The MinK Framework: Developing Metrics for the Measurement of Individual Knowledge

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The MinK Framework:
Developing Metrics for the Measurement of Individual Knowledge

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Abstract
Knowledge is the currency of the current economy and a vital resource for the sustainability of performance quality in today’s knowledge intensive business environment. To avoid the detrimental consequences of knowledge loss, managers are urged to identify where knowledge stocks exist and how knowledge flows within their organisations by keying out wellsprings of knowledge among their employees. Although some studies have attempted to measure knowledge on an organisational level using different methods, very few studies have addressed the individual knowledge carrier. Moving from a critical literature review of the existing approaches to knowledge measurement, this paper proposes a novel framework that enables organisations to measure individual knowledge in a business context using a set of metrics. The metrics are subsequently validated through a series of in-depth interviews with senior managers. A summary of the managers’ views on individual knowledge measurement is presented. Reflections regarding the industry application and recommendations for the proposed framework are also discussed.

Introduction
Knowledge is recognised as a foundation of sustainable quality and competitive advantage in the current complex and dynamic business era (Tullawat and Vichita Vathanophas, 2012). The ability of organisations to create value is no longer solely dependent on their financial and physical capital, but rather on their capacity to acquire, create and utilise knowledge (Carmeli and Tishler, 2004). Asserting that knowledge is the main value driver in today’s businesses, the management of knowledge as a strategic resource gave rise to the rapidly growing field of Knowledge Management (KM), which has been growing exponentially in the last decade (Serenko et al., 2010). However, based on the saying “if you can’t measure it, you can’t manage it,” the need to measure knowledge resources within an organisation emerged as a key area of interest for both researchers and practitioners within the KM domain (Skyrme, 2003).

Despite being one of the most challenging activities in KM (Chen et al., 2009), the need to measure knowledge arises to achieve two organisational objectives: internal monitoring and external presentation. From an internal perspective, managers may be oblivious to the knowledge that exists within their own organisations, as once stated by the CEO of Hewlett-Packard in his famous quote “if only HP knew what HP knew, we would be three times as profitable” (Davenport and Prusak, 2000). In such cases, knowledge measurement is essential to expose “hidden” knowledge resources leading to more effective KM (Edvinsson and Malone, 1997). Furthermore, knowledge measurement remains crucial during the implementation of KM initiatives to evaluate the effect of KM on organisational
knowledge and to provide managers with convincing justifications for the substantial costs associated with KM implementation (Liebowitz and Suen, 2000, Khalifa et al., 2008). From an external perspective, the mounting gap between book values and market values of companies has led to the widespread view that a company’s “true” value could only be expressed if intangible assets are also evaluated (Boda and Szlavik, 2007). In this regard, the value of a company is viewed as the summation of its financial capital and its intellectual capital (IC). IC (Galbraith, 1969) is a term that refers to “packaged useful knowledge” (Stewart, 1998). In the traditional conceptualisation where organisational knowledge is envisaged as a series of “stocks and flows”, IC refers to the stock of knowledge within an organisation at a certain time, while KM is concerned with the flows, namely knowledge acquisition and sharing (Bontis et al., 1999, Al-Laham et al., 2011).

The need to measure knowledge to enhance its management and evaluate companies has impelled researchers to propose a number of knowledge measurement frameworks. However, it is observed that the majority of models attempted to measure knowledge at a company level, with very few efforts directed towards measuring the knowledge of individual employees, although they are the actual source of all knowledge within any organisation (Kannan and Aulbur, 2004). In their classic work two decades ago, Nonaka and Takeuchi (1995) stated, “knowledge is created only by individuals. An organisation cannot create knowledge on its own.” “Organisational knowledge creation should be understood as a process that organisationally amplifies the knowledge created by individuals.” Viewing knowledge in isolation from the knowers who own it is among Fahey and Prusak’s (1998) list of gravest mistakes in KM where they state “there is no knowledge without someone knowing it.” Since knowledge identification is a core activity of the KM process (Heisig, 2009), the success of KM would be largely dependent upon an organisation’s ability to identify individual knowledge carriers and creators before striving to implement other KM activities including knowledge sharing and knowledge utilisation. This identification should contribute to the reduction of knowledge loss, since managers would take measures to ensure knowledge holders remain within the organisation through proper compensation, longer contracts and loyalty programmes. Despite its cardinal importance, the measurement of individual knowledge remains a fundamental, yet comparatively unexplored, subdomain of knowledge measurement and KM.

