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PRIORITIZING THE RELATIVE DOMINANCE OF DRIVERS FOR INTELLECTUAL ENTREPRENEURING THROUGH THE TERTIARY KNOWLEDGE INDUSTRY

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Abstract

The knowledge industry is becoming the dominant contributor to sustainable growth. It is causing a paradigm drift towards knowledge capitalization for improvement of productivity-driven competition to attain *better* economic performance, wealth generation, and development. Research has identified an "intellectual entrepreneurial capacity gap" as the constraint to attaining equity between developed and developing economies. The gap is fuelling the growing technological innovation divide – the widening boundary between developed and developing economies. As a contribution to reducing the gap, this paper presents a conceptual framework of drivers for intellectual entrepreneurial capacity in knowledge capitalization for technological and economic leapfrogging in development.

Keywords: Africa; Cameroon; technology innovation management; drivers for intellectual entrepreneuring; tertiary knowledge capitalization; economic leapfrogging; development; enabling environment.

Introduction

Economic trends now show that the knowledge industry is becoming the dominant contributor to sustainable economic growth (World Bank, 2006; 1999). A knowledge industry is an industry that operates in a knowledge-dense environment. In such an environment, the balance between knowledge and other resources has shifted so far towards the former that knowledge has become perhaps the most important factor determining the standard of living - more than land, than tools, than labor (World Bank, 1999). Developed and emerging economies are skewing more and more towards knowledge capitalization (a concept that implies improving market-driven competitivity and productivity of knowledge) for continuous improvement of productivity-driven competition in order to attain sustainable i) economic performance; ii) wealth generation; and iii) development and growth (Kwiatkowski & Sharif, 2005). On the other hand, their developing counterparts are lagging behind even though as contemporary economic competitors, they are compelled by unavoidable circumstances to compete in the same global market. Since intellectual entrepreneurial capacity (Johannison, Kwiatkowski, & Dandridge, 1999) has been demonstrated to lead innovations for economic development, its lack thereof is believed to be fuelling the growing gap in crucial technological innovation (Sharif, 1987) that plays a significant role in productivity and global competitiveness.

Historically, it has been reiterated that productivity in turn can lead to competitive advantage (Bell, 1999;

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Haines & Sharif, 2004; Prahalad and Hamel, 1990; Schumpeter, 1934, 1942, 1947, 1955) which is supposed to provide strategic positioning in the market for wealth creation; for economic and social wellbeing; and for development and growth. According to Kwiatkowski and Sharif (2005), intellectual entrepreneurial capacity was postulated to be understood as business venturing undertaken by intellectuals and/or intellectual features of any successful venturing undertaken within a knowledge-dense environment. In this 21st century however, the intellectual entrepreneurial capacity gap has been identified as one of the multiple limiting factors or gaps constraining the attainment of economic and social equity that are necessary to enhance and improve the livelihood of humankind. This is more so in developing economies than in their developed counterparts (Etzioni, 1968; Sanders, 2005; Winer, 2005).

Consequently, intellectual entrepreneurial capacity and knowledge capitalization have been demonstrated to be important and essential for innovation, technological and economic leapfrogging. And there seems to be consensus that there exists an intellectual entrepreneurial capacity gap which is partly responsible for underdevelopment.

The purpose of this paper is to present a conceptual framework of drivers for intellectual entrepreneurial capacity building with knowledge capitalization for development. The framework is conceived to respond to the need for reducing the intellectual entrepreneurial capacity gap, especially in developing countries in Sub-Saharan Africa (SSA). The framework is conceived in the context of the tertiary knowledge industry in response to current and anticipated world demand for knowledge-based goods, works and services. The tertiary knowledge industry is currently undergoing reforms into market-oriented centers of society-entrepreneurs with the principal objective of training and building citizen scholars who are skilled and equipped with tools to manage the intellectual entrepreneurial capacity gap (Cherwitz, 2004; Cherwitz 2005a, b, c; Cherwitz & Darwin, 2005; Entrepreneurship and Emerging Enterprises [EEE], 2006; Kwiatowski, 2001, 2003, 2004; Sharif, 2004, 2005).

The paper begins with a presentation and definition of the framework elements (that is, the drivers for intellectual "entrepreneuring" [Winer, 2005]). Next is a description of the Delphi Method (DM) and Analytic Hierarchy Process (AHP) .The DM and AHP are components of the methodology utilized for collating and analyzing data used for this paper. These two methods have been selected because they have been tried by other authors and found consistent with purposes that are similar with that of this paper. The third section of the paper is a presentation of the results of prioritizing the relative dominance of drivers for intellectual entrepreneuring. Prioritization is an AHP that uses Saaty's (1980; 1982) nine-point scale to determine the relative importance/dominance of the drivers. The prioritization exercise was conducted in four case interviews with practitioner/professional experts. The authors of this paper characterize the four experts (based on track records of their professional and academic achievements) as endowed with privileged work-cum-academic experience in the community of practice where knowledge is the driving force behind sustainable economic and social livelihood development. A synthesis of the prioritization results for the drivers in the conceptual framework is discussed in the fourth section. There is a conclusion in the fifth and last section of this paper. A list of references is provided at the end.

Drivers for Intellectual Entrepreneuring

Preamble - Demography and economic growth

The demographic structure (age, gender, size, and skills) of the human population in any one country is a factor that has an impact on economic development (Athukorala & Tsai, 2003; Australian Government [GoA], 2000; Hannum, 2005). Also very relevant are the impact of disease on humans and most recently the importance of HIV-AIDS on demography.

Demography and its human resource profile have evolved and impacted innovation, economic development and growth with different results depending on the regional or spatial location on the globe (Blank, 2005; GoA, 2000; Porca & Harrison, 2005; Sharif, 2006). The evolution is being shaped by frequent alterations among certain attributes, such as natural environment, economic structure, public and community institutions, social norms, and demographic characteristics. Two attributes of demography - population size and skills – will be examined concurrently in more detail.

Prevailing demographic characteristics do influence future possibilities. According to Bank's (2005) 'place-based' and 'people-based' policies "locations with only lower skilled jobs are likely to have large concentrations of the poor, less skilled and older workers, because younger workers and the more skilled ones are drawn out of the community to other opportunities" (Blank, 2005, p. 454). The presence of less skilled population may make an area unattractive to potential new industries and consequently economic growth and development. Since multiple causal factors affect place-specific outcomes and such factors interact so that 'outcome' and 'cause' are difficult to untangle, Blank (2005) advocates for the simultaneous implementation of both 'place-based' and 'people-based' policies for any effective impact of the local labor force. Place-based and people-based policies are those that take into consideration the geo-spatial distribution and/or concentration of natural and man-made capital, including skill sets. Place-based and people-based policies similar to the OLI-Eclectic advantages (Dunning, 1988,

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2001) discussed latter are needed for optimizing the location of any economic activity.

Drivers for Intellectual Entrepreneurial Capacity in Development

Given the need to conduct market-oriented education reforms, what are the inputs (*actors and factors*) that would contribute as pillars for intellectual entrepreneurial capacity development? How can stakeholders (governments/public sector, the private sector, universities and other institutions of higher learning - UIHLs, the civil society, non-governmental organizations – NGOs and the international development community) in tertiary education reforms organize the complex series of processes (such as the identification of investment opportunities, cost-benefit analysis, optimal mix of funding sources), so that the processes result in market-oriented intellectual capital formation?

