objects (actions, alternatives, candidates, patients, etc.) and columns correspond to attributes. To each pair (object, attribute) there is a designated value – or descriptor. Descriptors (placed in each row of the table) correspond to the information about the equivalent object of a given decision situation.

3.2 Approximation of sets

As we mentioned earlier, the concept of rough sets is founded on the assumption that with every object of the universe of discourse there is associated some information (data, knowledge). Objects characterised by the same information are indiscernible (similar) in view of available information about them (Slowinski et. al. 1997). Created in this way the indiscernibility relation enables one to characterize a collection of objects which in general are impossible to be accurately described by means of the values of their sets of attributes, in terms of lower or upper approximation (Beynon et.al. 2001). As a result, we can define a rough set as an approximate representation of a given crisp set in terms of two subsets (lower and upper approximation) derived from a crisp partition defined on the universal set involved (Beynon et.al. 2001), (Intana, Mukaidono 2002).

By the lower approximation of X we mean the set of all elements that are certainly in X, while the elements in the upper approximation can possible be classified as X (Salonen, Nurmi 1999). The boundary region (BND) of a particular set (A) constitutes the difference between the upper and lower approximation. If the boundary region of X is not empty (i.e. if the upper and lower approximations are not identical) then the set X is referred to as definable ('rough set') with respect to A; otherwise, it is called crisp (Pawlak 2000). In sum, the indiscernibility relation is used to define basic operations in rough sets:

Let P $\subseteq$ Y and Y $\subseteq$ U. The P-lower approximation of Y: $\underline{P}$(Y), and the P-upper approximation of Y: $\overline{P}$(Y) are defined as follows:

$$\underline{P}\,Y = \{x \in X : I_p(x) \subseteq Y\}$$

$$\overline{P}\,Y = \bigcup_{x \in Y} I_p(x)$$

3.3 Accuracy and quality of approximation

Using upper and lower approximation it is possible to define the accuracy as well as quality of approximation. These numbers are placed within a (0, 1) interval. They define exactly how it is possible to describe the examined set of objects using available information (Pawlak, Slowinski 1994).

Accuracy of approximation is closely related to the inexactness of a class, which is caused by the occurrence of a boundary region of a set. In other words, the lower accuracy of a set suggests a larger borderline region (Goh, Law, 2003). By definition, accuracy of approximation of Y is equal to the ratio of numbers of objects belonging to the lower approximation of Y to the number of objects belonging (representing) in the upper approximation of the set Y (Ahn et. al. 2000). It expresses the possible correct decision when classifying objects employing the attribute B. This ratio is defined as follows (Gento, Redondo, 2003):

$$\alpha_p(Y) = \frac{card(\underline{PY})}{card(\overline{PY})}$$

where ‘card’ means cardinality of the particular set

Quality of approximation defines the ratio of all P-correctly sorted objects to all objects of a system (McKee, 2000). In other words, it expresses the percentage of objects, which can be correctly classified to a particular class y employing attributes from the set P. The following indicator describes the quality of approximation of classification y by using attributes P (Tay, Shen 2002), (Slowinski et. al. 1997), (Wong, Chungb 2007):

$$\gamma_{p}(y) = \frac{\sum card(\underline{P}Y_i)}{card(U)}$$

where $P \subseteq Q$, and Q is finite set of attributes; $Y \subseteq U$, U is finite set of objects; $\underline{P}Y_i$ is the P-upper approximation of Y_i; subsets Y_i, i= 1, …., n are classes of classification y, and card(x) is the cardinality of a set x.

When the value of this ratio equals 1, the result of the classification is satisfactory. That means that all elements of the set have been unambiguously classified to the upper area (positive region), using the set of attributes P (Meskens et. al. 2002)

3.4 Attribute reduction

Another central matter in the research on the rough set theory is knowledge reduction (Jiye, Zongben, 2002). It is a process of finding the minimum number of indicators (attributes) that are important within a database. The set of reduced indicators obtained is known as a 'reduct' (Ahmad et. al. 2004). A reduct is then defined as a subset R of the set of conditional attributes C such that (Pawlak, Skowron, 2007), (Pawlak, 1991):

$\gamma_C(Q) = \gamma_R(Q)$

Less formally we can say that the reduced set of attributes R, $R \subseteq Q$, provides the same quality of classification as the original set of attributes Q (Dimitras et.al.).

