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Capitalising Knowledge and Leveraging Innovation: Toward an Integrative Linked Model

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Abstract

In today's business environment, the pursuit of innovation is mandatory for companies to stay competitive. Businesses are now increasingly focusing on leveraging innovation management (IM) as a corporate strategy. At the same time, the heightened attention placed on the explicit use of knowledge has also compelled managers to capitalise on knowledge management (KM) practices to create more cost-effective and better quality innovations. Thus, companies are turning to KM initiatives such as knowledge sharing methodologies, communities of practice and web-based technologies as management tools for improving innovation performance.

This article first argues for the need to connect the two strands of thinking behind knowledge management (KM) and innovation management (IM) - to capitalise on knowledge and leverage from innovation. Next, it highlights the links between KM and IM by proffering arguments on how they should be integrated together within an organisational context. It then develops an integrative linked model as the strategic framework for connecting knowledge management (KM) elements to innovation mechanisms and vice versa. The model is then applied on the case of Singapore Airlines – to purposefully identify opportunities from KM elements and innovation mechanisms to illustrate its applicability. Finally, it concludes that future studies based on survey techniques or interview methodologies using experts' opinions or managers' real-life experience should be considered to further consolidate the applicability of the model.

Keywords

Knowledge management (KM), KM practices, KM elements, KM initiatives, KM solutions, KM tools, innovation management (IM), innovation mechanisms, innovation pursuits, Rothwell's classification, innovation models, integrative linked model.

Background

“Innovation management (IM)”, which has attracted intense attention in recent years, is a field of study that deals primarily with issues relating to how the innovation process can be managed effectively (Foster, 1986; Pinchot, 1985; Drucker, 1973). On the other hand, “knowledge management (KM)” is a field of study that deals with the use of knowledge and its management in businesses to improve organisational innovation, responsiveness, productivity and competence (Goh, 2004; Maryam and Leidner, 2001; Barth, 2000; Amidon, 1997; Davenport, 1996). In recent years, innovation management (IM) has also been proven consistently to be a key value creator for highly competitive companies. With technological innovations as the mainstay of today’s businesses, innovation management (IM) has emerged strongly as an integral corporate function of successful businesses. Nevertheless, one major difficulty confronting companies that are involved in KM programmes lies in the need for continuous business strategies, for instance, to make better use of knowledge to create high quality, more cost-effective and sought-after innovations. At the same time, innovation-driven companies are also increasingly compelled to embark on knowledge management (KM) initiatives. Seemingly, it is not coincidental that the term “knowledge” is used so heavily in describing the term “innovation” or vice versa, since both terms encompass a fluid mix of framed experiences, skills, contextual information and expert insights (Amidon, 2002; Davenport and Prusak, 1998).

Apparently, two inter-related questions remain to be addressed: “In what ways is knowledge management (KM) associated with innovation management (IM)?” and “How should they be connected to be of practical value to managers?” To answer these two questions, one has to identify the links between knowledge management (KM) and innovation management (IM) and to suggest how both areas of management should be integrated within an organisational context (Goh, 2005; Tidd, Bessant and Pavitt, 2002; Sutton, 2002). Yet, until now, both KM and IM represent areas of management that seem to reside in separate spheres of influence, with little or almost no impact on one another. The growing concern, as global competition intensifies in the relentless pursuit of innovation, appears to be more than just identifying and resolving issues on KM or IM independently. Instead, it involves acquiring the ability to harness KM practices for executing IM processes and to incorporate IM activities for implementing KM practices as a deliberate corporate strategy. Given the current pervasive use of electronic commerce and the Internet as the common platform for driving innovation and knowledge strategies, it is now opportune to draw closer the two strands of thinking behind KM and IM. In the light of their inter-relatedness, it is vital to proffer arguments that propose potential links between KM and IM to contribute a more profound appreciation in this field of study. To achieve this, this article develops an “integrative linked model” by capturing overlapping issues between KM and IM that capitalise on knowledge and leverage from innovation in a holistic, systematic and inclusive manner (Goh, 2005; 2004; Hargadon and Sutton, 2000).

