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A research note on knowledge-uncertainty-based learning (KUBL), with an example on the subject of *Innovation Management*

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Abstract:

The notion of knowledge-uncertainty-based learning (KUBL) has recently been postulated by the writer in the field of management education. Due to its newness, the notion needs to be further conceptually refined. In this article, the writer draws on the academic ideas from the management knowledge domain to elaborate on the KUBL concept as an ideal-type of learning mode. This elaboration is achieved with ten management knowledge propositions derived from the management knowledge literature. This article also offers an illustrative example of a KUBL study material on the Innovation Management subject. As such, it contributes to the conceptual clarification and enrichment on KUBL. All in all, it offers to inform students interested in effective management subject learning and innovation management.

Keywords: Innovation management, knowledge-certainty-based learning (KCBL), knowledge-uncertainty-based learning (KUBL), KUBL study material, learning mode, management knowledge, management subject learning.

INTRODUCTION

There is a cliché in the management education field that students should develop deep-level and critical thinking. Nevertheless, from the writer's teaching experience in tertiary management education in

Hong Kong, many students remain much more comfortable when they are taught management subject knowledge sounding certain, objective and actionable. Such management knowledge is conceived to be easy to comprehend, memorize and apply. After all, many of the writer's students in Hong Kong are preoccupied with their full-time jobs – they experience severe time-poverty syndrome. For them, further intellectual effort on critical reflective leaning implies additional "workload" [and consumed time] of learning. In consonance with this prevailing learning stance, many of the writer's students feel more at ease reading management subject textbooks and practitioners' advices on the public social media for their management subject learning. These study materials are more explanatory in nature and forthcoming with concrete practical advices on management practices as compared with the writings of academic journal articles. By contrast, most of them find no enjoyment in reading academic journal articles: those readings are too complicated, abstract and time-consuming to study. This kind of learning mode is, regrettably, incompatible with the educational goal of promoting deep-level and critical thinking in intellectual learning. In response to this management subject learning concern on effective learning, the writer of late has postulated the notion of knowledge-uncertainty-based learning (KUBL) as an analytical ideal-type of learning mode (Ho, 2019a; 2019b). So far, two articles have been produced on this idea. This article is yet another work to contribute to the enhancement of the KUBL notion by drawing on some ideas from the management knowledge literature. It also offers an example of KUBL study materials on the subject of Innovation Management.

The propositions of management knowledge for the study of knowledge-uncertainty-based learning (KUBL)

The literature of management knowledge offers some useful propositions[1] on management knowledge. Having some basic grasp of them, in turn, contributes to a deeper understanding of the knowledge-uncertainty-based learning (KUBL) mode as put forward

[1] These propositions include theories, metaphors, empirical findings, value statements and experience-based advices/ suggestions, some being general while others time/place/organization-specific, in the academic literature. Very often, they are tentative in nature as well as weakly related and somewhat incompatible with each other.

by this writer. Via a review of some of the management knowledge writings, ten management knowledge propositions are identified by the writer, grouped under the three categories of (i) management knowledge, (ii) management discipline and (iii) management study[2]. They are as follows:

I. On management knowledge

Proposition 1: Management knowledge "can be understood as an 'ecology' and the totality of management concepts as 'population' .... Within such ecology, multiple management concepts may agglomerate, thereby forming distinct 'families'" (Höllerer *et al*., 2019).

Proposition 2: Management knowledge comprises "few if any laws of management" but "lots of management theories", though relatively lacking in "evidential support" and extremely tentative in their conclusions (Griseri, 2002: 43).

Proposition 3: Management knowledge must possess certain stability in order to be able to claim some kind of validity (Griseri, 2002: 40) and "has to be understood in terms of its relationship with other resources and indeed with reference to the challenges and tasks presented to an organisation or industry" (Griseri, 2002: 19).

Proposition 4: Management knowledge produced by media, consultants and business schools often comprises "externally derived 'best practices'" (Lervik and Lunnan, 2004).