The collection of the most important attributes in the system is called the core of the set. The core is the most essential part of the set P, it cannot be eliminated without disturbing the ability of approximating the decision (Pawlak, Slowinski, 1994). In other words, the core of the set is the intersection of the all reducts in the set (Goh, Law, 2003), (Tay, Shen, 2002).

3.5 Attribute importance

Applying the concept of attribute reduction, it is possible to determine the importance of the analysed attributes. The order of importance of success indicators is calculated based on the frequency of occurrences in the sets of reducts obtained. In other words, the attributes that are present in more reducts are more important than the attributes that are characterised by less frequent occurrence in the reducts. Consequently, as we stated earlier, attributes that form the core of the set are absolutely indispensable, and thus are present in each reduct. Therefore they are characterised by 100% occurrence in the reduct. We can say thus that the attributes that form the core of the set are the most important and area absolutely indispensable in the set.

4. Presentation of the rough sets results

4.1 Research methodology

The conceptual framework of this research is based on the Intangible Assets taxonomy proposed by Contractor (2000). The main interest of this study was concerned with the third level of Intangible Assets: namely Uncodified Human and Organizational Capital. It embraces such elements as Collective Corporate Knowledge, Individual Employee Skills and Knowledge. In order to fully describe this concept we analysed a number of different models used to measure and manage intangible assets (Bontis, 2001), (Baruch 2001),(Sveiby 1997), (Andriessen, 2002), (Brooking, 1996), (Ulf, 1999), (Dawson, 1994), (CG E&Y, 2000), (Nally, 2000). As most of them emphasized the role of human resources in corporate value creation, we decided to focus on this aspect of the intellectual capital. After the literature review we distinguished the following areas of interest:

- Communication (11 attributes)
- Competencies (10 attributes)
- Organizational Culture (9 attributes)
- Training (7 attributes)
- Motivation (12 attributes)

Each of the following areas was described by the set of indicators (intangible assets) incorporated from such models as the Balanced Scorecard, Kaplan & Norton (1992), Intangible Assets Monitor, Sveiby (1997, 2000), Skandia Navigator, Edvinsson (2001), or Value Creation Index (CG E&Y, 2001).

Consequently, the research model's structure consisted of 5 separate areas that were in turn described by a set of specific attributes (7-12). The values of the indicators (intangible assets) were obtained by a questionnaire tool distributed among small and medium size companies located in Warsaw, Poland during 2007-2008. The Rough Sets approach was applied into the analysis of the received data. The choice of such method was determined by numerous advantages that are characteristics for Rough Sets as opposite to the traditional statistical methods (Maciocha, 2009). As this technique was shown to provide even better results than traditional statistical analysis (Slowinski et.al. 1997) it seemed that the application of this method to the present data analysis was the best choice.

4.2 The data and the information table

Obtained through a questionnaire, data were entered into an input file in the Rose2Little. One hundred and twenty-nine objects were described by 58 attributes that in turn formed the five above mentioned areas. For data quality analysis purposes, we eliminated any objects that were characterised by incomplete information. Consequently, five separate information tables (one for each area) were constructed (Table 1). The level of organisational financial performance (which was measured on a five point – Likert scale: very bad, bad, average, good, and very good) was represented by the decision attribute in each system.