To tackle these issues, the conceptual framework has been developed to illustrate the systemic integration and balancing of six *dimensions* required for intellectual entrepreneurial capacity in development. The six dimensions are i) integrating science of administration for an assumed deterministic situation; ii) assessing craft of management for more certainty than uncertainty; iii) benchmarking art of leadership for more uncertainty than certainty; iv) taking courage to risk and act in essentially uncertainty; v) distilling skills in a known context in more certainty; and vi) breaking the enterprise barrier in more uncertainty. The framework is developed in the context of tertiary education-led technology-enabled innovation management for wealth creation and for improvement of socio-economic wellbeing. Tertiary education in the context of this paper means post-high school general education and/or vocational training, including education from UIHLs.

In an attempt to develop an option to resolve the crucial intellectual entrepreneurial capacity gap – a component of the concept of crucial technological innovation deficit in development (Agwe, 2007) - the six dimensions comprised of distinct actors and factors are then integrated in a framework. Figure 1 depicts the interface of how the various framework elements could interact to resolve the gap. A brief description of the dimensions and a listing if their respective component factors and actors are presented below[1]:

[1] See Agwe (2007) for a detailed description and measurement of the dimensions; factors and actors; and existing resources in the pool.

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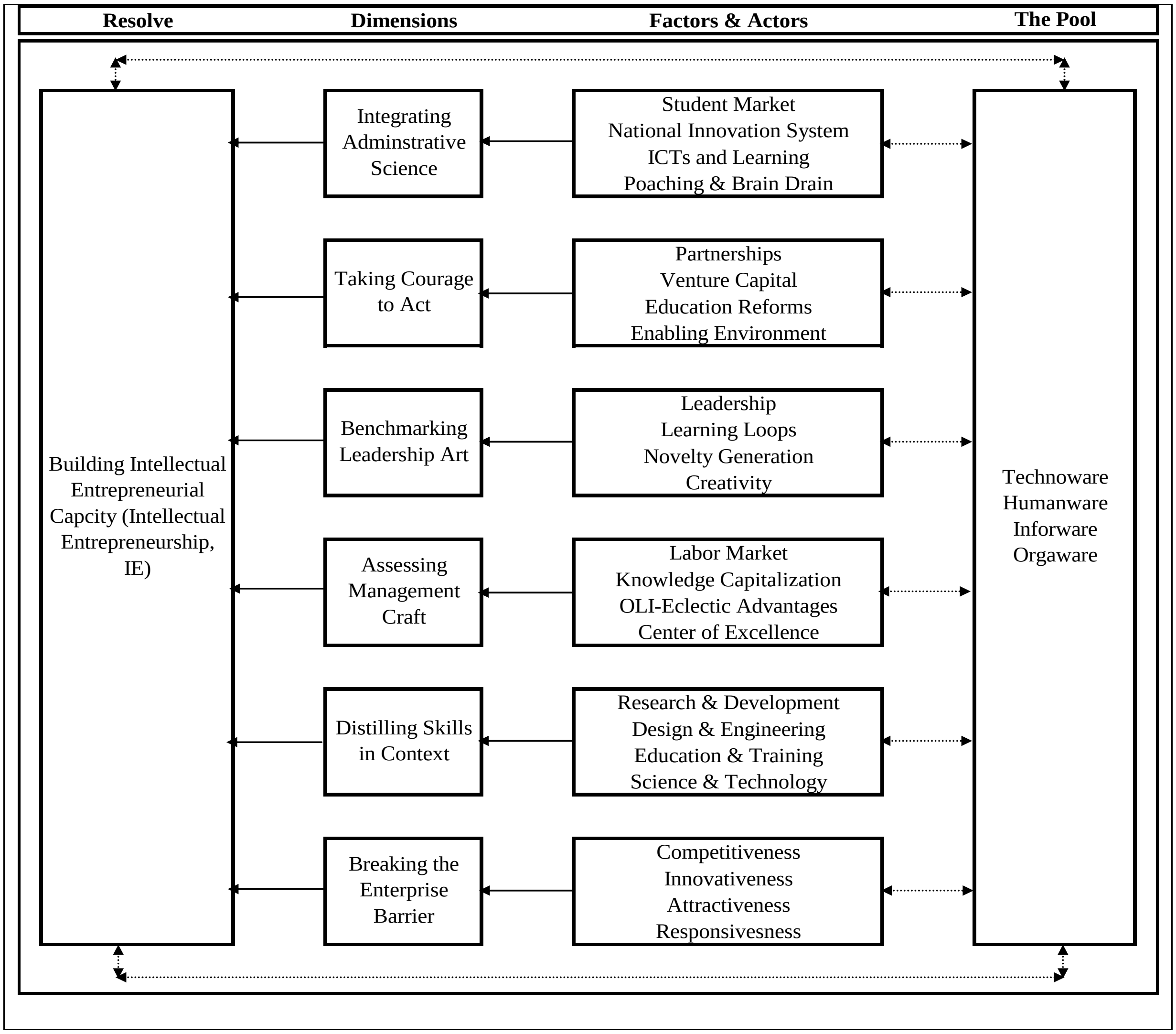

Figure 1. Integrative framework of drivers of intellectual entrepreneuring.

The six dimensions with their respective actors and factors

Integrating science of administration for an assumed deterministic situation:

Science in this case of management is not about the development of systematic knowledge through research. According to Mintzberg (2004, p. 93) it is based on logic; it relies on scientific facts; it is concerned with replicability; it involves deductive decision making approaches, that is, from general concepts to specific applications; it employs planning as its strategy making tool. The situation is deterministic because all factors taken into consideration do pre-exist: so, there is no invention or discovery factored-in. Successful implementation of this dimension for intellectual entrepreneuring requires the tertiary knowledge industry to systematically acquaint itself with, analyze and assess four existing factors and actors namely: composition of the student market, performance of the national innovation system (NIS); how information and communication technologies (ICTs) impact learning; and strategies to manage poaching and brain drain.

Taking courage to risk and act in an essentially uncertain situation:

Knowledge by and of itself does not lead to material wealth unless an entrepreneur (specifically an intellectual entrepreneur) is available to transform the knowledge for wealth creation and for development. Sanders (2005)

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suggested that such intellectual entrepreneurship was to be closely linked to material wealth creation (intellectual product and intellectual capital) and humanitarian outcomes (society betterment through economic development). In this sense, the intellectual entrepreneur has the 'courage to act'. Courage, because s/he has to use partial knowledge and/or combine dispersed knowledge from technological capital and from other resources for economic activities. The technological capital referred to here is made up of four dynamically related components: Technorware, Humanware, Inforware, and Orgaware – THIO (Sharif, 2004). As Sharif (2006) noted, courage is needed in order to undertake actions necessary to integrate the incomplete or partial and dispersed knowledge with emotional energy from Cultureware (or the world of mindset) and earthly matter from Natureware (or the world of matter). Sharif (2006) articulated that the world of mindset or culture-based motivational resources includes beliefs, values, attitudes, and aspirations; while the world of matter consists of nature-based derived resources comprising of energy, chemicals (inorganic materials) and leaving things (organic materials). Sanders (2005, p. 38) hypothesized that the "courage to act" may be a more critical motivator when the outcomes are devoid of wealth creation but focus on humanitarian outcomes. An exploitation of four elements (partnerships, venture capital, education reforms, and an enabling environment) is worthy of producing the courage to act in intellectual entrepreneurial capacity training and development by the tertiary knowledge industry.