This study presents an attempt to fill this gap by proposing a new framework referred to as MinK, an acronym for Measuring Individual Knowledge. The ultimate objective of MinK is to provide managers with a comprehensive tool which allows them to assess individual knowledge given the complexities surrounding the process. In attempt to achieve the stated objective, a succinct critical review of the different existing methods used to measure knowledge in the KM literature was conducted along with a discussion of the main frameworks used by each method. The development of MinK is then described and the model’s structure is presented. A pilot study aimed at the preliminary validation of MinK is introduced followed by the findings and future work recommendations.
Literature Review

The literature offers a diverse array of knowledge measurement methods in which researchers have applied different methods to assess organisational knowledge (Skyrme, 2005). Three main approaches are identified: Financial Methods, IC Components Methods, and Performance Methods.

Financial Methods

In the first approach, IC is computed in financial terms by using data from a company’s financial results and records. Few of the most widely cited models and their respective knowledge valuation methodologies are listed in Table 1.

### Table 1: Financial knowledge measurement methods

<table>
<thead>
<tr>
<th>Model</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobin’s Q (Tobin, 1969)</td>
<td>Measures knowledge as the ratio between a company’s market value and its book value. A Q higher than one is an indicator of the ability to create value by utilising knowledge.</td>
</tr>
<tr>
<td>Economic Value Added (Stewart, 1994)</td>
<td>Applying 164 adjustments to traditional balance sheets to account for intangibles after which EVA is calculated by deducting the cost of capital from operating profit (Weaver, 2001).</td>
</tr>
</tbody>
</table>
| Human Resource Accounting (HRA) (Hermanson, 1964) | Uses three types of models:  
  * Cost models- Value human capital comprising knowledge as the cost of acquiring human assets.  
  * Market models - Equate knowledge with cost of buying an individual’s services from the market.  
  * Income models- Use the present value of the revenues an employee is expected to generate while working for a company as a measure of knowledge (Flamholtz et al., 1993). |
| Value Creation Intellectual Coefficient (Pulic, 2000) | Calculates how efficiently financial and intellectual capital are utilised to generate value for the company using financial data. |

IC Components Methods

Within the second approach, IC is divided into different components, and each component is measured individually (Luthy, 1998). Most IC methods tend to apply a minimum of the first two of the following four steps:

1. **Classification**: IC is broken down into components, usually Human Capital (HC) and Structural Capital (SC), where HC refers to the combined knowledge of employees, while SC refers to “knowledge that doesn’t go home at night” including the company’s supportive infrastructure, business processes, IT systems and customer relations (Ranjit, 2004). SC may be divided further into Organisational Capital and Customer Capital (Edvinsson, 1997).

2. **Metric Development**: Metrics are selected to measure each IC component.
3. **Aggregation**: IC measures are aggregated into one numerical figure using such methods as averages, weighted averages or other methods. The outcome of this step should be one number that reflects a company’s IC.

4. **Financial Valuation**: A financial value of IC may be computed and presented in monetary terms, or a correlation may be established between the IC value and a financial indicator. Widely cited IC frameworks in the KM literature are summarised in Table 2.

