

# Measuring Human Intellectual Capital Transfer in HEI-Industry Engagements

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## Abstract

Several researchers perceive the construction industry as a knowledge based, value creating sector of the economy. There is an emerging importance placed on human resource management in the construction industry, as one of labour intensive sectors of the economy. The issue of the critical role played by employees in fostering an effective construction business has often been overlooked over the years. The capacity a company to create wealth is based on the knowledge and capabilities of its people, particularly in professional services. Therefore, value is added to companies by recruiting new staff with higher levels of knowledge and/or through developing the knowledge of the existing workforce. Increasingly, the construction industry demands a professionally qualified workforce especially in the field of project management, engineering, estimating, surveying and contract management. Employer engagement is one of the initiatives to encourage higher education institutes to develop better graduates by improving curriculum through construction industry participation. However, benchmarking performance of employer engagements remains elusive in the absence of credible, independent and quantitative measures. Hence, this research attempts to develop a theory for effective human resource management and to construct a simplistic model to help the industry practitioners to select appropriate personnel. While expert workshop was used for exploratory stage a short questionnaire was used to understand the behaviour of various human knowledge capital variables to form a simplistic model.

**Keywords:** employer engagement, professional qualification, employee selection, human intellectual capital, human intellectual capital measurement

## **1. Introduction**

The UK construction industry is one of the strongest in the world, with output ranked top amongst top global construction industries (DTI 2006). The industry contributes roughly 8% of the national GDP and employs in excess of 1.8 million people. Nonetheless there is a deep concern about industry skill shortage and under achievement. Globally, the education system is identified as not delivering the required number of specialists across project management, engineering, estimating, surveying and contract management (KPMG International 2008). Furthermore, a considerable amount of attention and effort has been directed in number of disciplines to address the industry's poor performance level.

There is an emerging importance placed on human resource management in the construction industry, as one of labour intensive sectors of the economy, which is still considered to be an uncharted territory (Kululanga and McCaffer 2001) within construction organisations. Nesan & Holt (1999) argued that the issue of the critical role that employees play in fostering an effective construction business has often been overlooked over the years. According to Cooke-Davies (2002), "it is people who deliver the projects and not processes and systems", which gains increased validity in the context of labour intensive construction industry. Hence, it is a prerequisite to explore personnel knowledge define more appropriate and realistic employee selection and Industry-HEI engagements for the improvement of knowledge-centric construction industry.

## **2. Intellectual capital and organisational performance**

The growth of tertiary sector with the fundamental characteristic to provide services by manipulating knowledge and information is plainly overtaking the secondary sector. Dynamic nature of the business world, globalisation of markets, ever changing demand and satisfaction of customers have increased organisational competitiveness in incorporating higher value into products and services. In addition to traditional cost focused management tools, this necessitate the understanding of external competitive forces which has to be supplemented by an understanding of organisations' resources and how they can be combined to provide better value (Marr and Spender, 2004). To provide this superior business performance, organisations have also adopted various business models, tools and processes. As the result, strategic resources have been stretched to its maximum to drive organisational competence and to achieve competitive advantage. According to Grant (1991), knowledge of an organisation is considered as the central focus on which to ground organisational strategy and the primary basis on which it can establish its identity and frame its strategy. Intellectual Capital (IC), as a bundle of knowledge assets, represents an essential factor in enhancing this organisational performance improvement (Marr and Schiuma, 2001, Schiuma and Lerro, 2008).

It is argued that business performance is the result of an organisation's ability to manage its business processes. Besides, the effectiveness and efficiency of performing organisational

processes are based on organisational competencies (Moustaghfir, 2008). IC enables organisations to grow and develop the appropriate organisational competencies which can lead to competitive advantage (Cardy and Selvarajan, 2006). Hence, it places IC at the heart of business performance and value creation (Carlucci and Schiuma, 2006, Schiuma and Lerro, 2008). Further, „dynamic capabilities“ are developed through learning mechanisms, which continually shape organisational competencies (Zollo and Winter, 2002). This concept of „dynamic capabilities“ denote organisational ability to integrate, build and reconfigure internal and external competencies to address rapidly changing environments (Teece *et al.*, 1997). This involves effectiveness of IC to constantly reconfigure, accumulate and dispose of knowledge resources to meet the demands of shifting markets.