Linking KM to IM

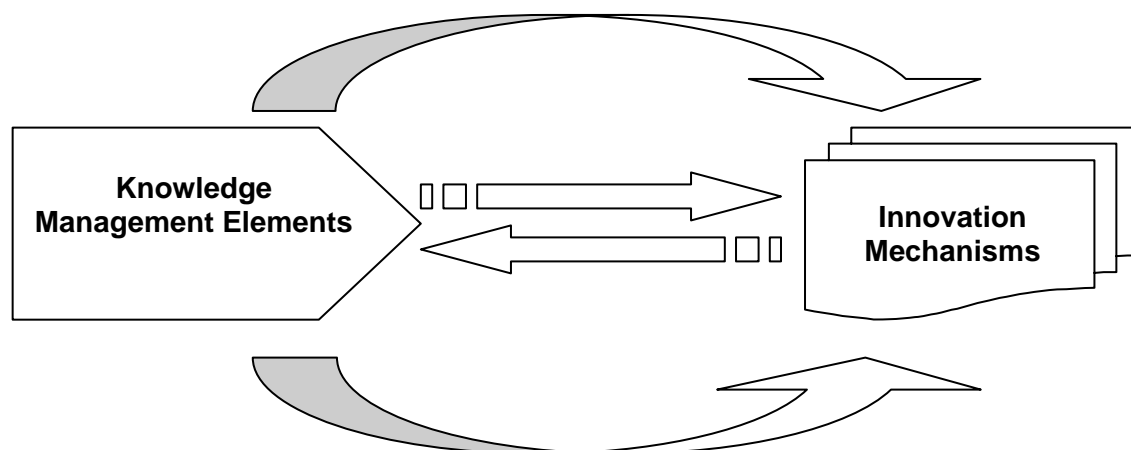
Currently, the mainstream KM literature does not deal adequately the management of innovation as an area of concern. Most KM writers tend not to exhibit the same degree of understanding on the subject of innovation as IM researchers. For example, pertinent issues relating to the economic significance of innovation are discussed to a much lesser extent compared to mainstream IM literature. On the other hand, IM writers are often less able to articulate how KM practices can be

effectively employed as a strategic tool to enhance innovation performance. Nevertheless, virtually every organisation is grappling with the immense opportunities presented by best KM practices, including new ways to acquire, assimilate and share knowledge in the pursuit of innovation (Goh, 2005; 2004; Albers and Brewer, 2003). Besides, the interest on IM activities and how they can be replicated in other contexts such as in knowledge management (KM) domains has grown tremendously. By linking KM to IM, the synergistic benefits could be better exploited for businesses.

Capitalising Knowledge

While competitive advantage may be derived from possession of physical assets, the prevailing business environment appears to favour organisations that know how to effectively capitalise knowledge to create new innovations, whether in products, processes and services. Indeed, today's businesses are rapidly moving toward knowledge-intensive areas like biomedical technologies and computer technologies to the point that firms that wish to enhance their business competitiveness must strongly emphasis best KM practices to derive knowledge capital. For example, companies involved in intellectual property are now implementing KM solutions that automate the entire knowledge asset management life-cycle from research (e.g. invention disclosures) to patent documentation (e.g. legal filings) to technology marketing and licensing (e.g. technology transfer agreements). Capitalising knowledge encompass two facets of implementation – one, “managing” the knowledge that already exists internally, and two, “enhancing” an organisation's capability to make full use of available knowledge, both internally and externally, for business objectives including pursuing innovation (McElroy, 2003). The first part concerns the efficient knowledge management (KM) practice *per se* within an organisation, while the second part is about directing KM practices (e.g. virtual learning or e-commerce) at innovation outcomes. But to truly capitalise on knowledge as a business practice, the KM elements of creation, acquisition, integration, distribution, and application of knowledge have been identified, as illustrated in Figure 1, to be of paramount importance (Sutton, 2002; Von Knogh, Ichijo and Nonaka, 2000; Hargadon and Sutton, 2000). For instance, tacit knowledge, which constitutes a vital knowledge asset in innovation pursuits, requires “distribution” to facilitate transfers between individuals (e.g. via social activities). Hence, the business action of “capitalising knowledge” requires a deliberate emphasis on recognising the potential of KM elements (Goh, 2005; Lang, 2001).