Benchmarking art of leadership for more uncertainty than certainty:

Art – as one of the poles of management – encourages and represents creative imagination resulting in insights, intuition and vision. It may be seen in one sense as fusion of ideas at the tacit level (Heffner, 2006; Mintzberg, 2004; Sharif, 2005). Mintzberg (2004, p. 39) characterized 'the art' as being based on imagination (the visual); relies on creative insights; is concerned with novelty; involves inductive decision making approaches, that is, from specific events to the broad overview; employs visioning in strategy making. As Oils get engaged in scaling up intellectual entrepreneurial capacity building for development, benchmarking the art of leadership in management under conditions of uncertainty than certainty requires a comprehensive synthesis of four forms of insights and visions. The four forms are leadership, learning loops, novelty generation and creativity.

Assessing craft of management for more certainty than uncertainty:

Craft is about making connections, building on tangible experiences and iterating back and forth between the specific and the general. In a holistic way, Mint berg (2004, p.93) describes craft – one of his three poles of managing – as based on experience (the visceral); relies on practical experiences; is concerned with utility; involves iterative decision making approaches, that is, from general concepts to specific applications and back to general concepts; employs venturing as its strategy making tool. Craft as dynamic learning, iterating between deductive and inductive tools in the form of actions and experiments operates most effectively in more certainty than uncertainty (Sharif, 2006). "Craftsmen are helpful, wise and reasonable" (Patricia Pitcher in Mintzberg, 2004, p. 103). This section focuses on appraising or assessing management craft as a requisite form of action. Management craft in this paper dwells on four factors and actors: the labor market, knowledge capitalization, eclectic advantages and centers of excellence.

Distilling skills in a known context in more certainty than uncertainty:

It can be said that the best foresight is derived from a solid insight based on skills that have been distilled or filtered for contemporary and future market needs. Such best foresight is commensurate with customer/client desires for sophistication and well-being and the distilled skills provide the tools necessary for competing. As such, it can be assumed that only entrepreneurs with good foresight are capable of responding effectively to the exigencies and demands of the ever increasingly competitive global market. Competition in this context could imply catching-up, leapfrogging, surpassing or staying ahead of ones peers. To be successful in the contemporary globalizing market requires distilling skills in a particular context and this appears to require developing intellectual capital and putting it to work as dictated by the market. Advocates of intellectual entrepreneurial capacity development believe that distillation is achievable through acquiring actionable tertiary level education and knowledge through combining cognitive and reactive with creative and productive learning.

However, the knowledge industry, particularly in many developing countries, has yet to recognize the centrality of knowledge capitalization as the paramount intermediary between inputs and outputs for successful competitiveness in wealth generation and for economic and social wellbeing. Since entrepreneurs are creative people, they are endowed with skills to spot potential innovations. Innovations are the centrality of intellectual capital that is produced through *customized* education and training (E&T), science and technology (S&T), research and development (R&D), and design and engineering (D&E). These four pairs of combinations entail a significant presence of creativity acquired through learning – the life-long process and the essence of acquiring wisdom. Only market-oriented tertiary knowledge industry stakeholders

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would take the courage and risk to invest and venture in these areas in response to contemporary demand or in anticipation of future market niches.

Breaking the enterprise barrier in a more uncertainty than in certainty situation:

The role of tertiary education as a knowledge industry that develops intellectual entrepreneurial capacity is an important factor for knowledge capitalization. This kind of prior education is a driver to enterprise-based training since it increases the ability of the worker to acquire new skills (Johanson & Adams, 2004). The new skills in turn correlate with organizations (firms or companies) investing in new technologies; and the cycle continues. Breaking the enterprise barrier in an intensely competitive global market depends significantly on providing on-the-job or organization- or enterprise-based training. This is required for providing the quality and meeting the product and service standards that are important to customers and clients whose demands are becoming increasingly more and more sophisticated. Training within the enterprise (in-service training) allows for continuous learning and adaptation to new technologies, thereby improving the technological capacity with updated skills and knowledge required to set up and operate efficiently and competitively. Success in breaking the enterprise barrier requires four balanced score card items concurrently (Sharif, 1993; 1999). The four balance score card items are: competitiveness, innovativeness, attractiveness, and responsiveness.

Tapping and exploiting the existing pool of resources

For any intellectual entrepreneur to perform his/her business efficiently and effectively, Kwiatowaki (2004) noted two factors – opportunity and necessary resources – that should be noticed and reflected upon simultaneously. Since no invention or discovery is implied in this framework, the pool of the already existing opportunities and necessary resources is selected as the source of inputs for the development of yet new intellectual/knowledge capital for the less privileged in both developed and developing societies. Intellectual capital and entrepreneurial capacity should be developed from a combination of different proportions of four types of resources exploited from the already existing global pool of tangible and intangible Natureware and Cultureware. The four types of resources of interest consist of (a) nature-based derived resources that include matter, energy, land, water, space; (b) intelligence-based created resources such as tools (Technoware), skills (Humanware), facts (Inforware) , and methods (Orgaware) – THIO; (c) goodwill-based created resources (social capital) that involve connections, networks, reputation, credibility, trust, glamour; and (d) convenience-based surrogate resources made up of money, credit, and insurance (Kwiatowski, 2004; Sharif, 2004).

Intellectual entrepreneurial capacity should therefore be endowed with skills in recognizing emerging future patterns – the essence of detecting opportunities – and aptitude of deciding if, when, why and how to tap and exploit existing necessary resources. Four of the resources in ‘the pool of existing resources’ are of major interest to this paper. As explained by Sharif, they are object-embodied physical facilities - tools (Technoware); person-embodied human ingenuity - skills (Humanware); record-embodied codified knowledge - facts (Inforware); and organization-embodied operational schemes - methods/procedures (Orgaware). Although they present in different proportions, these four factors and actors - THIO - the intelligence-based created resources are dynamically interrelated and always present concurrently in every system (Haines & Sharif, 2004; Heffner, 2006).

In summary, the set of four indicators listed above for measuring each of the 24 factors and actors provided background data that was presented in formats that were intended to unveil any trends and raise awareness. The trends unveiled were then used as guide for expert prioritization of the framework elements for 21 countries selected from 184 member countries of the World Bank Group. Data collated using the above indicators confirmed that overall socio-economic performance in developed countries is *better* than that in their developing counterparts. ‘Better’ performance is an indication of operations conducted based on knowledge workers, intellectual entrepreneuring and knowledge capitalization.

The Study Methodology

The contemporary world is complex and has a “multiple perspective nature” (Linstone, 1999). Improving performance therein through any type of structuring and restructuring interventions would typically call for the utilization of multiple decision-making criteria techniques or multiple perspectives decision making techniques (Linstone, 1999). Linstone also refers to such techniques as the TOP-perspective (that is, Technical, Organizational and Personal perspective). The research method employed in this project can be described as pragmatic, with a systematic inquiry into a real practical world situation. It offers the potential to benefit from a mixed methods approach with its numerous advantages over either a quantitative or qualitative approach for collecting relevant numeric (quantitative) and non-numeric (qualitative) data (Creswell, 2003; Heffner, 2006).

This study is focused on improving development management through allocating more attention to encourage technological innovation and creativity. Its emphasis is directed to knowledge capitalization based on intellectual entrepreneurial capacity development by the tertiary knowledge industry. The DM and AHP approaches

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discussed below to explore input from different experts appear to be the best alternative approach to achieving the required level of attention. The experts were selected based on two principal criteria i) that they were assessed by the authors of this paper to be endowed with a comparative advantage in skills, experiences and privileged knowledge in the research area of interest in this paper and that at the time of the interview they were working in different departments of the same international development organization. The organization would have a diversified business portfolio, one business line of which must be knowledge for development (K4D); and ii) that the experts had been exposed to or must have used the DM and AHP methodologies in their professional and academic business lives and were also available to grant at least one hour of their time for the interview. Four main components of the research methodology explored for this paper are explained briefly below.