This growing concern has led to obliqueness of definitions from numerous fields of study in an attempt to raise the understanding and importance of this phenomenon. According to Bontis (1998), “Intellectual capital has been considered by many, defined by some, understood by a selected few, and formally valued by practically no one”. He also supported the view of „intellectual action“, which considers the move from „having knowledge and skills“ to „using the knowledge and skills“. Interestingly, IC is often considered as a practitioner driven concept, where its core components were fuelled by practitioner interest (Edvinsson and Sullivan, 1996, Swart, 2006).

Several authors view IC as something that can create value in the future, or has the potential to create value (Edvinsson and Sullivan, 1996, Bouty, 2000, Keenan and Aggestam, 2001, Mouritsen *et al.*, 2002, Shaikh, 2004). Mouritsen *et al.* (2002) view IC as organisational knowledge resources that, in combination, are constitutive for capabilities, making it possible for the organisation to take action. Edvinsson and Sullivan (1996) defines IC as „knowledge that can be converted into values“ which is not restricted to either technological innovations or intellectual property and broadly include „ideas, general knowledge, designs, computer programs, data processes and publications. They also include management knowledge as an integral part on an organisation“s IC. In a later study, Edvinsson (2000) considers IC as the future earning potential deriving from a combination of human capital and the potential of an organisation“s people. He further states that IC is developed around fast learning, organisational networking and relationship building, as well as ethos and aesthetics for the brain, leading to more of a symbolic management and meaning of leadership. Similarly, Rastogi (2002), views IC as organisation“s holistic capacity or meta-capacity to meet the challenges and exploit opportunities in its continual support of and search for value creation. He also proposes an organisational knowledge management nexus consists of a dense, dynamic, and mutually supportive interactive pattern of social capital, human capital, and knowledge management. The term „nexus“ is used to express the failure of the model when, it“s three constituents and the links among them, are weak, or inoperative.

Alternatively, IC can be viewed as central to organisational performance because it is of value in itself and it doesn“t have to be turned into something valuable. According to Barney (1991), knowledge and skills are regarded as valuable, rare, inimitable and non-substitutable. Roos (1998) postulated that the concept of IC is not the mere understanding and assessment or the

illustration of the tacit value of an organisation; The deeper purpose of IC is to change people's behaviours by transposing the results of the assessment or illustration of organisational tacit values into new values. Here, these organisational routines and rites are seen as a form of capital in itself. According to Ulrich (1998) IC equals competence multiplied by commitment and lies with skilled employees who are committed to business goals. This type of competence and commitment assessment can be used at organisational, unit or individual level. Even though these viewpoints indicate the present value of IC to the organisational performance the view of potential value still dominate these approaches (Swart, 2006).

