A Conceptual Model to Assess KM and Innovation Projects: A Need for an Unified Framework

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Abstract. Firm performance required numerous projects like total quality, reengineering of innovation and knowledge processes, rationalization projects. Their respective results and impacts are assessed through performance models or frameworks which are rarely combined although managers could benefit from integrated and coherent models, mainly for innovation and KM (Knowledge Management). Models for measuring innovation and KM performance are new and concern mainly large companies. They have almost all been developed relying on input/output frameworks. The processes generating performance are not thoroughly taking in account. Drawing upon a literature review and a theoretical study, this paper contribution is based on an integrated conceptual model combining the value innovation chain of Hansen and Birkinshaw (2007) [1], and the SECI KM model of Nonaka and Takeuchi (1995) [2], to build an integrated KM-innovation framework which can help to assess KM projects and innovation projects in different types of organizations.

Keywords: Innovation performance measurement · KM performance measurement · Innovation process · KM process · Integrated framework

1 Introduction

In order to improve their performance, most organizations put in place different types of projects namely BPR (Business Process Reengineering), KM and innovation projects. For these various projects, managers need to measure impacts and outcomes on organizational performance. Scholars had developed several models with different perspectives to measure the outcomes of these projects (Andreeva and Kianto, 2012 [3]). But each of these models concerns specifically one project type at a time. However, organizations manage limited resources (financial, human, informational, etc.) and must recognize that many organizational projects are integrated and combined to fulfill the same final mission, to improve organizational performance. The scope of this paper is based on KM and innovation projects. KM projects are a key solution to build a competitive advantage and enhance business performance (Bontis, 2001 [4];

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Bose, 2004 [5]; Carlucci and Schiuma, 2006 [6]). Innovation projects also contribute to the same result. To be successful, innovations projects need to develop new knowledge. According to Nelson and Winter (1982) [7], the firm process of acquisition, storage, maintenance and renewal of technological and organizational knowledge is the cornerstone of the firm innovation performance. The process of knowledge management (creation, exploitation, sharing, transfer) is achieved by various strategies. Nonaka and Takeuchi (1995) [2] underline four strategies, namely socialization (tacit to tacit), externalization (tacit to explicit), combination (explicit to explicit) and internalization (explicit to tacit). Both KM an innovation projects contribute to improve productivity, consumer satisfaction, and new products and services. They are intertwined but available frameworks in the literature evaluate the nature and value of their impacts separately. For managers and from a strategic point of view, it would be useful to have an integrated framework to assess KM and innovation projects. This paper is structured as follows: the first section is a review of the different KM assessment models, the second section is a review of innovation measurement frameworks and the third section proposes an integrated conceptual framework based on input-ouput model combined with the balanced scorecard model.

2 Literature Review

2.1 Knowledge Management Assessment Models: Options and Limits

Knowledge is intangible (Nonaka and Takeuchi (1995) [2]) and its management cannot be assessed with conventional methods, as financial or accounting ones (Bontis, 2001 [4]). Furthermore, financial resources are necessary to put in place KM projects and managers are looking for return on investment. Measurement is thus necessary to justify these investments although it remains difficult to establish the link between investment in knowledge management and organisational performance.

The literature about KM addresses the measurement issues with numerous different approaches. These differences are mostly due to the profile, experience and disciplinary field of the scholar. Thus, all the KM measurement frameworks, within an organization, can be grouped into three main approaches. The first one focuses on metrics, the second one focuses on methodological aspects and the third one prioritizes measurement models. In the first approach, various authors propose “metrics” of the level of knowledge within an organization. Those metrics are related to a characteristic or a condition of the organization. No processing measure is proposed between an initial and a final state. Table 1 below illustrated the parameters of all the three approaches.