Figure 1: Relation between KM Elements and Innovation Mechanisms



A Sample of KM Elements and Innovation Mechanisms

KM Elements	Innovation Mechanisms
Creation	<ul style="list-style-type: none"> • Motivational carrots / Incentives • Introduce change – setting, groups, viewpoints • Cultural evaluation – organisational and group • Treat everything as temporary – teams, organisations, procedures, product lines • Reject underlying values and beliefs (personal and organisational) • Encourage experimentation and ignore experts • Environmental factors – working conditions, economic means, transfer mechanisms, mentors • Hire smart and different • Incite discomfort and dissatisfaction
Acquisition	<ul style="list-style-type: none"> • Encourage education and learning – often alternative • Internal & external sources – user communities • Opportunism – look outside the box • Idea storage medium – enable storage of non-used or used ideas
Integration	<ul style="list-style-type: none"> • Strategic Direction • Integration of functional knowledge with process knowledge • Challenge existing practices • Use different perspectives – idea sharing
Distribution	<ul style="list-style-type: none"> • Connecting those that know with those that need to know • Transfer mechanisms • Encourage idea sharing • Keep ideas alive – not just an archive, make tangible if possible • Spread information about who knows what – subject matter experts
Application	<ul style="list-style-type: none"> • Freedom to experiment – prototype, model, pilot, test good ideas • Organisational acceptance of short term financial loss

(Source: Albers and Brewer, 2003)

Leveraging Innovation

The fundamental goal of innovation is concerned about how its outcome can eventually support a business activity based on economic objectives. While the term “innovation” has become a popular corporate buzzword, companies continue to face difficulties in innovation. This is partly because many managers merely adopt a marketing-based approach to innovation, while others tend to emphasise the importance of creativity, without fully understanding the strategic moves needed to leverage innovation. Currently, the two schools of “best IM practices”, which are dominant in management literature, do not seem to offer the right answers either (Albers and Brewer, 2003; Hargadon and Sutton, 2002; Tidd, Bessant and Pavitt, 2002). One focuses primarily on technology management derived from the experience of American high-technology companies; and the other concentrates mainly on “rules” for management of product development based on the practice of Japanese manufacturing giants. Whatever these “practice schools” emphasise, it is well documented that today’s successful companies tend to implement corporate strategies that leverage innovation management to harness the untapped value of knowledge processes. In fact, knowledge-intensive organisations are relying more and more on innovation mechanisms to navigate the knowledge landscape for good ideas. It is thus not surprising that the KM industry now offers a wide range of

technological tools from standard, off-the-shelf computer packages to highly sophisticated software designed for delivering solutions including innovation management (IM). However, applying KM tools alone is inadequate, as IM involves continuous interaction between innovation mechanisms and KM elements.

Innovation Models

The idea of designing innovation models to fit, support and address new business strategies has been a familiar theme in research. In fact, a wide variety of innovation models can be found in extant management literature. In recent years, a rising number of new innovation models have been developed to help managers conceptualise, devise and implement innovation management (IM) programmes. However, one that specifically focuses on integrating KM and IM into a functional working model for capitalising knowledge and leveraging innovation has yet to be proposed. Indeed, for close to two decades, innovation models have evolved progressively in tandem with new themes that emerged from innovation research. To extend insightful perspectives surrounding these evolving models, Rothwell (1992) offers a five-generation classification of innovation models to highlight the modelling themes that have made significant progress from conventional linear models to highly complex interactive models as summarised in Figure 2. Increasingly, the key features and thematic emphases of new innovation models are now directed at highly knowledge-intensive processes such as inter-firm integration or parallel development, customer alliances or corporate flexibility and the like, just to cite some examples.