<table>
<thead>
<tr>
<th>Framework</th>
<th>IC Classification</th>
<th>Metric Development</th>
<th>Aggregation</th>
<th>Financial Valuation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skandia Navigator</td>
<td>• Human Capital</td>
<td>• Developed 112 metrics that cover five components of IC.</td>
<td>• Combines all financial indicators into a single monetary value $C$.</td>
<td>• The overall financial value of IC is equal to $I$ multiplied by $C$.</td>
</tr>
<tr>
<td>(Edvinsson and Malone, 1997)</td>
<td>• Structural Capital</td>
<td></td>
<td>• Converts all the remaining metrics into ratios then aggregates them into an efficiency indicator $I$.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Customer Capital</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Organisational Capital</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Process Capital</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Innovation Capital</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IC Index</td>
<td>• Human Capital (<strong>thinking part</strong>)</td>
<td>• Does not propose specific metrics.</td>
<td>• Metrics must be expressed as a dimensionless numbers.</td>
<td>• Indicates the behaviour of a correctly designed IC Index should be correlated to financial value of the company.</td>
</tr>
<tr>
<td>(Roos et al., 1998)</td>
<td>o Competence</td>
<td></td>
<td>• Provides a framework by which every organisation would set its own metrics in light of its strategy, characteristics and the surrounding environment.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Attitude</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Intellectual Agility</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Structural Capital (<strong>non-thinking part</strong>)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Relationships</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Organisation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Renewal and Development</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intangible Assets Monitor</td>
<td>• Internal Structure</td>
<td>• Proposes indices to measure each IC component from three perspectives:</td>
<td>• Visually presents IC components' strengths and weaknesses in an aggregated tabular form, but provides no numerical aggregation.</td>
<td>• No financial valuation.</td>
</tr>
<tr>
<td>(Sveiby, 1997, Sveiby, 1993)</td>
<td>• External Structure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Human Competence</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: IC Component measurement models
| IC Rating (Jacobsen et al., 2005) | - Human Capital  
  o Management  
  o Employees  
- Organisational Capital  
  o Process  
  o Intellectual Properties  
- Relational Capital  
  o Network  
  o Brand  
  o Customers  
- Business Recipe | - Evaluates 200 parameters through in-depth interviews with internal and external stakeholders.  
- Assesses IC components from the perspectives of:  
  o Effectiveness  
  o Risk  
  o Renewal | - Results are presented using a letter grading system ranging from ‘AAA’ to ‘D’ in one diagram, but no numerical aggregation is conducted. | - No financial valuation. |
|-----------------------------|---------------------------------|--------------------------------------------------|-----------------------------|
| Knowledge Assets Map (Marr et al., 2004) | - Stakeholder Resources  
  o Stakeholder Relationships  
  o Human Resources  
- Structural Resources  
  o Human Resources  
  o Physical Infrastructure  
  o Virtual Infrastructure (Culture, routines, and IP) | - Does not propose specific metrics and states that metrics should be identified by top management according to their organisation’s unique competencies and strategy. | - No numerical aggregation is suggested, however, managers have the flexibility to present their selected indicators in the manner they find most appropriate to evaluate their company’s knowledge assets. | - No financial valuation. |
| Technology Broker (IC Audit) (Brooking, 1996) | - Market assets  
- Human-centred assets  
- Intellectual property assets  
- Infrastructure assets | - IC components are audited using:  
  - Surveys  
  - Interviews  
  - Quantitative analysis  
  - Market research  
  - Documents auditing  
  - Evaluation of return on investment  
  - Based on the audit, each aspect is compared with the optimal state and is rated with an index score from 1 to 5. | - Results are visually represented on a target diagram/bull’s-eye chart (Wickham, 2008) to depict the score, importance and trend of each aspect.  
- No numerical aggregation. | - Uses cost, market or income valuation methods (as described in HRA). |
Performance Methods
While a number of researchers designed ample models to measure knowledge, others adopted
the view that knowledge could not be measured due to its fluid and complex nature, and that
only the effects or outcomes of utilising knowledge are measureable (Liebowitz and Wright,
1999). Therefore, research within the third knowledge measurement approach directs its
efforts towards the measurement of the impact of applying knowledge with the objective of
establishing a link between KM and improvement in organisational performance, a link that
according to the literature remain nebulous (Petra and Annelies, 2012). This is achieved by
the comparison of an organisation’s performance before a KM process is instated and after its
implementation to identify the effect KM has had on performance. To this end, studies vary
in their methodology of evaluating organisational performance mostly adopting either a
quantitative or qualitative approach (Huang et al., 2007). To measure performance,
quantitative methods use financial indicators such as profitability or return investment, or
non-financial indicators such as cycle time or number of complaints. On the other hand,
qualitative methods rely on surveys, questionnaires, or interviews to obtain feedback on the
effect of KM on performance. Finally, some KM researchers assess performance using The
Balanced Scorecard; one of the most popular and comprehensive performance measurement
tools that comprises quantitative, qualitative, financial and non-financial measures (Kaplan
and Norton, 1996).

In summary, review of the literature reveals three main approaches to knowledge
measurement. Financial models provide a concise unbiased overview of a company’s IC and
may be beneficial in investment decisions and benchmarking, however, they do not elucidate
where KM problems exist nor do they suggest what decisions should be taken to improve
knowledge creation, sharing and utilisation (Kannan and Aulbur, 2004). IC Components
models offer more vivid insights about each element of IC and where corrective action is
required, however, are criticised because they provide a “snap shot” evaluation of knowledge
only reflecting static knowledge stocks without considering the dynamism of
organisational knowledge present in knowledge flows (Lerro et al., 2012, Bontis, 2001).
Finally, performance methods provide some correlation between KM and performance,
however, are built on the inaccurate assumption that changes in organisational performance
are solely due to KM disregarding a number of other endogenous and exogenous
performance factors (Yu et al., 2007).