Hanley and Malafsky (2003) [8] present a systemic approach based on input-output model (Table 2) where they identify process metrics, output metrics and outcome metrics for KM measurement. They outline the link between the knowledge project and the organizational performance. But there is no organizational level underlined, nor any specific human resource, namely individual, group or service related to the performance achieved by the KM project. However, Hanley and Malafsky [8] approach presents parameters to consider when assessing knowledge management project influence on organizational performance.

Table 1. Perspectives on KM assessment

Metrics based	Methodological based	Model based
1-Customer focus (ex: market share, customer lost, annual sale per customer, etc.) 2- Human capital (ex: number of employees; number of managers; revenues/employee) 3- Financial focus (ex: total assets; total assets per employee; profits per employee) 4- Process focus (ex: processing time; quality performance; IT capacity/employee)	1- What is the business objective? 2- What KM methods and tools will we use? 3- Who are the stakeholders? 4- Which framework is the best? 5- What should be measure? 6- How should we collect and analyze the measures? 7- What do the measures tell us and how should we change?	1- Input-ouput 2- Balanced scorecard 3- Economic value added (EVA) 4- Net present value

Table 2. Example of KM performance measures

Key system measures	Key output measures	Key outcomes measures
1- Number of users 2- Number of downloads 3- Dwell time 4- Contribution rate over time 5- Total number of contributions	1-Time to solve problem 2-Number of apprentices mentored by colleagues 3- Number of problems solved 4- Time to find an expert	1-Time saved by implementing best practice 2- Money saved by implementing best practice 3- Number of groups certified in the use of the best practice 4- Rate of change in operating costs

The Balanced Scorecard is a framework which offers many advantages in terms of measurement of the performance. First of all, it takes into account several dimensions, namely: customer, finances, internal processes, training and improvement. This integration of the 4 distinct, but complementary prospects makes it possible to ensure the multi-factor approach of measurement. Secondly, it is non-prescriptive and therefore can be adapted to various contexts and situations. With that in mind, it becomes relevant to see under which conditions it will be applicable in a context of knowledge management.

Chen and Chen (2005) [9] adapted the BSC for KM purposes. Drawing on the work of various authors (Kaplan and Norton, 1996 [10]; Nonaka and Takeuchi, 1995 [2]; Alavi and Leidner, 1997 [11]; Liebowitz, 1999 [12]), Chen and Chen (2005) [9] established that the process of KM can be divided into 4 core activities, namely: 1- creation, 2- conversion, 3- circulation, and 4 - completion. These processes are used as substitutes for the four initial ones proposed in the primary Norton and Kaplan model. Conceptually, Chen and Chen (2005) [9] framework summarised in Table 3 adapts the BSC in response to the specific needs of KM performance measurement.

Table 3. The balanced scorecard model adapted by Chen and Chen (2005) [9]

Balanced scorecard perspective (Kaplan and Norton, 1996 [10])	Balanced scorecard adapted by Chen and Chen (2005) [9]	Questions
Growth and learning perspective	Creation	What competition advantages are emerging?
Internal process perspective	Circulation	Is KM operating effectively and efficiently?
Customer perspective	Conversion	Is KM satisfying user needs?
Financial perspective	Completion	How does KM look to management?

Another adaptation of the BSC to KM performance assessment has been proposed by Wu (2005) [13]. Here, a more qualitative and integrated approach is adopted by associating the dimensions related to the organization (human capital, customer capital, organisational capital) to the operational dimensions of the BSC (finance, process, learning, etc.). This combination makes it possible to distinguish elements related to KM as a stock (organizational capital) from the dynamic aspects related to the transformation from stock into flow. Table 4 below summarises the adaptation developed by Wu (2005) [13], which proves to be very relevant in a non-commercial organisational context, where results are not necessarily financial or quantitative.