Figure 2: Rothwell's Generation of Innovation Models

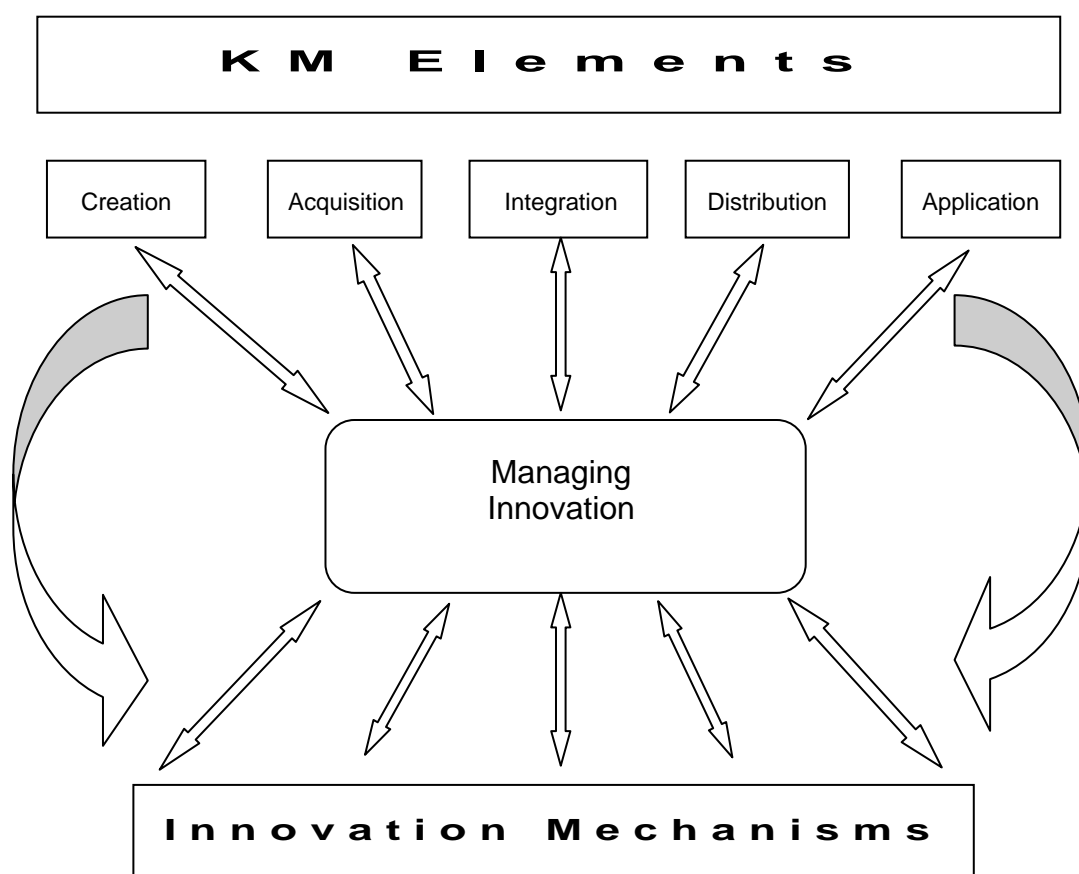
Generation	Model	Key Features	Thematic Emphasis
First	Simple Linear Model (Sequential)	Technology Push	Research and Development (R&D)
Second	Simple Linear Model (Sequential)	Market Pull	Marketing
Third	Coupling Model (Sequential with Feedback Loops)	Push-Pull Combination	Integration at the R&D-Market interface
Fourth	Parallel Model	Internal integration and parallel development	Supplier linkages and customer alliances
Fifth	Systems Integration and Networking Model	Inter-firm integration and parallel development	Corporate flexibility and time-based development

(Source: Adapted from Tidd, Bessant and Pavitt, 2002)

On the whole, Rothwell's (1992) classification may be divided into two main groups, namely: first and second generation models as one group; and third to fifth generation models as another group. The first group comprises "linear archetypes" that fundamentally model market pull and technology push concepts. These models are used to explain macroeconomic theories relating to innovation such as Mansfield's (1971) "market stimuli", Schumpeter's (1939) "science-push" theory and

Schmookler's (1966) "demand-pull" controversy of innovation. Researchers in the innovation field have also used models (e.g. developmental models and evolutionary models) that are sequential in nature to explain the phenomenal changes occurring in the innovation process. But in reality, the innovation process is fundamentally non-linear which is why attempts to predict outcomes using "linear archetypes" often fail, even if a large number of research parameters are included for analysis (McEwan, 1991). The second group views the innovation process as a multi-factorial phenomenon that requires high levels of complex integration at either intra- or inter-firm levels or both. While these models have achieved considerable success in specific domains of the innovation process, Rothwell's (1992) five generations of innovation models involve primarily the same basic process framework underpinning the assumption of ordered, stable changes from scientific discovery, leading to industrial R&D, manufacturing activities and finally ending up as new innovations. Such an assumption does not fully recognise the attribution of dynamics of knowledge processes (Conner, 1991; Wernerfelt, 1995).