The Structured/Participant Observation Expert Case Interviews

A questionnaire drawn for collecting the required data was sent by email attachment to the four interviewees selected so they could familiarize themselves with before the planned face-to-face (f2f) structured/participant observation, (Mintzberg, 2006) DM-type conversation and AHP scoring exercise. An exception to the f2f approach was done on request by the first interviewee who for reasons of time management offered to provide a telephone interview. DM and AHP are two analytical tools used in this research and are discussed in the next subsections.

The Delphi Method

The Delphi Method - DM (Linstone & Turoff, 1975; Loo, 2002) is a data collection technique for conducting and recording results of a focused conversation. DM is like a group discussion without the disadvantages that may occur from group dynamics such as interpersonal conflict. Characteristics of this technique include anonymity, controlled feedback, statistical response and a series of rounds of interviews (Heffner, 2006). To implement DM for consolidating expert judgment, the original process involves six steps defined by Linstone and Turoff (1975).

Used initially for forecasting, DM has been adapted for use as a research tool to develop a comprehensive representation of a current situation or issue (Scott in Heffner, 2006). Referring to different authors who have used a modified DM, Heffner (2006, p. 57) states “the Delphi method has been used extensively in studies of health care and has been applied to management and technological studies as well.”

The Analytic Hierarchy Process (AHP)

Use of relative measures in decision-making has been demonstrated to be more valuable than decisions taken based on absolute measures, especially when considering tangibles and intangibles together (Haines & Sharif, 2004). Therefore, it is advisable to use relative scoring methods when attempting to assess the relative importance (or relative dominance or relative preference) of factors and actors that contribute to taking a decision. The AHP developed by Saaty (1980; 1982) for complex decision problems is a technique used for data analysis to develop a prioritization of relative importance of model factors. It is a decision-making framework that uses a hierarchical structure to describe a management problem. AHP paired comparisons rank all items at each level with respect to their relative importance with each other, and then convert level-specific local priorities into broader level decision priorities. The AHP is explained further latter.

Operationalizing Framework Elements for Prioritization

In order to utilize the techniques identified above, the framework has to be restructured or converted into an analytical hierarchy to facilitate pair-wise comparison and geometric mean prioritization of the model (or framework) elements. Operationalizing or test-applying the framework requires that several stakeholders of the tertiary knowledge industry and knowledge capitalization for development undertake a prioritization of the model factors. In order to facilitate such an analysis and decision making, it is imperative to reorganize the model factors into the AHP (hierarchical tree) structure.

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Figure 2. The framework restructured in an analytical hierarchy.

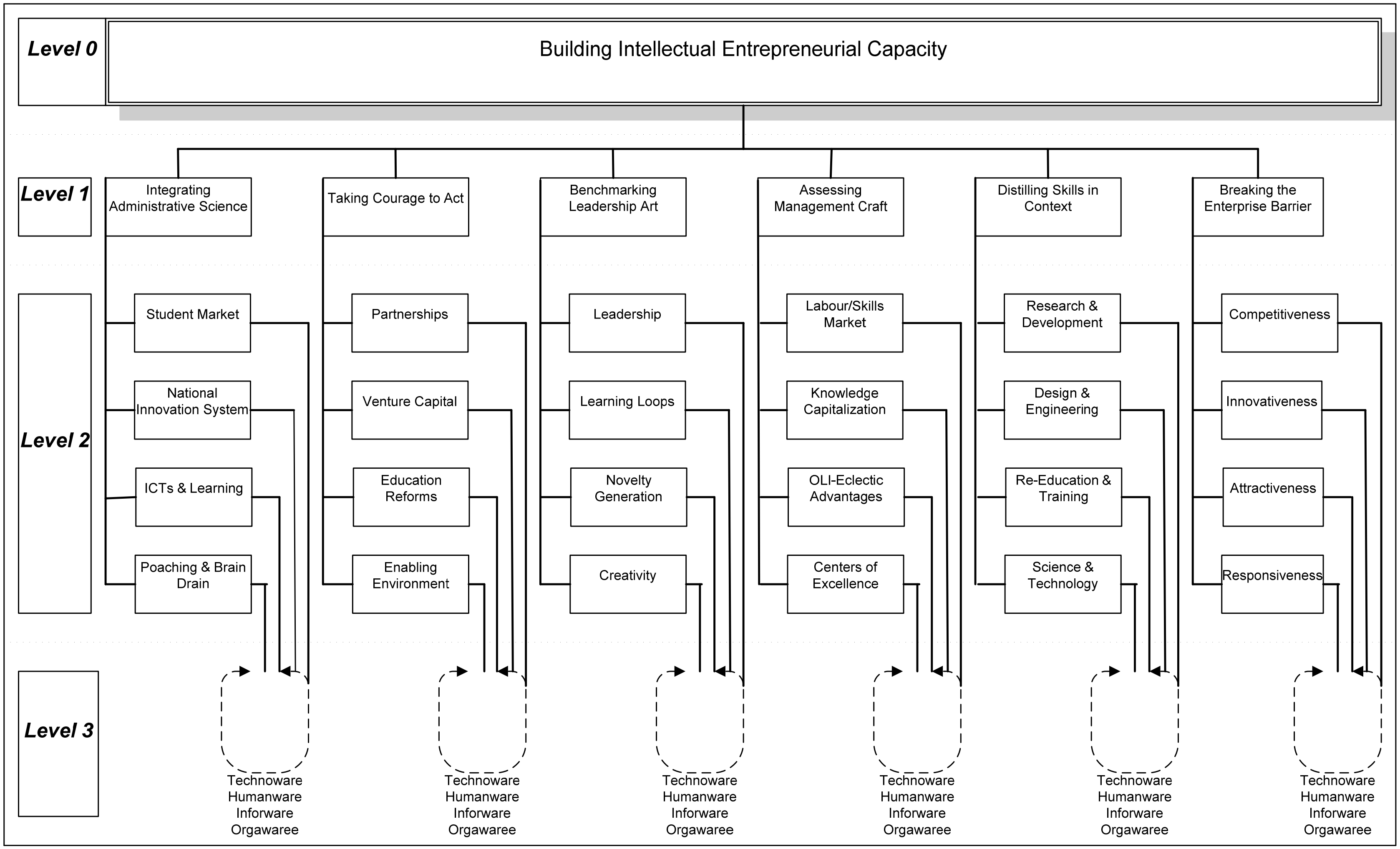

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Figure 2 shows the framework converted to a hierarchy of factors and actors at four levels in the following bottom-up order: Level 3, Level 2, Level 1 and Level 0 and described briefly here. Since no invention is intended in this model, there is only an exploitation of the pool of resources that are already existing (Level 3) from which those considered relevant for this research are selected and disaggregated into actors and factors (Level 2). Level 2 actors and factors are then recombined in new ways – recombinant innovation - (Level 1) to attain the goal (Level 0). The arrows in Figure 1 (the concept framework diagram) show that it is a system in which attaining Level 0 feeds back into Level 3 and the cycle starts all over again, hopefully with cascading incremental effects occurring as technological leapfrogging (Sharif, 2004) is taking place and resulting in wealth generation, development, growth and the ultimate betterment of humankind. Figure 2 is a pictorial view of how old knowledge (Figure 1) can be fused to generate new knowledge - the notion of knowledge fusion (Heffner, 2006).