Proposition 5: Management knowledge "shapes managerial thinking and organizing, and specific elements of management knowledge, here referred to as *management concepts*, diffuse widely as standardized solutions to typical organizational problems" (Höllerer *et al*., 2019).

II. On management discipline

Proposition 6: A **management discipline** is "an area for discussion, debate and shared investigation", and, "To acquire expertise in a discipline suggests that one has learned how to discipline one's thinking related to that subject, that one has acquired the discipline of approaching the phenomena in a characteristic way defined within the canons of the subject. Hence there must be a

[2] The scheme of categorization emerges from the writer's review of the identified academic literature ideas.

shared understanding of the key issues and the key ways of investigating these" (Griseri, 2002: 40).

III. On management study

Proposition 7: Management study "has to involve some aspects of what managers and/or the managed choose to do. There is an intimate connection with practice which is not always there in, say, psychology, operational research, or economics" (Griseri, 2002: 17).

Proposition 8: Management study involves theorization, which is "the establishment of social categories and their causal relationships – as the key mechanism through which ideas and practices become socially meaningful" (Höllerer *et al*., 2019).

Proposition 9: Management study has experienced "an expansion in the creation, circulation and commercialization of management knowledge as a significant feature of modern economic life", including "a significant expansion of different *media products oriented towards management*" (Engwall and Kipping, 2004).

Proposition 10: Management study, e.g., management and organisation studies, "has come under scrutiny for its strikingly Westocentric (especially Anglo-American) aura" as well as ahistorical and decontextualised stance (Girei, 2017). Echoing this, "the space for a multiplicity of perspectives, and for more voices and more encounters between them, has been explicitly encouraged" (Jaya, 2001).

These ten propositions, being a sample of academic ideas chosen by the writer from the management knowledge literature, are useful for clarifying and enriching the topic of knowledge-uncertainty-based learning. To follow up on this discussion, it is necessary to introduce the notions of knowledge-uncertainty-based learning (KUBL) and its counterpart, i.e., knowledge-certainty-based learning (KCBL) together. Both learning modes comprise specific learning preference and understanding of management knowledge nature. For KCBL as a learning mode, the learning preference is to study management subject materials, chiefly textbooks and practitioners/ consultants' articles on public social media that are capable of clearly explaining management knowledge in a straightforward way with concrete examples and practice advices. As to the learning mode of KUBL, the learning preference is to study management subject materials, primarily academic journal articles that stimulate critical

and deep-level thinking on management subjects; they are acknowleged as full of knowledge gaps and uncertainty, controversies, and evolving as well as fragmented knowledge. In Ho (2019a), the nature of KUBL is explained in terms of six underlying thinkings, i.e., (i) the life-history view, (ii) diverse and incompatible sources of ideas, (iii) the socially constructed knowledge nature of ideas, (iv) the problematic world context view, (v) the multiple underlying research paradigm view and (vi) the multiple research movement view. And, in Ho (2019b), KCBL and KUBL are compared in terms of six attributes, namely, (i) theoretical stance on the nature of management subject knowledge produced by the academic community, (ii) theoretical stance on the world of management practices, (iii) perceived nature of management subject knowledge production activities, (iv) theoretical stance on the world of academic community, (v) prime study materials of management subjects and, lastly, (vi) order of learning in terms of Bloom's Taxonomy of Learning. Here, the writer offers to associate the ten propositions as compatible[3] and supportive to their respective learning modes, i.e., KCBL and KUBL. They are summarized in Table 1 as follows:

Table 1: The ten management knowledge propositions and their compatibility with KCBL and KUBL

Propositions	**Learning mode: KCBL**	**Learning mode: KUBL**
Proposition 1: "Management knowledge as an ecology of management concepts"	Compatible	Compatible
Proposition 2: "Management knowledge as weakly supported theories"	Compatible	Mildly incompatible
Proposition 3: "Preference for knowledge stability on management knowledge"	Supportive	Mildly incompatible
Proposition 4: "Management knowledge as externally derived best practices"	Supportive	Incompatible
Proposition 5: "Management knowledge as standardized solutions"	Supportive	Incompatible
Proposition 6: "Management	Supportive	Mildly incompatible