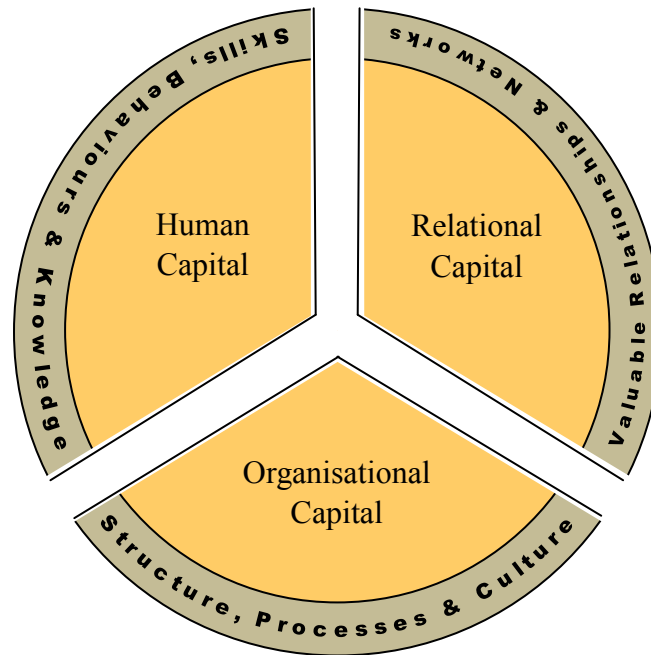


Figure 1: Types of intellectual capital

Considering the commonalities of these approaches, IC can be considered as all intangible resources that contribute to the delivery of organisational strategy along with physical and financial capital. Even though commentators tend to use different terminologies to explicate two types of organisational assets, commonly they can be divided into tangible and intangible assets. While tangible assets are referred as traditional or physical assets (Civi, 2000, Drucker, 1992), intangible assets are mostly referred as intellectual capital (Bontis, 1998, Caddy, 2002, Marr and Moustaghfir, 2005, Mouritsen *et al.*, 2004, Petty and Guthrie, 2000). Despite the differences in the usage of terminology, many researchers believe in the importance of intellectual capital over the traditional tangible assets of an organisation. According to Marr (2008), IC can be split into human capital, relational/social capital and organisational/structural capital (figure 1). While Petty and Guthrie (2000) supports the definition of IC as „the economic value of two categories of intangible assets of a company: organisational and human capital“, Wright *et al.* (2001) argue that IC is a factor that includes human capital, social capital and organisational capital. However, for competitive advantage is to be achieved, integration between these components is required. Interestingly, of these various categorisations of intellectual capital, human capital is regarded as the most valuable asset (Brennan and Connell, 2000).

### 3. Human intellectual capital measures

With „knowledge worker“ concepts (Porter, 2004), IC is further seen as a vital ingredient for survival of organisations and their performance. They take the centre stage in the explanation of the organisational assets that continually create value over and above physical and financial resources (Polanyi, 1967, Ulrich, 1998). The capacity for wealth creation of an organisation is based on the knowledge and capabilities of its people (Savage 1990). Therefore, the value addition is done to the organisations by installing such personnel knowledge into knowledge management systems that organisations create and use. The advocates of the human capital approach emphasise that many of the assets that individuals bring to the organisation are intangible, premised in individual, tacit knowledge rather than the more explicit, explicated, formal, routine and standardised knowledge (Edvinsson and Malone 1997; Marsick and Watkins 1999; Garavan, Morley et al. 2001). This focus on human capital as a strategic resource central, help organisations to achieve competitive advantage in its business environment. It also represents an alternative way in which to understand employee selection and evaluation. Employee selection and evaluation practices can contribute significantly to the organisation gaining a competitive advantage.

The contemporary employee selection and evaluation is a complex decision-making process for placing the right employees in the right jobs at the right time (Golec and Kahya 2007). Organisations frequently spend considerable resources making an effort to engage employees who are well suited to the positions that should be filled. Engaging employees may be subjected to the trial time, but in case of poor or disappointing employees, there are often substantial costs associated with the engaging, training, and firing before realising that an employee is inadequate. Therefore these painstaking decisions can be very significant at the beginning about whom to engage (Baron and Kreps 1999).

Individual competency is anything that an employee brings to a job or acquires along the way throughout a career that ultimately contributes to the success of entire organisation (Kennedy and Dresser 2005). This includes relevant skills, knowledge, abilities, formal education and experience gained on the job. Perhaps, one way of looking at this is by understanding various „human intellectual capital measures“, which represents the areas where personnel knowledge can add value to an organisation to achieve competitive advantage in business environment. Measurement of intellectual capital is mainly concerned with finding the best metrics to use for the purpose of measuring human intellectual capital. Skandia navigator developed by Edvinsson and Malone (1997), the balanced scorecard by Kaplan and Norton (1996), Sveiby's intangible assets monitor (Sveiby 1997) are a few of them, currently being used under the intellectual capital measurement domain.