The MinK Framework
The authors endeavoured to benefit from the existing mass of knowledge measurement
literature when developing a new individual measurement model. First, the authors adopted
the view that the absolute “quantity” of knowledge an individual holds could never be
measured with a direct formula because knowledge is both intangible and contextual.
However, the assessment of certain attributes and actions of individuals could provide a good
indication of the knowledge they hold, acquire and share. Thus, instead of attempting to
measure knowledge itself, characteristics that indicate knowledge is present within an
individual would be identified and assessed. Accordingly, ten individual knowledge
indicators (IKI) are suggested in MinK, where each indicator implies that an individual possesses certain knowledge that is of value to his/her organisation or is actively acquiring and sharing knowledge. In light of the literature review, the authors preferred not to rely on a single approach when developing IKIs but rather amalgamated a number of perspectives to propose IKIs that reflect individual knowledge components, knowledge stocks and flows, knowledge utilisation outcomes (i.e. effects on performance), in addition to financial IKIs. The ten IKIs are:

1. **Education** - The formal education an individual has received from academic institutions (e.g. BSc, MBA, PhD...etc.)
2. **Training** - Training courses and internships the individual has attended during their career.
3. **Experience** - The individual’s years of professional experience.
4. **IT Literacy** - An individual’s ability to use IT tools (software and hardware) in business to acquire, create and share knowledge.
5. **Business Communications** - The nature, rate and patterns of an individual’s internal business communications (with managers, colleagues, subordinates) and external communications (with customers, suppliers, regulators) using different means (meeting, phone calls, emails).
6. **Business Process Interactions** - The interaction of the individual with business processes internal and external to the organisation.
7. **Personal Network** - The size and quality of the network of business contacts the individual interacts with.
8. **Performance** - The individual’s performance at work and contribution to their organisation.
9. **Creativity/Innovation** - The ability of the individual to generate new ideas and solutions to existing problems.
10. **Financial Indicators** - The financial value of the individual on the job market (e.g. recruitment cost, training cost, salary) and their monetary contribution to the organisation (e.g. sales, cost-savings, funds acquired).

The first four IKIs (education, training, experience, IT literacy) are knowledge stock indicators. These are background measures that reflect an individual’s knowledge based on their history and background and provide static measures of a person’s knowledge stock (Bolisani and Oltramari, 2012). The next three IKIs (business communications, business process interactions, personal network) are knowledge flow indicators, which are process indicators that reflect the exposure of individuals to knowledge flows and their corresponding roles in knowledge acquisition and sharing (Malhotra, 2003). The following two IKIs (performance and creativity) are knowledge utilisation indicators, which, as output indicators, reflect the effect an individual’s knowledge has had on the outcomes of their work and their performance. The inclusion of this perspective is essential because an employee’s knowledge would be of value to his/her organisation only if it is used to sustain quality, improve performance, and gain competitive advantage (Baron, 2011). Finally, analogous to financial methods in the literature, the last indicator uses financial figures associated with the individual as measures of their knowledge.
The subsequent step is the development of metrics to assess each IKI. Metrics are measurement units which describe the properties of each indicator (Lerro et al., 2012). They may be direct counts, monetary values or ratios/percentages when used to measure quantitative attributes, or numerical scale-based ratings when used to quantify qualitative attributes. Proposed metrics for each indicator are shown in Table 3 along with their corresponding units of measurement, where “#” is a number, “%” is a percentage, “$” is a monetary value and “r” is a rating.