[3] "Compatible" means that the idea (here, the proposition) is able to co-exist with the learning mode; "supportive", on the other hand, means that the idea (i.e., the proposition) is able to justify the intellectual validity of the learning mode.

discipline as an area of discussion in a characteristic way"		
Proposition 7: "Management study as practice-focused"	Compatible	Mildly compatible
Proposition 8: "Management study involving theorization as socially meaningful"	Mildly incompatible	Supportive
Proposition 9: "Management study as commercialization of knowledge"	Supportive	Mildly incompatible
Proposition 10: "Management in need of multiplicity of perspectives"	Mildly incompatible	Supportive

Regarding Table 1, the word "compatible" means that the proposition does not conceptually contradict the learning mode, i.e., KCBL or KUBL, with regard to its attributes (Ho, 2019b). "Supportive" is a stronger attribute as it is able to justify the validity of the learning mode. The evaluation exercise on compatibility and supportiveness is an impressionistic one from the writer. Thus, readers are encouraged to do their own evaluation of them as a reflective learning endeavour. Some of the propositions are compatible with both KCBL and KUBL, e.g., propositions 1 and 7 whereas a few are clearly affiliated with only one learning mode, e.g., 4, 5, 6, 8, 9 and 10. All in all, Table 1 offers a way to clarify the KCBL and KUBL notions with ideas (in terms of the ten propositions) from the management knowledge literature. Nonetheless, the purpose of the exercise (re: Table 1) is not simply to reveal the incompatibility between the KCBL and KUBL notions, but to inform management subject learners to make better use of both of them in management subject learning. Clearly, both are useful learning modes with different strengths: KCBL is more relevant for lower-order learning while KUBL is mainly for higher-order learning. Hence, knowing the differences between them enables learners to more skilfully orient and reorient their learning mode as the learning situation changes. With the KCBL and KUBL notions now clarified, the writer moves on to the next task of reviewing the academic literature of Innovation Management in *European Journal of Innovation Management* to come up with a KUBL study material. This kind of study material is very useful for KUBL.

Examining the innovation management literature to come up with a KUBL study material for the management subject

The management subject considered here is innovation management. As a concise introduction on the innovation management subject, two definitions are offered here: *innovation* can be considered as "something new that brings benefits for an organization or/ and for society", and *innovation management* as "the systematic promotion of innovations in organizations" (Hengsberger, 2018). To underline the uncertainty nature of management knowledge, the KUBL literature review extracts information about knowledge gaps and points of contention in the academic literature of innovation management. For this brief exercise primarily for illustration purpose, the academic literature is from the articles published in the *European Journal of Innovation Management* (Emerald), from 2003 to 2019. Table 2 is the outcome of the KUBL literature review by the writer. It represents a KUBL study material on Innovation Management.

Table 2: Issues and related key words in Innovation Management research: a sample of academic articles, sorted in chronological order

Years of publication	**Issues and knowledge gaps as recognized in innovation management academic articles: extracts from the *European Journal of Innovation Management***	**Key words involved**
Article 1 2003	"Although conceptual frameworks of innovation diffusion do exist...., they are based on systems that are characteristically non-linear and stochastic and lack generality from which usable management practices can be derived. In other words, these frameworks offer marginal practical utility to organizations seeking to understand the innovation diffusion process" (Hivner *et al*., 2003).	Innovation diffusion frameworks
Article 2 2003	"Past research has demonstrated that industrial customers can, in effect, bring about product innovation among their suppliers. However, little seems to be known as to whether consumers are also potential inventors of new services" (Magnusson, 2003).	Consumer role in innovation
Article 3 2004	"The question of how partners in a collaborative IOR [interorganizational relationships] obligate themselves to general commitments and specific courses of action has thus been of particular interest to a number of scholars and practicing managers. Nevertheless, in a comprehensive analysis of earlier empirical studies, Sobrero and Schrader (1998) found that understanding the "how" falls far behind the tested insights into justifying whether or not to start an alliance. They also found that the link between contractual and procedural coordination within the relationship has been rather neglected" (Marshall, 2004).	Business alliance's role in innovation
Article 4	"Predicting whether an innovation will be adopted in a	Innovation adoption