With model factors rearranged in a tree structure (Figure 2), it then becomes possible to apply specific methods to members of the tree to ease prioritization and decision making. Using Saaty's (1980/82) nine-point ratio, a pair-wise comparison matrix can then be generated between factors and actors at any particular level of the decision hierarchy for expert and other stakeholder opinion on the relative weighted importance of various alternatives and performance measures. By applying the geometric mean procedure, expert scores within each row are then normalized with the weighted scoring model so that they sum up to 1. A relative dominance table is then generated from the computed weights at each level of hierarchy for each factor and actor. The relative dominance helps the decision maker to determine how resources and investments could be (re)-directed. The calculated relative dominance of model factors and actors from expert opinion can be set as the benchmark (or target or planned reference point) for resource/investment allocation. From here, a probable logical step would then be to compare i) the planned (Model) profile developed using AHP with ii) the actual profile to see where and if adjustments should be made. A spidergram or radar diagram is a useful visualization for this kind of comparison exercises.

Table 1. *Codes for framework elements*

Level 1 Elements		**Level 2 Elements**		**Level 3 Elements**	
Code	**Name**	**Code**	**Name**	**Code**	**Name**
L1a	L1-Integrating Administrative Science	L2a.1	L2a-Student Market	L3a	L3-Technoware
		L2a.2	L2a-National Innovation System	L3b	L3-Humanware
				L3c	L3-Inforware
		L2a.3	L2a-ICTs and Learning	L3d	L3-Orgaware
		L2a.4	L2a-Poaching & Brain Drain		
L1b	L1-Taking Courage to Act	L2b.1	L2b-Partnerships		
		L2b.2	L2b-Venture Capital		
		L2b.3	L2b-Education Reforms		
		L2b.4	L2b-Enabling Environment		

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L1c	L1-Benchmarking Leadership Art	L2c.1	L2c-Leadership		
		L2c.2	L2c-Learning Loops		
		L2c.3	L2c-Novelty Generation		
		L2c.4	L2c-Creativity		
L1d	L1-Assessing Management Craft	L2d.1	L2d-Labor/Skills Market		
		L2d.2	L2d-Knowledge Capitalization		
		L2d.3	L2d-OLI-Eclectic Advantages		
		L2d.4	L2d-Center of Excellence		
L1e	L1-Distilling Skills in Context	L2e.1	L2e-Research & Development		
		L2e.2	L2e-Design & Engineering		
		L2e.3	L2e-Education & Training		
		L2e.4	L2e-Science & Technology		
L1f	L1-Breaking the Enterprise Barrier	L2f.1	L2f-Competitiveness		
		L2f.2	L2f-Innovativeness		
		L2f.3	L2f-Attractiveness		
		L2f.4	L2f-Responsivesness		

Table 1 presents codes for framework elements and level names. Codes are suggested for the simple fact that there are many (34) framework elements with much longer names which can cause congestion and create difficulty in comprehending diagrams in which such names are used. The codes, instead of the much longer names, are utilized in order to present more compact but detailed visual aids for management decision-making. Table 1 is the key or legend to refer to for names of codes used in subsequent discussions in this paper.

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Presentation of Results of the Expert Prioritization Exercise

Since the objective of this paper is to develop a priority list of drivers for intellectual entrepreneuring, this section presents results to confirm the validation of the conceptual framework developed and discussed in the previous sections. Selected expert reflections and feedback combined with participant observations are provided for each of the four DM technique-driven interviews. Research can be conducted in many ways: one of the approaches involves gathering data from primary sources for empirical evidence, while another involves gathering data from secondary sources, analyzing and recombining (re-synthesizing) the data into new forms and then presenting the new forms to experts for their value judgment and opinions as they draw heavily on their experiences. Mintzberg (2005) distinguishes between these two approaches in that the first one leads to a model resulting in scientific theory, while the second leads to a model resulting in management theory. Mintzberg refers to the second model-type as *management concepts* instead of management theory. Hence, this conceptual paper involves the second (practical) approach whereby expert judgments and opinions have been explored to reach a practical management decision. During the interviews, Mintsberg's structured observation technique was employed alongside Saaty's analytical hierarchy process conducted to prioritize the framework elements. The structured conversation was consistent with the DM-AHP methodology to create knowledge for management decision-making as it involved the investigator sitting down with the interviewee on equal terms, observing, asking questions guided by issues of interest to the research, and discussing while taking down notes on feedback from the interviewee.

In summary, this section analyzes and synthesizes expert opinions using the main research tools described in previous sections. The tools are the Delphi Method (DM), the Analytic Hierarchy Process (AHP) with its pair-wise comparison and geometric mean weighting exercises, and a graphical representation for visual-aided management decision-making. While this section focuses on the determination of the relative importance of the framework elements, it also acts in a dual capacity: i) in a way as a revalidation of the conceptual framework, and ii) also as a revalidation of the tools used in collecting and analyzing data discussed in this paper.

Overview of Interviewees.

Four experts were interviewed for this prioritization exercise. The experts did business primarily in some aspect of technology for development (T4D) for an international development organization. This section presents the results of the interviews conducted for the exercise of prioritizing drivers for intellectual entrepreneuring (the framework elements). The experts were presented with background data for 21 of the 184 member countries of the World Bank Group. To implement DM for consolidating expert judgment, the original process involves six steps: i) the Delphi Administrator (DA) obtains opinions of experts and stated reasons for their opinion on a specific problem; ii) the DA reduces all individual opinions and their reasons to standardized statements to preserve anonymity; iii) the DA transmits to individual experts the aggregated opinion statistics of all experts surveyed and also provides each expert the reasons given by all the other experts; iv) the DA requests a re-evaluation and further substantiation (reason) of the opinion; v) iterative feedback of previous round response statistics and response for judgment continues until no substantial change occurs; and finally, vi) the DA takes the last round opinion and computes a set of median values to represent expert judgment.

However, for this paper, the interviews were conducted using a modified Delphi-type discussion. The modification involved considering mainly the first three of the six DM steps. Although only the first three steps were employed for this research, all of DM's principles were observed. The initial steps were complemented with other principles from Mintzberg's (2005) structured/participant observation technique. Each interview proceeding was guided by the relevance of the context of the interviewee's scope of work and the principles of the AHP raw scoring process.

AHP scoring with normalized relative weighting:

AHP uses pair-wise comparison matrix and matrix algebra (eigenvector analysis) to identify and attribute weights (using geometric means or the n^{th} root of n comparisons for relative importance/dominance of multiple variables affecting the same outcome) to factors and actors that are important for helping management to make a decision. Using AHP for weighted scoring involves four main steps i) decompose the problem into a hierarchy; ii) prioritize the hierarchy elements using pair-wise comparison of importance; iii) normalize values to obtain relative weights; and iv) select intervals for scoring alternative values against each criterion function.

Table 2 presents results from exploring the hierarchical tree process. The table summarizes four sets of pair-wise comparison raw scores and normalized relative weights for the six level 1 dimensions for intellectual entrepreneuring. Raw scores were also used in the calculation of the normalized relative weights for the rest of 28 drivers for intellectual entrepreneuring. The 28 drivers include 24 factors and actors for levels 2a–2f and the four level 3 technology components (THIO).