Based on these models various authors have looked into different types intellectual capital measures to help organisations to strengthen and improve their competitive advantage by measuring and recuperating intellectual capital. Table 1 provides a list of measures used by various commentators to evaluate employee competence/human capital. This list only provides the concerned factors mentioned by the researchers in their research article. From this analysis

is it evident that qualification and work experience are perceived as the most important factors in determining employee competence/human capital. Most of the authors in this area agree with the importance of these two factors and suggested other factors which would also help the organisation in improving its culture and competitive advantage.

Table 1: Sources of reference for various human intellectual capital measures

	<i>Armstrong and Baron (1998)</i>	<i>Caddy (2002)</i>	<i>Edvinsson and Malone (1997)</i>	<i>Golec and Katya (2007)</i>	<i>Guthrie (2001)</i>	<i>Kennedy and Dresser (2005)</i>	<i>Petty and Guthrie (2000)</i>	<i>Sveiby (1997)</i>	<i>Turner and Cox (2002)</i>
<i>Qualification</i>	√		√	√	√		√	√	
<i>Work experience</i>		√	√		√		√	√	
<i>Training and education</i>	√	√	√	√				√	
<i>Rewards and recognition</i>		√							
<i>Communication skills</i>	√			√		√			
<i>Innovative capabilities</i>			√	√			√		√
<i>Leadership qualities</i>	√		√	√					√
<i>Salaries and benefits</i>		√						√	
<i>Involvement in projects</i>								√	
<i>Value and attitude</i>	√			√				√	

Informal communications conducted with academics and industry practitioners suggest the same. Especially, the employee selection and evaluation based on qualification and work experience is found to be very common in practice. However, there is a concern over the class of qualification, decay of „knowledge from qualification“ over the years, relevance of the qualification, relevance of the work experience and relative importance of work experience to qualification. Research has attempted to incorporate these factors in forming a simplistic, quantitative model. Having this in mind, this research proposes measures for human intellectual capital transfer. These measures are formed by exploring and understanding criteria for employee selection and evaluation.

#### 4. Research methodology

This research is aimed to develop a model to measure human intellectual capital for employee selection and evaluation. This is largely a model development/theory building by quantitative research methods using primary data gathered from employers“ opinion. As shown in Table 2,

the exploratory, first phase of the research focuses establishing and understanding components of human intellectual capital. This will further inform significant components in addition to ones found from the literature review. The second phase of the research will concentrate on quantifying and scaling of components. For this, a survey method was adopted to collect quantitative data which was analysed with regression analysis. By collecting data on qualification (Q), work experience (E) and Decay of knowledge (D) and using regression analysis between these variables, quantitative relationship between knowledge and variables such as qualification and experience was developed.

Table 2: Research Methodology

Phase	Research type	Research method	Research techniques
1	Exploratory research	Expert opinion	Focus group and content analysis
2	Model development	Survey	Questionnaire survey and regression analysis