Figure 3: Integrative Linked Model



An Integrative Linked Model

In this article, it is proposed that the simultaneously application of KM and IM in an organisational context can be conceived by an integrative linked model, as depicted in Figure 3, comprising knowledge management (KM) elements and innovation mechanisms to guide management ideas and direct organisational efforts. As both KM and IM are fundamentally strategic alternatives, they constitute options of differentiation for organisations to forge a competitive advantage. The basic rationale of the integrative linked model is thus centred on connecting dynamic aspects of KM

elements and innovation mechanisms to identify opportunities as prospective outcomes of organisational innovations. Firstly, it harnesses intellectual capital attributed from KM elements to widen the scope of opportunities for innovation ideas to be centred primarily on knowledge themes. Secondly, it leverages on innovation mechanisms to illicit ideas or in other words, the organisation draws upon the infrastructures, procedures and processes of the existing innovation ecosystem (e.g. information sharing). Overall, it offers a management system designed to support organisations by taking advantage of what knowledge management (KM) elements and innovation mechanisms could offer in terms of changing competitive dynamics (Rumizen, 2002; Knapp and Yo, 1999; O'Reilly and Tushman, 1997).

In essence, the integrative linked model is not a management substitute for KM practices or IM processes. Rather, it is intended to help organisations develop, formulate and implement business strategies via capitalising knowledge and leveraging innovation by adopting a competitive and dynamic mindset of seeking new opportunities (e.g. aspiring to be a knowledge-creating innovative company). On the one hand, the knowledge part includes the elements of creation, acquisition, integration, distribution, and application of knowledge, the innovation part involves access to related innovation mechanisms of KM elements to identify opportunities. Thus, the integration is aimed at realising the benefits of synergistic contribution from linking KM and IM methodically: for example, utilising unused knowledge management elements or experimenting untried innovation mechanisms. Organisations that had participated in knowledge management (KM) practices would find it easier to apply this integrative linked model. For instance, it may be used to model an innovation-driven knowledge ecosystem or a knowledge-based innovation system. Given that the model is centred on knowledge as well as innovation, organisations may apply it to fit their unique situation and business needs with appropriate flexibility and customisation.

Knowledge Management Elements

Acknowledging that an integrative view of KM and IM needs to be adopted for linking actions of capitalising knowledge and leveraging innovation, KM elements that merit attention are identified and described as follows:

Creation

Knowledge creation produces intellectual capital of value to business. While using technology solutions (e.g. Lotus Notes) for knowledge creation is vital, it is insufficient to realise the value of specific knowledge (e.g. tacit knowledge). Effective knowledge creation hinges on social relationships and the processes involved may occur in a physical or virtual platform or even through a combination of these platforms (e.g. on-line conferencing or forums). Hence, the socialisation side of knowledge creation should not be ignored. Instead, one should experiment new organisational forms (e.g. community of practice) to promote knowledge creation.

Acquisition

Prior to activities involving decision-making or problem-solving, knowledge needs to be acquired from information sources or from individuals who possess the required training, skills and experience. In today's complex business world, examples of knowledge that might be acquired include software code, project specifications and various forms of intellectual property. In practice, knowledge acquisition may be

aided by technological tools and be organised or stored in a structured form like knowledge repository as facts, frames or rules.

Integration

Knowledge management (KM) is usually concerned with processes relating to knowledge embedded inside an organisation. Yet, this “look within” view, though critical for managing internal knowledge assets, is usually less holistic because, in a knowledge economy, the vast expanse of knowledge resides outside an organisation’s boundaries. Thus, knowledge integration (e.g. combining external process knowledge with internal functional knowledge) is needed to sharpen organisational business adaptability. Appropriate systems, structures and processes toward managing external knowledge should be implemented for effective knowledge integration.

Distribution

Knowledge distribution is about the process of moving useful knowledge from one individual to another person. But for distributed knowledge to have utility, factors such as relational channels (i.e. frequency and depth of human-to-human contact); and partner similarity (sameness in background, interests or education) are important. Knowledge distribution depends on communication facilitation, collaborative knowledge sharing and productive knowledge exchange between individuals. Thus, the technological tools and techniques used in managing knowledge flow are vital to efficient knowledge distribution, and may influence corporate competitiveness across all the levels of management.