Table 1: Decision table

Object no	A1	A2	A3	…	A8	A9	…	…	A10	A11	D
1	3	4	1	…	4	5	…	…	4	2	1
2	2	2	1	…	5	1	…	…	1	5	4
3	4	3	2	…	2	3	…	…	2	1	2
⋮	⋮	⋮	⋮	⋯	⋮	⋮	⋯	⋯	⋮	⋮	⋮
40	1	5	4	…	3	3	…	…	3	3	5
41	5	3	1	…	4	1	…	…	4	1	3

4.3 Approximation of sets

The prediction accuracy was assessed based on the number of correctly classified cases. Approximations of the decision classes are characterised in Table 2. The quality of classification was very high for all analysed areas (equal to one for areas II, IV, and V and 0.97 for areas I and III). We can say thus that the attributes provided satisfactory discrimination between the five financial classes. A similar situation is present in terms of the accuracy of the classification. Areas II, IV, and V were perfectly approximated by the whole set of attributes – the accuracy of the classification for them was equal one. For the remaining areas the level of accuracy of the classification, however, was slightly lower. This was especially visible in areas I and III– in the class 4 and 5 where accuracy of the classification was equal to 0.9459 and 0.9048 respectively.

Table 2: Quality and accuracy of classification

SECTION	Quality Of Classific	Accuracy	Class	# of Objects	Lower Approxim	Upper Approxim
		1.000	(1)	1	1	1
I–	0.9744	1.000	(2)	2	2	2
		1.000	(3)	19	19	19
		0.9459	(4)	36	35	37
		0.9048	(5)	20	19	21

SECTION	Quality Of Classific	Accuracy	Class	# of Objects	Lower Approxim	Upper Approxim
II	1.000	1.000	(1)	1	1	1
		1.000	(2)	2	2	2
		1.000	(3)	19	19	19
		1.000	(4)	36	36	36
		1.000	(5)	20	20	20
III	0.9744	1.000	(1)	1	1	1
		1.000	(2)	2	2	2
		1.000	(3)	19	19	19
		0.9459	(4)	36	35	37
		0.9048	(5)	20	19	21
IV	1.000	1.000	(1)	1	1	1
		1.000	(2)	2	2	2
		1.000	(3)	19	19	19
		1.000	(4)	36	36	36
		1.000	(5)	20	20	20
V	1.000	1.000	(1)	1	1	1
		1.000	(2)	2	2	2
		1.000	(3)	19	19	19
		1.000	(4)	36	36	36
		1.000	(5)	20	20	20

4.4 Attribute's reduction

Reduction of information table constitutes one of the most important steps in the Rough Sets Data Analysis. Table 3 presents results of the reduction stage in our data analysis.

Table 3: Reducts – number, minimum and maximum length

Section	# of reducts	Min length	Max length	# of describing attributes
I CULTURE	8	6	7	9
II – COMPETENCIES	2	7	7	8
III TRAINING	1	6	6	7
IV- MOTIVATION	184	5	7	12
V- COMMUNICATION	65	6	7	11

It depicts the number of reducts that were obtained for each area as well as the minimum and maximum length of the reducts. It is interesting to notice that there was only one reduct for the Training area and it consisted of six attributes. This means that only one attribute in that area was redundant. For each area we can observe significant reduction in terms of number of attributes placed in the reduct.

4.5 Core of the set

The indispensible attributes – namely the core -- was found for the three following areas: I - Culture, II – Competencies and III – Training. In the area of Culture, the core consisted of two attributes A1 and A3, while in the remaining two areas, six different attributes formed each core. The number and type of attributes in each core are presented in Table 4.

Table 4: Core of each set of attributes

SECTION	I	II	III	IV	V
CORE: ATTRIBUTE	A1	A1	A1	-	-
	A3	A2	A2	-	-
		A3	A3	-	-
		A5	A4	-	-
		A8	A5	-	-
		A9	A6	-	-

4.6 Attribute importance

With the intention of meeting our research goal, we needed to distinguish the most characteristic of the financial performance intangibles. After the analysis of the core of the set, we focused on finding the relative frequency of the occurrence of the attributes in the reducts. Table 5 presents attribute rankings in terms of their relative frequency of occurrence in reducts. The highest relative frequency of attribute occurrence in the reduct is represented by 100% and is accredited to the core of the set. In other words, these attributes represent the most important, indispensable attributes that cannot be removed from the set without affecting the quality of accuracy of approximation.