## 5. Components of human intellectual capital

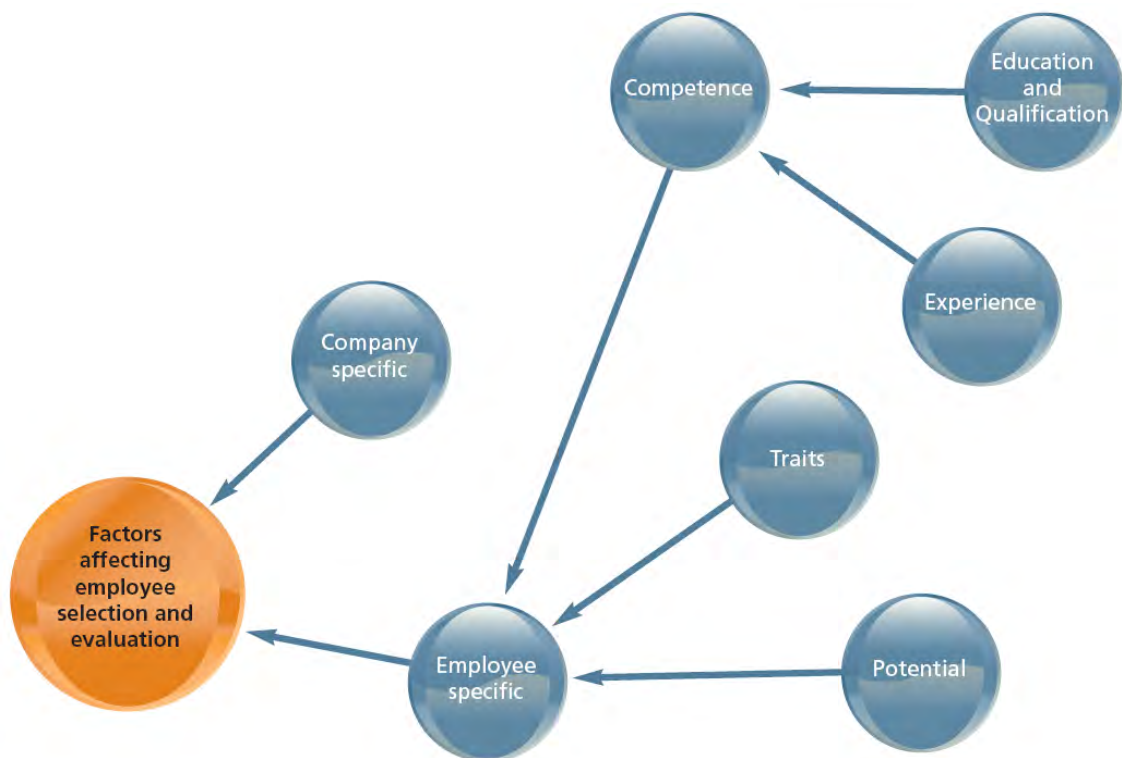


Figure 2: Cognitive diagram of factors affecting employee selection and evaluation

Representatives from industry and HEIs provided rich information regarding factors affecting employee selection and evaluation in a half day workshop. Experts considered these factors into two categories, Company Specific and Employee Specific. Company Specific factors such as size, cultural fit, market condition, team composition, internal competency judgement, project type and size were considered unique for each company. One of the experts stated that „we look for employees who are culturally fit to work with us; we had few problems with an employee who was appointed at a senior position who was not aligned with our way of working“. Another expert insisted that each appointment depends on the advertisement and it mainly depends on company name and size, project team, project size etc. Since these factors depend on company attributes a „relevance factor ( $r_1$ )“ was proposed. Figure 2 provide a cognitive diagram portraying factors affecting employee selection and evaluation.

Employee Specific factors were categorised into competency, potential and traits. Traits are personal characteristics of employees preferred by employers for a chosen employment. These are very subjective and socially constructed. Hence, interaction and communications are the best means to evaluate this component. As shown in the literature review, competence forms a major part in employee evaluation. The complex nature of competence was comprehensively scrutinised in the workshop and links were formed among experience, academic qualifications, professional qualification and potential. Initial knowledge gained from qualification is considered to be decaying over a period of time and personal knowledge/human intellectual capital increases with experience. „Knowledge decay“ concept, where initial knowledge gained from qualification decays over a period of time was confronted with the provision of Continuing Professional Development (CPD) provided by professional institutions. Hence, experts believed that personals with professional qualification who attend CPD sessions shouldn't be subjected to knowledge decay. Experts also expressed their focus on employee potential which could be measured by their progression and grade. This raises concerns about the level of qualification, decay of „knowledge from qualification“ over the years, relevance of the qualification, relevance of the work experience and relative importance of work experience to qualification.

## **6. Development of simplistic model for competency based employee selection and evaluation**

This approach emerges from the notion of separately calculating the knowledge components from qualification and experience. It is evident from the focus group content analysis that competence, traits and potential are important elements in selecting employees; hence highly sought after in HEI-Industry engagements. While initial knowledge gained from qualification decays over a period of time personal knowledge/human intellectual capital increases with experience. To bring this concept into context, an approach very similar to „unit theory of learning curve“ is adopted. Here, total output is articulated by multiplying initial input and learning rate. Using a similar approach, existing knowledge from qualification can be calculated as shown in equation 1 (figure 3). Very similar to this, equation 2 indicates present



knowledge after a period of experience. These two components are combined together to represent human intellectual capital.