Table 3: Metrics for each individual knowledge indicator

<table>
<thead>
<tr>
<th>Knowledge Stock Indicators</th>
<th>Knowledge Flow Indicators</th>
<th>Knowledge Utilisation Indicators</th>
<th>Financial Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Education</strong></td>
<td><strong>Business Communication</strong></td>
<td><strong>Performance</strong></td>
<td><strong>Compensation ($)</strong></td>
</tr>
<tr>
<td>• Level of education (r)</td>
<td>• Meetings attended per week (#)</td>
<td>• Performance Appraisal (r)</td>
<td>• Recruitment / Replacement costs ($)</td>
</tr>
<tr>
<td>• Grades (%)</td>
<td>• Meetings with managers per week (#)</td>
<td>• Cost Savings ($)</td>
<td>• Market cost of equivalent services ($)</td>
</tr>
<tr>
<td>• Relevance of education to job (r)</td>
<td>• Meetings with subordinates per week (#)</td>
<td>• Income generated/Sales ($)</td>
<td>• Investment in Training ($)</td>
</tr>
<tr>
<td><strong>Experience</strong></td>
<td>• Meetings with per week with external stakeholders (#)</td>
<td>• Productivity (r)</td>
<td><strong>Cost Savings ($)</strong></td>
</tr>
<tr>
<td>• Professional years (#)</td>
<td>• Communications sent per week (#) (phone/email/memo/report)</td>
<td>• Percentage of Target(s) Achieved (%)</td>
<td><strong>Income generated/Sales ($)</strong></td>
</tr>
<tr>
<td>• Grades (%)</td>
<td>• Communications received per week (#)</td>
<td>• New ideas suggested (#)</td>
<td><strong>Productivity (r)</strong></td>
</tr>
<tr>
<td>• Relevance of education to job (r)</td>
<td></td>
<td>• New ideas implemented (#)</td>
<td><strong>Percentage of Target(s) Achieved (%)</strong></td>
</tr>
<tr>
<td><strong>Training</strong></td>
<td>• Processes utilised (#)</td>
<td>• Patents (#)</td>
<td><strong>Compensation ($)</strong></td>
</tr>
<tr>
<td>• Professional Qualifications (r)</td>
<td>• Processes supervised (#)</td>
<td></td>
<td><strong>Recruitment / Replacement costs ($)</strong></td>
</tr>
<tr>
<td>• Training hours (#)</td>
<td>• Processes reviewed/audited (#)</td>
<td></td>
<td><strong>Market cost of equivalent services ($)</strong></td>
</tr>
<tr>
<td>• Training expense ($)</td>
<td>• Process improvement Suggestions (#)</td>
<td></td>
<td><strong>Investment in Training ($)</strong></td>
</tr>
<tr>
<td>• Internships (n)</td>
<td>• Process improvement suggestions implemented (#)</td>
<td></td>
<td><strong>Financial Indicators</strong></td>
</tr>
<tr>
<td><strong>General IT Literacy</strong></td>
<td>• Business process quality systems involvement (e.g. ISO) (r)</td>
<td>• Contribution to information systems (r)</td>
<td><strong>Cost Savings ($)</strong></td>
</tr>
<tr>
<td>(Windows, Office, Internet)</td>
<td>• Process improvement suggestions implemented (#)</td>
<td></td>
<td><strong>Percentage of Target(s) Achieved (%)</strong></td>
</tr>
<tr>
<td><strong>Specific IT literacy</strong></td>
<td>• Contribution to information systems (r)</td>
<td>• Contribution to information systems (r)</td>
<td><strong>Productivity (r)</strong></td>
</tr>
<tr>
<td>(Function specific software)</td>
<td></td>
<td></td>
<td><strong>Percentage of Target(s) Achieved (%)</strong></td>
</tr>
</tbody>
</table>

The metrics shown in Table 3 provide a comprehensive approach to assessing individual knowledge indicators, facilitating a systematic evaluation of knowledge stocks, flows, utilisation and financial aspects.
Preliminary Validation Study
Before proceeding to the second phase of this research, preliminary validation was required to examine the validity of the proposed indicators and metrics as measures of individual knowledge. A study was conducted through semi-structured interviews of a sample of eleven senior managers and directors representing small, medium and large corporations from eight different industries and located in six countries (Table 4). Respondents were selected from diverse backgrounds to examine the generalisability of MinK across different disciplines, company sizes and countries.

Table 4: Pilot study respondents' profiles

<table>
<thead>
<tr>
<th>Respondent No.</th>
<th>Position</th>
<th>Company Description</th>
<th>Number of Employees</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Managing Director</td>
<td>Marketing consulting company</td>
<td>6</td>
<td>Egypt</td>
</tr>
<tr>
<td>2</td>
<td>HR Consultant</td>
<td>Training and HR consulting company</td>
<td>9</td>
<td>South Africa</td>
</tr>
<tr>
<td>3</td>
<td>Chief Scientist</td>
<td>Software research company</td>
<td>9</td>
<td>USA</td>
</tr>
<tr>
<td>4</td>
<td>Business Development Manager</td>
<td>Healthcare development contractor</td>
<td>25</td>
<td>Lebanon</td>
</tr>
<tr>
<td>5</td>
<td>Sales Lead</td>
<td>Multinational Pharmaceutical Company</td>
<td>150</td>
<td>Dubai</td>
</tr>
<tr>
<td>6</td>
<td>Associate Professor</td>
<td>Private college</td>
<td>174</td>
<td>USA</td>
</tr>
<tr>
<td>7</td>
<td>Business Development Advisor</td>
<td>Medical equipment supplier</td>
<td>300</td>
<td>Egypt</td>
</tr>
<tr>
<td>8</td>
<td>Managing Director</td>
<td>Private equity and investment advisory</td>
<td>400</td>
<td>Egypt</td>
</tr>
<tr>
<td>9</td>
<td>Vice-President for Quality Assurance</td>
<td>Private university</td>
<td>1000</td>
<td>Egypt</td>
</tr>
<tr>
<td>10</td>
<td>Channel Marketing Manager</td>
<td>Multinational consumer goods manufacturer</td>
<td>1800</td>
<td>Egypt</td>
</tr>
<tr>
<td>11</td>
<td>Supply Planning Manager</td>
<td>Multinational food manufacturer</td>
<td>70000</td>
<td>Saudi Arabia</td>
</tr>
</tbody>
</table>