2005	market has always formed a major scientific challenge. Generations of scientists have pursued this challenge, by studying the subject from different disciplinary angles and for different kinds of innovations. Sociologists and psychologists have tried to pinpoint the unique characteristics of the first groups of consumers that adopt an innovation (the innovators and the early adopters)" (Langley *et al*., 2005).	
Article 5 2005	"Although there are a number of studies on continuous improvement in SMEs (Gunasekaran *et al*., 1996; Bessant and Caffyn, 1997; Bessant and Francis, 1999), there is a relative paucity of in-depth studies of innovation implementation in SMEs (McAdam, 2000). It cannot be assumed that innovation implementation principles in large organisations are directly transferable to SMEs, where the SME is treated as a scaler version of the large organisation (Teece, 1996)" (Humphreys *et al*., 2005).	Innovation implementation in SMEs
Article 6 2005	"Knowledge has been cited for some time as a major source of competitive advantage (de Geus, 1997; Drucker, 1964). More recently, the focus has been upon using knowledge to promote and support innovation within both teams and companies (Newell at al., 2002)" (Davison and Blackman, 2005).	Knowledge management for innovation
Article 7 2006	"Schumpeter assumes that large companies can come up with a larger number of innovations, and with more incisive ones than small companies. The confirmation or rejection of this hypothesis has been the subject of over 100 empirical studies but, overall, the resulting picture is unclear" (Herrmann, 2006).	Innovation success for companies of different sizes
Article 8 2006	"Much of the knowledge-management literature (Tsoukas and Mylonopoulos, 2004; Easterby-Smith and Lyles, 2003; Newell *et al*., 2002; Prichard *et al*., 2000; Spender, 1996; Nonaka and Takeushi, 1995) and the literature on innovation (Jassawalla and Sashittal, 2002; Hargadon and Sutton, 1997; Cheng and Van de Ven, 1996; Leonard-Barton, 1995; Dougherty and Heller, 1994; Feldman, 1989; Burns and Stalker, 1961) examines innovative work wherein the knowledgeable agent is capable of determining and controlling the entire process. In such a perspective, innovation work is a more or less linear engagement with finalizing a predetermined artifact or service. Even though such a view is adequate for a broad range of innovative activities, it does not address what may be called science-based innovation, that is, innovation work that is based on the ability to the exploit scientific competencies accommodated by the focal firm" (Styhre, 2006).	Knowledge management for science-based innovation
Article 9 2006	"Recently published works (1990-2004) have mainly examined the success factors as key determinants of disruptive innovation. However, organisational learning over-samples success and under-samples failure" (Assink, 2006).	Learning from failure in innovation management
Article 10 2006	"Recent IT adoption literature has focused on acceptance models relating perceptions and beliefs to attitudes, behavioral intention and usage of the technology. Much of the most recent literature addresses the antecedents of	IT adoption attitudes