<b>Equation 1: Present knowledge from Qualification = <math>r_1QD</math></b>	
Where,	$Q$ = Qualification $r_1$ = Relevance of the qualification $D$ = Decay of „knowledge from qualification“ over the years
<b>Equation 2: Present knowledge with experience = <math>r_1Qr_2E</math></b>	
Where,	$Q$ = Qualification $E$ = Work experience $r_1$ = Relevance of the qualification $r_2$ = Relevance of the work experience
Human intellectual capital: $I = r_1QD + r_1Qr_2E - r_1Q$	
$I = r_1Q (D + r_2E - 1)$	

Figure 3: Human intellectual capital model

This abstract model is proposed to be measured in units which would help to determine human intellectual capital transfer from HEI to Industry. As mentioned earlier, relevance of the qualification ( $r_1$ ) and work experience ( $r_2$ ) are very subjective and they are left for the management/decision maker for suitable employee selection and evaluation. However, it is prerequisite to quantify qualification ( $Q$ ), work experience ( $E$ ) and decay of knowledge ( $D$ ) in order to be able to measure human intellectual capital.

## 6.1 Regression model development

In the second model development phase, data has been gathered through a survey of 20 industry practitioners and academics to formulate the influence of qualification ( $Q$ ), work experience ( $E$ ) and decay of knowledge ( $D$ ) to human intellectual capital. Online questionnaires were used to gather this primary data, which had two main sections. Whilst the first section sought out the opinion of industry practitioners and academics on intellectual capacity against various qualifications, the second section surveyed the behaviours of intellectual capacity for work experience ( $E$ ) and decay of knowledge ( $D$ ) over the years of experience. From this survey, each component of human intellectual capital ( $Q$ ,  $E$  and  $D$ ) was quantified individually and integrated to a single unit measure. This construction of quantitative relationships between these individual components and human intellectual capital was carried out by regression analysis.

Human intellectual capital: $I = r_1 Q (D + r_2 E - I)$	
$I = r_1 (-0.026x^4 + 0.275x^3 - 0.659x^2 + 8.44x + 28.90) [(113.773 - 7.719t + 0.281t^2 - 0.003t^3) + r_2 e^{5.106 - 1.053t} - 1]$	
Where,	$x$ = Total credits
	$t$ = Number of years
	$r_1$ = Relevance of the qualification

Figure 4: Human intellectual capital formula

As shown in figure 4, evaluated patterns/equations of the individual components were integrated, which resulted in the above mentioned human intellectual capital formula. Total credits earned from higher educational qualification and years of experience were considered as independent variables in this equation. It is found from the regression analysis that each component has a significance level of 60-70%. The research reported here, is an initial attempt to construct a formula which could lead towards customised formula for each industry employers, especially for HEI-industry engagements. This research points out that a quantitative model could be constructed with increased validity and reliability by using a neural network with additional data collection and training. Importantly, to increase its credibility and to further generalise, this research needs additional data collection. With additional data, it would be possible to construct a neural network to model the complex non-linear multi-criteria relationships between human intellectual capital transfer and components such as qualification and experience. Furthermore, definition of relevance factors for qualification and experience could be developed based on the availability of data for training a neural network.

## 7. Conclusion

There is an emerging importance placed on human resource management in the construction industry, as one of labour intensive sectors of the economy. The capacity a company to create wealth is based on the knowledge and capabilities of its people, particularly in professional services. Employer engagement is one of the initiatives to encourage higher education institutions (HEI) to develop better graduates by improving curriculum through construction industry participation. These HEI-industry engagements require a performance measurement tool. Since knowledge transfer takes the centre stage in HEI-industry engagements, a quantitative human intellectual capital model is proposed from initial findings. This provides evidence and guide towards developing a quantitative measure. A detailed neural network could provide a further accurate model to quantify HEI-industry knowledge transfer. Hence, this research, in its next phase intends to launch a development of neural network to model complex non-linear multi-criteria relationships between components of human intellectual capital.

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