Table 5: Attribute importance in each section

Culture				Comptenecies			Training			Motivation			Communication		
#	Attr	F	% Freq	Attr	F	% Frequ	Attr	F	%Frequency	Attr	F	% Freq	Attr	F	% Freq
1	A1	8	100.0	A1	2	100.0	A1	1	100.00	A5	122	66.30	A10	53	81.54
2	A3	8	100.0	A2	2	100.0	A2	1	100.00	A3	104	56.52	A5	51	78.46
3	A8	6	75.00	A3	2	100.0	A3	1	100.00	A8	100	54.35	A3	41	63.08
4	A4	5	62.50	A5	2	100.0	A4	1	100.00	A12	95	51.63	A4	41	63.08
5	A6	5	62.50	A8	2	100.0	A5	1	100.00	A11	90	48.91	A11	41	63.08
6	A7	5	62.50	A9	2	100.0	A6	1	100.00	A10	90	48.91	A9	40	61.54
7	A5	5	62.50	A6	1	50.00	A7	0	0.00	A	89	48.37	A8	35	53.85
8	A2	4	50.00	A7	1	50.00				A6	89	48.37	A2	31	47.69
9	A9	3	37.50							A4	88	47.83	A6	27	41.54
10										A1	83	45.11	A7	25	38.46
11										A7	76	41.30	A1	23	35.38
12										A9	71	38.59			

Where:

Att- attribute code

F- frequency of occurrence of the attribute in the reducts

%Freq – percentage frequency of occurrence of the attribute in the reducts

Table 6 describes each area attributes that were characterised by at least 50% frequency of occurrence in the reducts. Next, all of these attributes were ranked from the highest frequency of occurrence in the reducts to the smallest, regardless of the area to which they belong. This ranking (presented in Table 7) forms two clusters. Representing absolute essential intangibles (characterised by 100% of occurrence in the reducts), the first cluster consists of various intangibles related to the training aspects (nearly 45%), competencies (nearly 45%) and culture (2%). Apart from the training frequency and quality, the important aspects were related to the dissemination of the training knowledge by employees who attended the training as well as employee's judgment of the need for a given training.

Table 6: Ranking of the most important attributes (above 50% of occurrence in the reducts)

#	**CULTURE**		**COMPETENCIES**		**TRAINIG**		**MOTIVATION**		**COMMUNICATION**	
	Attribute	% Frequency	Attribute	% Frequency	Attribute	% Frequency	Attribute	% Frequency	Attribute	% Frequency
1	A1	100.0	A1	100.0	A1	100.00	A5	66.30	A10	81.54
2	A3	100.0	A2	100.0	A2	100.00	A3	56.52	A5	78.46
3	A8	75.00	A3	100.0	A3	100.00	A8	54.35	A3	63.08
4	A4	62.50	A5	100.0	A4	100.00			A4	63.08
5	A6	62.50	A8	100.0	A5	100.00			A11	63.08
6	A7	62.50	A9	100.0	A6	100.00				
7	A5	62.50								

What is also important is the fact that the manager's competencies in team management were not only highlighted in the Training area, but also in the Competencies section. Consequently, in the Competencies section, apart from possessing the characteristic of position knowledge, it is important

for managers to develop and exhibit so called soft skills: the ability to motivate subordinates and build good work teams. This last aspect was also highlighted in the level of cooperation between employees. In terms of Culture two aspects turned out to be crucial. The first related to the level of autonomy for employees when performing their duties. The second focused on the degree to which management attends to employees' problems. The second group of assets consist of four attributes, of which two were related to the communication, one to culture, and one to motivation. We need to remember, however, that being important these assets did not turn out to be absolutely indispensible in the creation of organisational value.