	these perceptions. What remains largely unexplored, however, are the processes by which these factors and others work together in adoption-related attitude formation, decision-making, short-term and long-term behavior, and mental modelling" (Seligman, 2006).	
Article 11 2007	"Although the importance of radical innovations is widely recognized, developing them is still rather poorly understood (Leifer *et al*., 2001). Further research is thus needed, especially since the failure rate is particularly high due to the various challenges inherent in their development" (Sandberg, 2007).	Radical innovation development
Article 12 2007	".... innovation process models have traditionally been characterised as highly linear, involving the creation of knowledge, the transformation of this knowledge into new applications and the commercialisation of these applications to market requirements (Pavitt, 2004). Where innovations systems models have emerged and have become popular, they have tended to address the complex interactions between system participants (within network, regional and national aggregations). A far less prevalent application of systems approaches in the innovation literature has been the examination of the recursive processes that occur within the fundamental problem solving arena of innovation (Leydesdorff and Etzkowitz, 1998)" (Rice and Martin, 2007).	Innovation process models
Article 13 2008	"One crucial question the current management literature lacks an answer for, yet, is how an organisation can best combine and integrate its exploratory – research driven – and its exploitative units (Cesaroni *et al*., 2005). This is not only an organisational question but also leads to the strategic question of what linkages the exploitative and the explorative units should have in particular for conducting successful new business development" (Bröring and Herzog, 2008).	On exploratory and exploitation units integration
Article 14 2008	"To date, the relation between organizational learning and innovation has been mainly studied in the management research field, while the market orientation-innovation link has been examined in the literature on marketing. However, some authors highlight the need to consider the complementary or even synergistic effects of both market orientation and organizational learning on innovation (Baker and Sinkula, 2002) and performance (Baker and Sinkula, 1999)" (Jiménez-Jimenez and Valle, 2008).	Organizational learning for innovation
Article 15 2008	"Recently, there has been a great deal of academic and practitioner interest in the concept of creativity and innovation in organizations, and in particular, the effects of an innovation culture on organizational performance (Christensen and Raynor, 2003; Govindarajan and Trimble, 2005; Hamel, 2002; Hammer, 2004; Senge and Carstedt, 2001). This focus is not surprising, as innovation has been touted as the differentiator that will lead to the next level of competitive advantage (Amit and Schoemaker, 1993; Prahalad and Hamel, 1990). However, much of the extant literature to date evidences a uni-dimensional view of innovation. This cause and effect approach has lead to a	Innovation culture

	lack of consensus on innovation and difficulties in both comparing findings across studies and drawing unbiased conclusions" (Dobni, 2008).	
Article 16 2008	"Understanding how to manage innovation successfully is crucially important in a time when innovation is an almost obligatory survival strategy ("innovate or die" (Drucker, 1999)) that at the same time is very risky because it may lead to the demise of a company (Olleros, 1986; Tellis and Golder, 1996). It is not surprising, then, that many innovation management studies have a normative nature and focus on how to innovate successfully. Given the fact that innovation management has changed over the last four decades, it appears that every time frame has its own notions of what successful or best practices are. These so-called innovation generations are descriptions ". . . of what constitutes the dominant model of best practice . . ." (Rothwell, 1994, p. 23). However, although this historical division may have been accurate in the past, current innovation practices suggest that innovative companies do not automatically follow the best practices as prescribed by the dominant model of their time" (Ortt and van der Duin, 2008).	Dominant models of best practice on innovation management
Article 17 2009	"Although it is still acknowledged that controlling R&D and innovation is a challenging task (Brown and Svenson, 1988), today the issue is being extensively debated in the innovation and R&D management literature, and it raises the interest of practitioners as well (Werner and Souder, 1997; Hauser, 1998; Driva and Pawar, 1999; Driva *et al*., 2000; Poh *et al*., 2001; Loch and Tapper, 2002; Godener and Soderquist, 2004; Ojanen and Vuola, 2006)" (Chiesa *et al*., 2009).	Innovation and R&D control
Article 18 2009	"The influence of product innovation on business performance has been one of the issues of most importance in recent literature. From a positive point of view, product innovation represents the provision of solutions to market threats and opportunities, creating the "basis for the survival and success of the firm well into the future" (Hult *et al*., 2004, p. 429). However, product innovation is a costly and risky activity (Simpson *et al*., 2006), one issue of particular relevance for SMEs, generally handicapped with financial and management competency restrictions (Freel, 2000a). Therefore, it is not surprise that research so far has been inconclusive about a direct immediate and straightforward positive impact of product innovation on performance in SMEs (Freel, 2000b)" (Hernández-Espallardo and Delgado-Ballester, 2009).	Product innovation impacts on SMEs
Article 19 2010	"Innovation has become one of the main priorities of most countries. The European Union, through the Lisbon strategy, aims at stimulating national R&D investments in order to reach the "ideal" 3 per cent GDP level. Many studies have used R&D expenditure as a measure of the capacity of a firm to innovate. While emphasizing innovation input and support instruments, these works did not take into account other types of innovation strategies such as marketing or organization. The literature on	Types of innovation strategies