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Table 2. *Pair-wise comparison matrix of level 1 dimensions for Intellectual Entrepreneuring*

Level 1 dimensions	**Raw Scores**						**Normalized Geometric Mean Calculation**		
	L1a	**L1b**	**L1c**	**L1d**	**L1e**	**L1f**	**Product of Row Entries**	**Geometric Mean of Product - GMP (6th root)**	**GMP Norma-lized Relative Weight**
L1a									
Expert 1	1.0[A]	0.3[C]	0.2	0.1	0.3	0.2	0.00	0.26	0.03[D]
Expert 2	1.0	0.3	0.3	0.2	0.3	1.0	0.00	0.38	0.05
Expert 3	1.0	0.2	0.3	0.2	0.3	3.0	0.01	0.46	0.06
Expert 4	1.0	0.3	0.3	0.5	0.2	1.0	0.01	0.45	0.06
L1b									
Expert 1	4.0[B]	1.0	0.3	0.3	0.3	0.2	0.02	0.51	0.06[E]
Expert 2	3.0	1.0	3.0	2.0	4.0	1.0	72.00	2.04	0.27
Expert 3	5.0	1.0	4.0	2.0	3.0	3.0	360.00	2.67	0.35
Expert 4	4.0	1.0	2.0	3.0	2.0	1.0	48.00	1.91	0.26
L1c									
Expert 1	5.0	3.0	1.0	0.5	0.3	0.3	0.63	0.92	0.11[F]
Expert 2	4.0	.03	1.0	3.0	4.0	4.0	64.00	2.00	0.26
Expert 3	3.0	0.3	1.0	0.3	1.0	0.3	0.08	0.66	0.09
Expert 4	3.0	0.5	1.0	3.0	0.5	0.3	0.75	0.95	0.13
L1d									
Expert 1	7.0	3.0	2.0	1.0	0.3	0.2	2.10	1.13	0.14[G]
Expert 2	6.0	0.5	.03	1.0	3.0	2.0	6.00	1.35	0.18

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Expert 3	5.0	0.5	3.0	1.0	3.0	1.0	22.50	1.68	0.22
Expert 4	2.0	0.3	0.3	1.0	0.3	0.2	0.01	0.50	0.07
L1e									
Expert 1	4.0	4.0	3.0	4.0	1.0	1.0	192.00	2.40	0.29[H]
Expert 2	4.0	0.3	0.3	0.3	1.0	0.3	0.02	0.53	0.07
Expert 3	4.0	0.3	1.0	0.3	1.0	0.5	0.22	0.78	0.10
Expert 4	5.0	0.5	2.0	3.0	1.0	1.0	15.00	1.57	0.21
L1f									
Expert 1	6.0	6.0	4.0	5.0	1.0	1.0	720.00	2.99	0.36[I]
Expert 2	8.0	1.0	0.3	0.5	4.0	1.0	4.00	1.26	0.17
Expert 3	4.0	0.3	3.0	1.0	2.0	1.0	8.00	1.41	0.18
Expert 4	5.0	1.0	3.0	5.0	1.0	1.0	75.00	2.05	0.28

Interpreting raw scores (relative values): Some cells in Table 2 are shaded and lettered to ease referencing. Shaded cell A has a raw score of 1. What this means is that comparing level 1 dimension L1a to level 1 dimension L1a (that is, comparing 'Integrating Administrative Science' to itself) Expert 1 gave a relative value (raw core) of 1. According to AHP nine point ratio pair-wise comparison process, this score of 1 implies that both L1a are *relatively equally important* vis-à-vis each other. Shaded cell B in which L1b is compared with L1a (that is, comparing 'Taking Courage to Act' with 'Integrating Administrative Science'), Expert 1 gave a relative value of 4. According to Expert 1, the raw score of 4 means that 'Taking Courage to Act' was *strongly dominant over* 'Integrating Administrative Science'. The inverse of the afore-going comparison is comparing L1a with L1b (that is, comparing 'Integrating Administrative Science' with 'Taking Courage to Act'). For this inverse comparison, a raw score – the inverse of the relative value of 4 is computed. The result of the computation is one quarter (that is, 1/4 = 0.25 rounded up to 0.3 in one decimal place) as in shaded cell C. The rest of the raw scores (relative values) can be interpreted in the same way.

Interpreting normalized relative weights: In Table 2, shaded cells D, E, F, G, H, & I contain normalized relative weights of geometric mean (in this case the 6^{th} root) of the product of six raw scores in their respective rows. The six shaded cells contain Expert 1's normalized weights of 0.03, 0.06, 0.11, 0.14, 0.29, and 0.36 for level 1 dimension L1a, L1b, L1c, L1d, L1e and L1f, respectively. From Expert 1's raw scores or relative values, L1a (Integrating Administrative Science) has a relative weight of 0.03 compared to L1f (Breaking the Enterprise Barrier) with a relative weight of 0.36. What this implies is that Expert 1 attaches more weight or relevance or importance to L1f than to the other five inputs (L1a through L1e). As with eigenvector analysis, the sum of the normalized weights is equal to 1.00 for each row (or level) and for each expert. The same interpretation can be made for the geometric mean of product and the normalized relative weights in Table 3. Unlike in Table 2, Table 3 intentionally omits the pair-wise comparison raw scores. However, this time the relative weights are computed based on the 4^{th} root of the geometric mean of the product of four row entries.

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Table 3. Relative dominance table from pair-wise comparison matrix of level 2 factors and actors and level 3 existing resources.

	Level 2						Level 3
	Integrating Administrative Science	**Taking the Courage to Act**	**Benchmarking Leadership Arts**	**Assessing Management Craft**	**Distilling Skills in Context**	**Breaking the Enterprise Barrier**	**Existing Resources in the Pool**
	L2a.1	***L2b.1***	***L2c.1***	***L2d.1***	***L2e.1***	***L2f.1***	***L3a***
Expert Case 1	0.04	0.04	0.53	0.15	0.20	0.36	0.05
Expert Case 2	0.06	0.18	0.48	0.08	0.20	0.11	0.09
Expert Case 3	0.20	0.21	0.25	0.11	0.43	0.51	0.03
Expert Case 4	0.20	0.07	0.06	0.08	0.31	0.19	0.08
	L2a.2	***L2b.2***	***L2c.2***	***L2d.2***	***L2e.2***	***L2f.2***	***L3b***
Expert Case 1	0.20	0.08	0.11	0.18	0.07	0.47	0.17
Expert Case 2	0.33	0.08	0.13	0.46	0.07	0.13	0.10
Expert Case 3	0.49	0.19	0.52	0.05	0.11	0.27	0.29
Expert Case 4	0.19	0.22	0.18	0.23	0.28	0.49	0.61
	L2a.3	***L2b.3***	***L2c.3***	***L2d.3***	***L2e.3***	***L2f.3***	***L3c***
Expert	0.09	0.17	0.17	0.52	0.17	0.07	0.28

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Case 1							
Expert Case 2	0.22	0.21	0.32	0.26	0.20	0.25	0.32
Expert Case 3	0.23	0.09	0.06	0.24	0.35	0.13	0.08
Expert Case 4	0.45	0.44	0.35	0.27	0.13	0.10	0.13
	L2a.4	***L2b.4***	***L2c.4***	***L2d.4***	***L2e.4***	***L2f.4***	***L3d***
Expert Case 1	0.68	0.71	0.19	0.15	0.56	0.10	0.49
Expert Case 2	0.39	0.53	0.06	0.20	0.53	0.51	0.49
Expert Case 3	0.09	0.51	0.17	0.59	0.11	0.08	0.60
Expert Case 4	0.16	0.27	0.41	0.42	0.28	0.21	0.18

In summary, using Saaty's nine-point ratio, two consolidated pair-wise comparison matrixes (Tables 2 and 3) were generated between factors and actors at any particular level of the decision hierarchy. The normalized weights attributed to each driver for intellectual entrepreneuring by the experts and other stakeholder opinion can then be used to assist management in decision-making. For example, in multicriteria decisions required for allocating scarce resources following the relative weighted importance of various alternatives and performance measures.