Interviews started with background information about knowledge measurement and a brief explanation of MinK. The first few questions examined the awareness of knowledge management and measurement in respondents’ organisations and the KM challenges they are currently confronted with. Participants were then asked to complete an evaluation questionnaire to assess the relevance of the proposed indicators and metrics to individual knowledge measurement using a five-point Likert scale (Likert, 1932) ranging from 1 (highly irrelevant) to 5 (highly relevant). The questionnaire was then discussed and the managers provided insights related to their answers in addition to their reflections and opinions regarding the MinK framework.

Findings and Feedback
During initial discussions, participants seemed familiar with KM, and most of their organisations implemented some sort of KM activity, of which the most interesting was a
virtual interactive knowledge marketplace, mentioned by respondent number 10, which employees were encouraged to use by “selling” knowledge to their colleagues from their “kiosks” in return for virtual “stars”. However, most respondents indicated that their organisations were still suffering from knowledge loss primarily due to staff turnover. When introduced to MinK, all respondents emphasised the value of individual knowledge and expressed interest in the idea of individual knowledge measurement. Six out of the eleven participants stated their organisations attempt to measure individual knowledge mostly by performance appraisals or subjective assessments by managers.

![Figure 1: Indicators evaluation questionnaire results](image1)

Analysis of the questionnaire results regarding the evaluation of IKIs revealed that the MinK framework was highly regarded, where nine out of ten indicators had an average rating higher than 4. Having the lowest average rating of 3.4, financial indicators were viewed as the least relevant IKI. Five respondents questioned the relationship between compensation and knowledge since it is common for knowledgeable employees to be underpaid and, in some cases, less knowledgeable ones could be overpaid. On the other hand, two participants offered an interesting suggestion by recommending a new IKI to represent “interpersonal skills” or “the ability to convey knowledge” as an additional measure of knowledge flow. Nevertheless, the overall outcome of IKI evaluation was highly positive as interviewees unanimously agreed that MinK’s indicators collectively provide “a good indication of individual knowledge.”

![Figure 2: Metrics evaluation questionnaire results](image2)
When evaluating metrics, the metrics for six indicators received an average rating of 4 or higher (Figure 2). It was observed that participants who found financial indicators to be irrelevant also gave low ratings to financial metrics. Some respondents found that metrics under the Business Communications and Personal Network IKIs that were based on direct counts (e.g. number of contacts, number of emails per day) were not very relevant to their corresponding IKIs because they measured the “quantity” and not the “quality.” As one manager stated, “an employee can attend tens of meetings and receive hundreds of emails per day, only for bureaucratic tasks that would have limited effect on her or his individual knowledge.” Likewise, interestingly a large number of participants found that training expenses were highly irrelevant to the value of the knowledge acquired during training. Such comments by managers were found to offer valuable feedback that would be used to improve MinK.

Conclusion and Future Work
This study presented the first phase in the development of MinK, a framework designed to measure individual knowledge in a business context to fill an existing gap in the literature and, more importantly, help organisations manage knowledge more effectively by identifying knowledge holders. Ten indicators that denote individual knowledge were selected, and metrics were developed to assess each metric individually. As a mean of preliminary validation, a study was conducted though semi-structured interviews with managers from different industries. The framework was rated high and managers who contributed in the study provided useful insights and recommendations that will be considered in the final version of MinK.

The main limitation of the preliminary validation stage is the sample size. The subsequent phase is therefore planning to include more companies and a larger scale of contribution from top management in the targeted organisations. The framework will then be modified to incorporate the valid suggestions that emerged from the preliminary validation and the subsequent validation phase.

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