Application

Competitive advantage does not necessarily go to organisations who have the best or most knowledge, but to those who know how to apply knowledge. Until and unless knowledge application occurs, all the activities preceding it are actually in vain. Knowledge application is crucial to an organisation’s state of intellectual capital as it is basically a “learning-by-doing” process in which new contextual knowledge may be gained. Therefore, a continuous effort towards an organisational business culture of knowledge application must be maintained. This may be executed by the use of KM tools to foster knowledge application.

Innovation Mechanisms

Some organisations perceive innovations as the results of “mechanistic” actions. These organisations, as it seems, are often overly preoccupied with the intended objectives that knowledge processes should contribute and do not view knowledge management (KM) elements as potential origins of new innovations which may come from virtually anywhere (e.g. knowledge networks). One such example is “innovation portfolio management” – which involves techniques, which some organisations still rely on, to identify and implement innovation projects that adhere closely to resource deployment. Because innovations basically constitute the embodiment of knowledge assets, the role of innovation mechanisms occurring in knowledge management (KM) can be highly significant, like providing pertinent ideas at points-of-action needed for an organisation to innovate. In any case, the types of knowledge required for innovation, in contrast to tangible assets, are dynamic with respect to the origins they are derived from or the effects they produce. Hence, organisational capabilities in innovation may be aided by changing the “competitive dynamics” of KM elements based on innovation mechanisms (e.g. innovating through knowledge sharing). In

summary, the integrative linked model adopts the stance of dynamically connecting KM elements with innovation mechanisms as a means of identifying outcomes for organisational innovations in a single, holistic and inclusive management routine.

Putting the Model into Practice

Singapore Airlines

While Singapore, as indicated by a World Economic Forum (WEF) study, is ranked tenth in national innovative capacity, it has much room for improvement in terms of how KM practices are harnessed for organisational innovation. To illustrate the application of the integrated linked model, Singapore Airlines or SIA in short, has been selected for three reasons. First, the company's businesses operate in an emerging knowledge economy of Asia. Second, SIA is popularly hailed as a leading knowledge enterprise that drives knowledge-driven strategies relentlessly to achieve sustainable performance and long-term growth. Third, the company is widely recognised as one that places strong emphasis on knowledge-based innovation.

SIA's origin could be traced to the government-owned Malaysia-Singapore Airlines (MSA), the national airlines of the Malaysian federation of states to which Singapore belonged until its separation in the mid-sixties. Formed in 1972, SIA started as a small regional airline with a modest fleet comprising 10 aircraft and a route network spanning 22 cities in 18 countries. In three decades, SIA now prides itself as a carrier with a reputation for superior service, for instance in in-flight services. It now boasts a modern fleet of more than 90 aircraft, with a sophisticated route network to over 60 cities at 89 destinations in 40 countries. Being a national carrier, the Singapore government owns 57% of SIA through Temasek Holdings. SIA's units also include regional carrier SilkAir, a pilot school, and other repair and maintenance facilities. SIA is generally considered as one of the most successful airlines in Asia in terms of financial performance and service delivery. Prudent investment, judicious planning and continuous product innovation have forced the national carrier to excel in the hyper-competitive aviation business environment under tough conditions (e.g. global security threats). To achieve business profitability, SIA has identified innovation as one of the key strategic thrusts in the coming years. SIA has received many accolades as reflected by the numerous awards given to the company. For example, Asian "Most Admired Knowledge Enterprises (MAKE) Award" by Teleos, Asia's "Best Managed Company of the Decade" by Asiamoney, Asia's "Most Admired Company" for five successive years by Asian Business Magazine, "Best Airline" for the eleventh time in 12 years by Conde Naste Traveller.

Given the world's competitive aviation market, SIA's business model is also now being challenged. As a result, the demands placed on the company's management structures and systems have increased tremendously. Hence SIA has no choice but to constantly create new value for the markets it serves; and to continue with pursuing innovation through effective knowledge management (KM) practices. A case analysis of SIA, based on the application of the integrative linked model, was conducted to offers new insights into how the company has augmented its innovative capability by identifying opportunities from linking innovation mechanisms and knowledge management (KM) elements in an integrative way to embark on new programmes, services and schemes. A sample of SIA's results of model analysis is shown in Figure 4.