Synthesis and Discussion of Expert Scoring

Rank-ordering relative dominance of framework elements by level

This section consolidates the normalized relative weights (see previous section) from each expert interview for each driver for intellectual entrepreneuring. As reflected in the methodology section, DM-type computations of median values involve consolidation of judgment of several experts. Sums of the normalized relative weights are calculated and used to rank the relative importance of framework elements.

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Table 4. *Rank-ordering the relative dominance of level 1 dimensions*

Code	Sum of Normalized Scores	Rank Order of Relative Importance (%)
L1c	0.99	25%
L1b	0.94	23%
L1e	0.67	17%
L1d	0.60	15%
L1f	0.59	15%
L1a	0.20	5%

The sums are obtained by adding together the normalized relative weights from each expert for each of the six dimensions; for each of the 24 factors and actors; and for each of the four components of technology. Table 4 presents ranking in descending order of the calculated relative dominance of the drivers for intellectual entrepreneuring at level 1.

By consolidating the different expert normalized relative weights for level 1 dimensions, Table 4 shows that the driver L1c (Benchmarking Leadership Art) with a 25% score is rank-ordered the most relatively important of the six drivers for intellectual entrepreneuring. This is followed in rank-order of relative importance by L1b (Taking Courage to Act) with a 23% score, L1e (Distilling Skills in Context) with a 17% score, L1d (Assessing Management Craft) and L1c (Breaking the Enterprise Barrier) each with a 15% score, and then L1a (Integrating Administrative Science) with a score of 5%. The same interpretation can be made on the rank-order of relative importance (in percentages) of level 2 and 3 drivers for intellectual entrepreneuring.

Table 5. *Rank-ordering the relative dominance of level 2 factors and actors and level 3 resources*

Code	Sum of Normalized Scores	Rank Order of Relative Importance (%)
L2a.4	1.31	33%
L2a.2	1.21	30%
L2a.3	0.98	24%
L2a.1	0.50	12%
L2b.4	2.02	51%

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L2b.3	0.91	23%
L2b.2	0.57	14%
L2b.1	0.50	12%
L2c.1	1.32	33%
L2d.4	1.37	34%
L2d.3	1.29	32%
L2d.2	0.93	23%
L2d.1	0.41	10%
L2e.4	1.49	37%
L2e.1	1.14	29%
L2e.3	0.84	21%
L2e.2	0.53	13%
L2f.2	1.36	34%
L2f.1	1.18	30%
L2f.4	0.90	23%
L2f.3	0.55	14%
L3d	1.76	44%
L3b	1.17	29%
L3c	0.81	20%
L3a	0.25	6%
L2d.4	1.37	34%
L2d.3	1.29	32%
L2d.2	0.93	23%

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Visual-aid for management decision-making:

In an attempt to uncover/visualize potential trends in the four separate sets of expert judgments, Figure 3 – accompanying Tables 4 and 5 - depicts the different expert judgments in a graphical form. On a closer examination of Figure 3, there seems to be no common trend for all four sets of expert judgment. For instance, there are differences in the peaks and troughs in the normalized expert scores within the same level and between the three different levels.

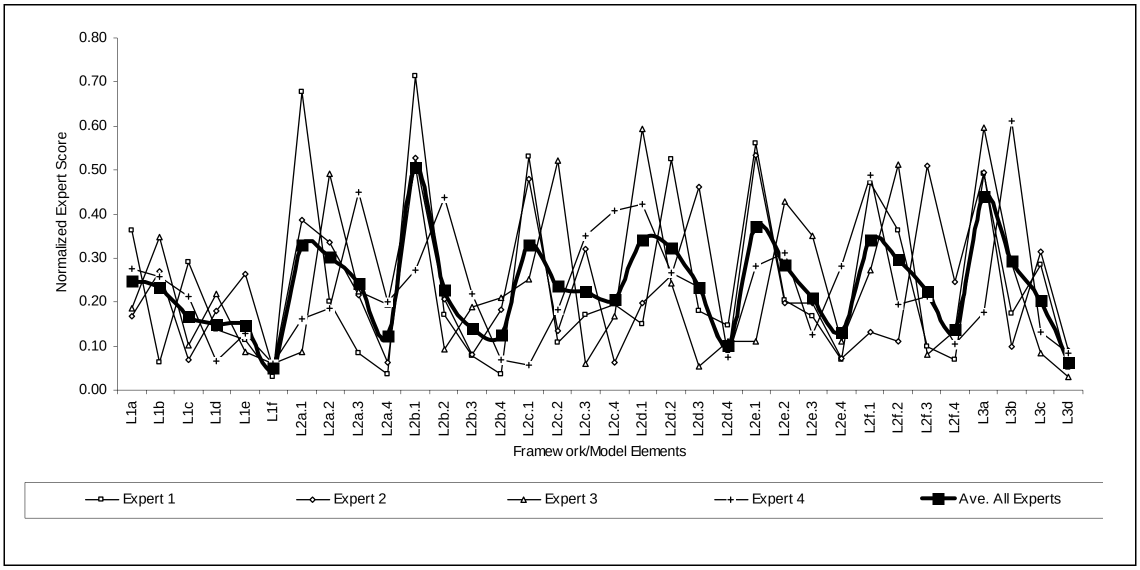

Figure 3. Intra- and inter-level comparison of expert-determined relative dominance of framework elements

This could be due to the fact that data was collected using only the initial stages of the DM. In order to minimize the differences between the expert scores, it is imperative to carry out a more comprehensive DM[2]. However, to try to mitigate the differences, a consolidation - the average[3] of the normalized expert scores - is introduced to even out the variations. With the average (consolidation) introduced in lieu of a comprehensive DM, a much generalized trend is observed: the average normalized expert score appears to *peak* and *trough* particularly with Expert 1 and Expert 2.

Rank-ordering relative dominance of all framework elements together

An observation by three of the four expert interviewees was that there were possible inherent overlaps between some of the model elements since most of them appear to be composite variables that could be decomposed into several single variables. As such, they severally recommended to lump all model elements together irrespective of level and then rank-order them to determine their over all relative dominance.

This section implements the recommendation of integrating the individual AHP scorings and rankings in terms of determining the relative dominance in the context of prioritizing drivers for knowledge capitalization in development. The exercise lumps all 34 framework elements (dimensions, factors and actors, and existing resources) together and subjects them to a rank-ordering for relative dominance to determine the priority for relative importance.

Table 6 presents all 34 drivers (levels 1, 2 and 3) lumped together with the sum of normalized expert AHP scoring and their ranking results in descending order of relative dominance. The ranking shows that based on the sum of normalized scores, the driver - '*enabling environment*' - in the context explained for this research, tops the list of 34. The enabling environment registered a sum of normalized scores of 2.02, which then positioned it at the top of the list with a rank-order relative dominance of 6 percent. At the other extreme is the framework element *'integrating administrative science'* which fetched a sum of normalized scores of 0.20, equivalent to 1 percent for the rank-order of relative dominance. The integrated/consolidated AHP scoring and ranking exercise resulted in placing 'integrating administrative science' at the bottom of the list of 34 drivers for intellectual entrepreneuring. The rank-orderings of the remaining 32

[2] A comprehensive DM was not done for this paper.
[3] An average is one of the central tendencies in statistics. It is used here to consolidate different expert opinions into one.