	innovation nevertheless highlights the iterative nature of the innovation process where non-technological activities play a crucial role" (Mothe *et al*., 2010).	
Article 20 2011	"Despite the growing importance of R&D collaborations in particular and open innovation in general, many important questions are still unexplored – also due to the (growing) complexity of such collaborative efforts and the nature of the underlying resources and knowledge (Chesbrough, 2003; Das and Teng, 2000; Granstrand, 2000; Gulati and Singh, 1998; Haefliger *et al*., 2008; Henkel, 2006)" (Bogers, 2011).	R&D and open innovation collaboration
Article 21 2011	"Although open innovation models have substantial benefits for R&D intense companies in high-tech sectors, little is known about their influence on innovation performance in traditional industries, such as manufacturing and service industries (Chesbrough and Crowther, 2006; Laursen and Salter, 2006; Muscio, 2007; van de Vrande *et al*., 2009)" (Inauen and Schenker-Wicki, 2011).	Performance influence of open innovation models
Article 22 2011	"The concept of open innovation has had a lot of promotion in recent years, although collaboration between firms has been happening for a long time, as in the case of joint ventures. Firm-university collaborations also are not a new phenomenon, nor are spin-offs. These observations leave an open path for further research: as more studies on open innovation are published, the confusion of terms used invariably would arise leading to an increasing need to clarify the terminology used. Although empirical studies are emerging, there is still a limited body of research on open innovation" (Duarte and Sarkar, 2011).	Concept clarity of open innovation
Article 23 2012	".... although many contributors to small firms' innovations have been identified, we do not know the prevalent patterns in broad samples of small firms" (de Jong and Hulsink, 2012).	Small firms' innovation patterns
Article 24 2014	"Owing to the fact that Rogers' theory holds the highest position and is well established in the world of innovations, it can be concluded that there have been many studies concentrating on Rogers' innovation attributes. However, there are also other attributes that have been used, studied, and reviewed as innovation attributes in the past, a classic example of which is the Tornatzky and Klein (1982) review. Evidently, Rogers' innovation attributes have been periodically reviewed both, in the revised editions of his books that came out until 2003, and also in the other reviews published in this area. This elucidates the fact that the other innovation attributes have not received as much attention as the Rogers' attributes" (Kapoor *et al*., 2014)	Innovation attributes
Article 25 2016	"It has been widely accepted that innovation plays a central role in technological and economic development. As a result, the study of innovation – that is, how to stimulate, nurture and diffuse it – has maintained a top position on the agendas of researchers, managers and policy makers. However, despite these acknowledged technological and economic outcomes, the social benefits associated with	Impacts of innovation on technological and economic development