Conclusion

Currently, the fields of KM and IM belong to management fields that do not automatically lend itself to quantified research. This is due, in part, to the fact that the concepts associated with the two fields of study tend to be rather amorphous and notoriously unstructured. Clearly, issues of both KM and IM are closely intertwined in multi-faceted ways – in terms of processes, dynamics and the like. In this type of research, not only is a quantitative approach hard to devise, but a systematic methodology seems equally difficult to reach. Thus, the chief contribution of this research rests on the proposal of an integrative linked model to demonstrate how common dynamics of KM and IM could be connected for capitalising knowledge and leveraging innovation. The model thus presents a knowledge-focused and innovation-centred framework to integrate KM elements and innovation mechanisms. Obviously, the better established the links between KM and IM and the closer the integration, the management framework is likely to be more useful in directing and guiding businesses to navigate the competitive global innovation landscape. In conclusion, future research in this field of study includes using survey techniques and interview methodologies to gather experts' opinion and real-life experience from managers on KM-IM integration; and to identify an in-depth exploration of other related concepts to further consolidate the applicability of the integrative linked mode

Figure 4: SIA's Results of Model Analysis

KM Elements(s)	Innovation Mechanism(s)	Outcome(s)
Knowledge Creation: Because SIA's airline seats are sold to a variety of markets with different traffic mix and seasonal travel capacity, the company employed the PROS Revenue Management system, using operations research techniques, to forecast demand for airline seats based on historical travel patterns and booking trends.	The company thus developed Krismax II System to overcome the complexities of matching seat capacity with customer demand; and to ensure a "best match" between supply and demand of airline seats to optimise the load factor.	SIA managed to minimise seat wastage, maximise profitable resource deployment, implement cost-effective sales planning marketing strategies, and achieve revenue enhancement.
Knowledge Acquisition: A diversity of knowledge on customers, industry dynamics and travellers' preferences were acquired. In-depth studies were conducted and extensive information was gathered from business partners, air-travellers and employees to improve on-board services, cabin amenities and entertainment programmes.	The company and IBM Business Innovation Services jointly developed in-flight innovations (e.g. offering mobile services via WAP and PDA) to improve service quality.	SIA became more advanced on e-commerce solutions for customer services. The company subsequently introduced short message service (SMS) remote check-in. Future plans include satellite news service and entertainment and cyber-cabins.
Knowledge Integration: SIA is known to be company reputable for collaborative knowledge sharing with external parties. The company works closely with partners in different communities to integrate knowledge about destinations (e.g. festivals, cultural performances and exhibitions) as a means of creating world-class event hubs.	SIA formed a department named "Commercial Partnerships – Associate Airlines" to identify initiatives that facilitate knowledge collaboration and transform enterprise knowledge into innovative products and services.	SIA was able to implement frequent flyer programmes and to develop optimised sales networks; and also to identify new initiatives like code-sharing services with other major airlines.
Knowledge Distribution: SIA understands that the parochial hierarchy-based management style not only hinders productive knowledge processes, but is also detrimental to fostering a knowledge-sharing culture. The company values employees' feedback at all rungs of the organisational structure.	SIA implemented the "Staff Ideas Action" scheme to institute management systems to ensure that feedback from all employees is received, considered and taken into account for improving company's level of services and products.	SIA dismantled top-down structures by holding regular dialogue sessions with staff. A pragmatic approach of staff communication and information was implemented using departmental newsletters and company-wide magazines.
Knowledge Application: The company treasures customer feedback and applies the knowledge about customers to better cater to their "latent" needs and "unmet" wants. For instance, SIA regularly conducts environmental scans on customer trends and applied the knowledge gained to improve its businesses.	The company developed a quarterly "Service Performance Index" – which is a consolidation of statistics relating to customer services. It helped SIA to closely monitor and benchmark its service standards globally against that of leading airlines.	SIA launched, due to customers' pent-up demand for lower domestic airfares, a low-cost, no-frills carrier, called Tiger Airways for budget travellers.

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