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drivers for intellectual entrepreneuring on the spectrum fall between the two extremes. They are also ranked in descending order of relative dominance (Table 6).

Table 6. ***Rank-ordering the relative dominance of all framework elements lumped together***

Model Element/ Level Code	Model Element	Sum of Normalized Scores (All Experts)	Rank Order of Relative Importance (%), All Model Elements
L2b.1	Enabling Environment	2.02	6%
L3a	Orgaware	1.76	5%
L2e.1	Science & Technology	1.49	5%
L2d.1	Center of Excellence	1.37	4%
L2f.1	Innovativeness	1.36	4%
L2c.1	Leadership	1.32	4%
L2a.1	Poaching & Brain Drain	1.31	4%
L2d.2	OLI-Eclectic Advantages	1.29	4%
L2a.2	National Innovation System	1.21	4%
L2f.2	Competitiveness	1.18	4%
L3b	Humanware	1.17	4%
L2e.2	Research & Development	1.14	4%
L1a	Breaking the Enterprise Barrier	0.99	3%
L2c.1	Leadership	1.32	4%
L2a.3	ICTs and Learning	0.98	3%
L2c.2	Learning Loops	0.95	3%
L1b	Taking Courage to Act	0.94	3%
L2d.3	Knowledge Capitalization	0.93	3%

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L2b.2	Education Reforms	0.91	3%
L2f.3	Responsiveness	0.90	3%
L2c.3	Novelty Generation	0.90	3%
L2e.3	Education & Training	0.84	3%
L2c.4	Creativity	0.83	3%
L3c	Inforware	0.81	3%
L1c	Distilling Skills in Context	0.67	2%
L1d	Assessing Management Craft	0.60	2%
L1e	Benchmarking Leadership Art	0.59	2%
L2b.3	Venture Capital	0.57	2%
L2f.4	Attractiveness	0.55	2%
L2e.4	Design & Engineering	0.53	2%
L2b.4	Partnerships	0.50	2%
L2a.4	Student Market	0.50	2%
L2d.4	Labor Market	0.41	1%
L3d	Technoware	0.25	1%
L1f	Integrating Admin. Science	0.20	1%
	Total	32.00	100%

Table 6 shows that the relative dominance of the rest of the drivers for intellectual entrepreneuring in development continues in descending order from ‘Orgaware’ with a 1.76 sum of normalized scores (equivalent to a 5 percent rank order of relative dominance) on the high end through to ‘Technoware’ with a 0.25 sum of normalized scores (equivalent to a 1 percent rank order of relative dominance) on the low end.

In an attempt to uncover/visualize any relevant common trends, Figure 4 – accompanying Table 6 – shows that while there appears to be a common trend for Expert 3 and Expert 4 in their prioritization of all the framework elements lumped together, Experts 1 & 2 do not show any discernable trend.

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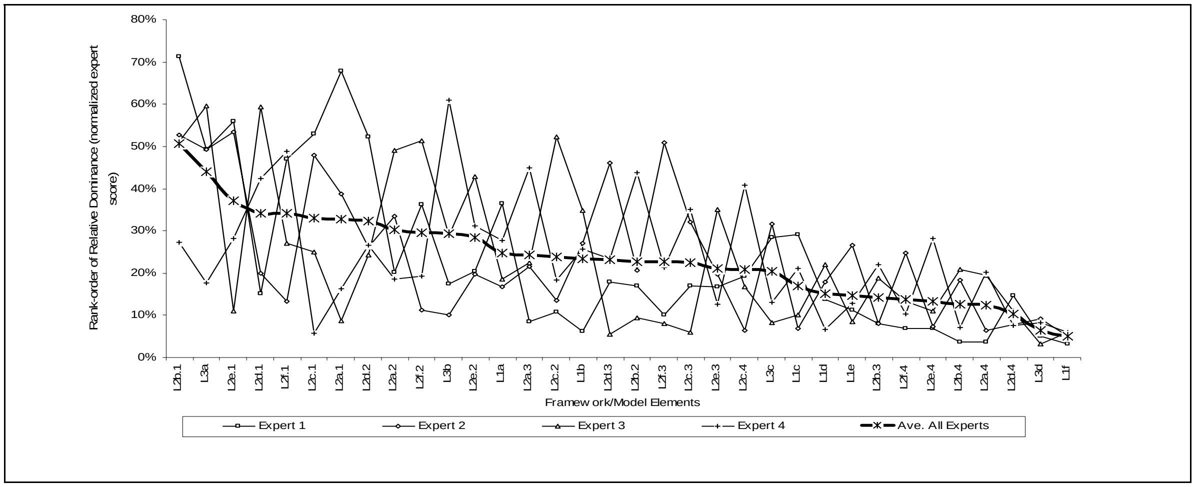

Figure 4. Comparing expert-determined relative dominance with consolidated average relative dominance for all (34) framework elements combined

However, the average (consolidation) of the four normalized expert scores for all model elements (Figure 4) confirms the revelation made above that the 'enabling environment' – level 2b factor and actor - is the most highly prioritized of the 34 drivers for intellectual entrepreneuring, while 'integrating administrative science' – level 1f dimension – is the least of priorities.

This rank-ordering of the relative dominance of drivers for intellectual entrepreneuring in development is intended to help guide stakeholders in knowledge capitalization in responsibly allocating resources to economic and social sectors in accordance with the dictates of the market. How this framework with its prioritized drivers for intellectual entrepreneuring can be put to use is the subject of another paper on field-testing and operationalizing the framework.

Conclusion

This paper has clearly shown that the perception of relative dominance of drivers for intellectual entrepreneurial capacity for knowledge capitalization in a development context varies among practitioner/professional experts. It has also demonstrated that consolidating/integrating expert scoring and then rank-ordering the results reveals 'enabling environment' as the most relatively dominant of the 34 drivers for intellectual entrepreneuring. This second finding is confirmed when the framework is field-tested for its practical applicability and potential use as operators in the knowledge business find the framework useful. However, the operators caution that the framework has to be adjusted for differences in culture. What this means is that for intellectual entrepreneuring to take root in development and undertake the 'specific aim' – that of relevance in higher education - there will be need to mobilize responsible actors and factors from the different domains (politics, universities, science, technology, industry, and business) to build up a strong coalition, and to establish a permanent dialogue with ministries of finance and other sources of funding. Such an enabling environment includes factors and actors that cultivate and provide support to development in the tertiary knowledge industry – the catalysts of market-oriented change. Drivers of the market-driven change in the tertiary knowledge industry include *transforming by design* of business-related education priorities and policies (market-oriented curricula); collective support system (good governance – transparency and accountability, favorable political economy, and political support mechanisms), public-private partnerships and customized technical assistance.

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Jonathan N. Agwe has earned the Ing. de T.A. (Rural Dev't Mgt.), M.Sc. Agri. Econs., M.A. Econ. Policy Mgt., and the D.Mgt. (in Technology Innovation Management) degrees between 1985 and 2007. For over 13 years he worked for the national government as a civil servant and for national representations of development community. In the last seven years, he has been working as an international civil servant for the World Bank where he conducts development work on a global scale. He has written on several development topics, especially on poverty reduction management approaches in Type II countries.

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and 20 doctoral dissertations. He has also worked for six years with the United Nations as the Director of the Asian and Pacific Center for Transfer of Technology (UN-ESCAP/APCTT).

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