	innovation can be less obvious, difficult to measure and take time to become apparent" (Voltan and De Fuentes, 2016).	
Article 26 2016	"Whereas the impact of national culture and globalization on consumer innovativeness (i.e. the relative time of adoption of an innovation) with regard to high-tech innovations is widely discussed in the innovation literature (e.g. Chandrasekaran and Tellis, 2008; Lim and Park, 2013), scant attention has been paid to another important aspect of innovation adoption behavior: consumer value and the related consumer willingness to pay (WTP) for innovations (e.g. Pak *et al*., 2014; Parry and Kawakami, 2015). Yet, this is a crucial issue, as an emphasis on consumer value and the related consumer WTP when establishing the launching price of an innovation contributes to the success of the innovation (Ingenbleek *et al*., 2003)" (Sadik-Rozsnyai, 2016).	Role of consumer value on innovation adoption
Article 27 2017	"Open innovation (OI) continues to generate research interest (Carlsson and Corvello, 2011; Elmquist *et al*., 2009; Greco *et al*., 2015; West and Bogers, 2014). Researchers have engaged with the phenomenon related to how companies can advance their innovation scope and also divest ideas that do not create a fit with the company's own business focus (Chesbrough, 2012). Furthermore, the collaborative efforts of OI have been emphasised (e.g. Gassmann and Enkel, 2004). While it has been acknowledged that OI may take many different forms and also be "open" to different extents (e.g. Dahlander and Gann, 2010; Moilanen *et al*., 2015), the dominating research perspectives on OI have emphasised resource and skill complementarities between companies (cf. Vanhaverbeke and Cloodt, 2014). But such fit would..... only provide a partial explanation as to whether companies manage to collaborate in OI processes" (Hasche *et al*., 2017).	Collaboration management in open innovation processes
Article 28 2018	"Given the prevalence and economic importance of family firms (De Massis *et al*., 2013; De Massis, Di Minin, and Frattini, 2015), and given the fact that family firms are transgenerational, also in family business research innovation and collaborative innovation have become topics of increasing interest (e.g. Pittino and Visintin, 2011; De Massis *et al*., 2013; Alberti *et al*., 2014; Veider and Matzler, 2016)" (Bigliardi and Galati, 2018).	Innovation management of family firms
Article 29 2018	"Previous research has examined open innovation and its related interactive mechanism then contributed to the understanding of how the network structure affects an organisation's innovation outcomes (West and Bogers, 2014). Despite those existing research effort taking from a structural perspective in particular, knowledge in the area of ecosystem dynamics and configuration appears insufficient and thus attention is needed (Spender *et al*., 2017)" (Lin, 2018).	Interactive mechanisms on innovation management
Article 30 2019	".... firm performance can be affected differently by different sources of knowledge. Hence, to develop the appropriate strategy for external knowledge source, it is	Impacts of external knowledge sources on innovation

	essential to know the impact of the various external knowledge sources on innovation performance. However, the extant empirical research explores the effect of external knowledge sources on technology innovation performance without taking into consideration the effect of different types of external knowledge sources on innovation output in manufacturing and service sector. The previous studies are limited regarding the external source of knowledge from the customers in general" (Basit and Medase, 2019).	performance

Regarding Table 2, the extracted information on knowledge gaps and points of contention from the academic articles of the *European Journal of Innovation Management* are sorted in chronological order, with key words in the third column to identify the key ideas involved. Such key words in Table 2 uncover a number of themes in the academic literature of innovation management. In our case, the themes are: (i) *innovation impacts*, e.g., articles 7, 11, 18, 21 and 25, (ii) *organizational considerations*, e.g., articles 13, 14, 15, 20, 29 and 30, (iii) *conceptual clarity and refinement*, e.g., articles 19, 22, and 24, (iv) *innovation models and practices*, e.g., articles 1, 4, 5, 6, 8, 9, 10, 12 ,16, 17. 23. 27 and 28, and (v) *stakeholders' attributes and roles*, e.g., articles 2, 3 and 26. Chronologically, most of the key ideas (re: key words of Table 2) are able to maintain their status as recurring research topics throughout the period covered in this literature review exercise (that is from 2003 to 2019). Nevertheless, it is also recognized that a few topics in Table 2, notably open innovation and innovation models, mainly appear in the later period in the *European Journal of Innovation Management* publication: they are relatively new topics. In short, Table 2, being a simple review exercise covering merely 30 articles, could only be treated as an illustrative example on KUBL study material. It is not good enough to be considered as a comprehensive literature review finding on Innovation Management. With regard to the topic of KUBL study material, Ho (2019a and 2019b) provide two more illustrative examples as related to Total Quality Management and Entrepreneurship. Readers who need more examples of KUBL study materials are referred to them.

CONCLUDING REMARKS

The notion of knowledge-uncertainty-based learning (KUBL) is a useful learning mode topic in the field of management education

research. It is, at the same time, revealing to students studying management subjects by promoting higher-order learning and more skillful learning orientation/ reorientation. This KUBL notion, as a learning mode, has by now been elaborated on in three articles by this writer, including this one. Thus, albeit a newly postulated notion, its nature has been clarified and enriched at some length. Finally, this article should also be of use to students interested in the subject of innovation management (re: Table 2).

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