Table 7: The most important attributes and their meaning

#	RANK	ATTRIBUTE	% FREQUENCY	CODIFICATION	SECTION
1	1	A1	100.00	To who is training directed	TRAINIG
2	1	A2	100.00	Existence of training program related to improvement of skills in team management towards managers in	TRAINIG
3	1	A3	100.00	Existence of duty to give relation from attended training	TRAINIG
4	1	A4	100.00	Number of training days per year	TRAINIG
5	1	A5	100.00	Employee's judgment of need for training	TRAINIG
6	1	A6	100.00	Contribution of the provided training to the improvement of the employee's qualifications	TRAINIG
7	1	A1	100.00	Managers' competencies in general	COMPETENCIES
8	1	A2	100.00	Level of managers' competencies in their position	COMPETENCIES
9	1	A3	100.00	Supervisor's ability to motivate subordinates	COMPETENCIES
10	1	A5	100.00	Supervisors' competencies in team building	COMPETENCIES
11	1	A8	100.00	Coworkers' competencies in terms of the position	COMPETENCIES
12	1	A9	100.00	Level of cooperation between employees	COMPETENCIES
13	1	A1	100.00	Level of autonomy for employees when performing their duties	CULTURE
14	1	A3	100.00	Degree to which management attends to employees' problems	CULTURE
15	2	A10	81.54	Level of exploitation of database	COMMUNICATION
16	3	A5	78.46	Frequency of internet usage	COMMUNICATION
17	3	A8	75.00	Support for knowledge sharing behaviour	CULTURE
18	3	A5	66.30	Quality of the benefits package offered by the organization	MOTIVATION

5. Conclusions and recommendations

In this paper we proposed a new approach to intangible assets' data analysis. The rationale behind the research was the fact that that the present accounting and reporting systems do not provide tools that are able to measure intangibles characterised by the most vague and complicated structure: uncodified human and organisational capital (Contractor, 2000). Relying on traditional measures seemed to be misleading, and thus it was of utmost importance to undertake effort to construct a new approach to intangibles' analysis. According to Kamath (2008), there are three different ways of moving ahead to develop a model:

- Adjusting the conventional methods of accounting to accommodate the new parameters and variables.
- Retaining traditional accounting and adding new measures to account for IC.
- Abandoning old methods completely and developing a new method.

We decided to apply the third approach. Instead of trying to measure and valuate different intangible assets, the problem was tackled from a different angle. The goal was to find out which intangible assets were playing the most important role in the value creation process. The conceptual framework of our research operated on the basis of the taxonomy proposed by Contractor (2000). Consequently, the study was concerned with the third level of intangible assets, namely, uncodified human capital. After careful analysis of existing models, five areas of interest (Training, Competencies, Organisational Culture, Communication, and Motivation) were distinguished. Next, they were described by a set of indicators. We aimed at discrimination of those intangible assets that were the

most important in the organisational value creation process. A new data analysis method enabled us to achieve this aim. The application of Rough Sets to the data analysis was also determined by the fact that this technique was shown to provide even better results than statistical tools in cases with vague and imprecise data (Slowinski et. al. 1997). Consequently, utilising the concept of relative frequency of occurrence in the reducts, we discriminated two sets of intangibles that were the most important in the process of value creation. In the first set we found intangibles that were absolutely indispensable. In the second set there were intangible assets that were important but not crucial for value creation. These intangibles were listed in Table 6 and Table 7. In the group representing absolutely essential intangibles we noticed that there were 14 different assets and the majority focus on various aspects of training and competencies. Consequently, two main areas, training (45%) and competencies (45%), accounted for nearly 90% of that group. The remaining 2% was related to organisational culture. In the Training area four important aspects that had an impact on the corporate performance. They were:

- Training frequency;
- Training quality,
- Dissemination of the training knowledge by employees attended the training,
- Employee's judgment of the need for a given training

In the Competencies section, attributes that turn out to be crucial for corporate performance were related to:

- Knowledge relevant to the position of the manager in the organisation
- Ability of managers to exhibit so called soft skills:
- *Ability to motivate subordinates*
- *Build good work team*

In terms of Culture two aspects turned out to be crucial. The first related to the level of autonomy for employees when performing their duties. The second focused on the degree to which management attends to the employee's problem.

We hope that this research will contribute to the further development of the IC field and believe that the model presented here will be further improved and employed in more advanced research. However, the study has some limitations. First, it is recommended to verify these results on a much bigger sample of companies, and if possible, to narrow the research scope to some particular industry. The next step in such analysis should further investigate the role and maybe even value of the most important intangible assets.

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