Table 4. The balanced scorecard adapted by Wu (2005) [13]

	Human capital	Organizational capital	Customer capital
Financial perspective Financial benefits	What are the benefits of human capital on corporate financial performance?	What are the benefits of organizational capital for corporate financial performance?	What are the benefits of customer capital for corporate financial performance?
Customer perspective Customer benefits	What are the benefits of human capital on internal and external customers?	What are the benefits of organizational capital for internal/external customers?	What are the benefits of customer capital for internal and external customers?
Internal process perspective Value chain	What is the value chain management of human capital?	What is the value chain management of organizational capital?	What is the value chain management of customer capital?
Learning and growth perspective	What are the future development and directions of human capital?	What are the future development and directions of organizational capital?	What are the future development and directions of customer capital?

Drawing on the BSC architecture, we can underline that the financial results are only one consequence of the improvement of the competencies of the employees, the control of the processes and the capability to adequately meet needs and customer requirements. Moreover, the BSC integrates internal and external dimensions, as well as qualitative and quantitative indicators. In particular, measurements related to the customer are mainly qualitative (example: satisfaction, time, etc.) whereas those related to financial results are mainly quantitative. Incidentally, the BSC is applicable as well as within business unit as to the level of a project or to the whole of the organization. The BSC represents a viable option to evaluate the impact of KM projects on organization. The flexibility and adaptability of the balanced scorecard enable its use in different contexts. Although they are all relevant, these categorizations of KM models remain difficult to operationalize and the innovation dimensions are not included.

2.2 Innovation Performance Measurement

The evolutionary theory of economic populated by Nelson and Winter (1982) [7] gave some foundations to innovation research. It states that firms evolve not only through optimization but also through learning and exploration. It put also an emphasis on the firm process of acquisition, storage, maintenance and renewal of technological and organizational knowledge. According to the authors, that process is the cornerstone of the firm innovation performance. The stakeholder theory (Freeman et al., 2010 [14]) also contributed to the current stream of innovation research based on networks and ecosystem. In concordance with that theory, the knowledge required for the building and management of disruptive change lies increasingly outside the boundaries of the firm and the innovation performance is related to an efficient management of the firm relevant stakeholders through partnership and alliances.

Drivers for successful innovation are well documented, specifically for large firms but their metrics are still unsatisfactory (Adams et al., 2006) [15]. Four drivers for successful innovation were identified by Tidd et al. (2006) [16]: an appropriate strategy, internal and external effective links, creative mechanisms to promote change, the existence of an organizing framework wearer.

Models of innovation performance has been developed drawing on different methodologies including empirical ones like firms survey (OECD, 2005 [17]; Alegre et al., 2006 [18]), case study (Lazzarotti et al., 2011 [19]) and theoretical approaches (Adams et al., 2006 [15]; Schentler et al., 2010 [20]; Edison et al., 2013 [21]). The OCDE methodology is well spread and validated among the OCDE thirty members and its main focus is the national innovation system performance and less the firm performance. The following Table 5 illustrated different methodologies from quantitative to qualitative ones that are involved in innovation measurement studies.

Measurement frameworks used for innovation are also diversified and include the OECD model (OECD, 2005 [17]; Alegre et al., 2006 [18]); the balance scorecard (BSC) model (Kerssens-van Drongelen and Bilderbeek, 2002 [29]; Schentler et al.,

Table 5. Methodologies involved in innovation measurement studies

Study	Data source	Methods or frameworks	Example of paper
Quantitative	Public data (public companies)	Net actual value	Dyer et al., 2011 [22]
	Survey	DEA (data envelopment analysis) and/or AHP (analytic hierarchic process)	Cruz-Cazares et al., 2013 [23]
			Guan et al., 2006 [24]
			Hashimoto and Haneda, 2008 [25]
			Jayanthi et al., 2009 [26]
		Structural equation model	Alegre et al., 2006 [27]
Qualitative	Case study	Balanced scorecard (BSC)	Lazzarotti et al., 2011 [19]
		BSC and DEA	Bakhtiar et al., 2009 [28]

2010 [20]; Lazzarotti et al., 2011 [19]). The BSC framework inspired Lazzarotti et al. (2011) [19] to develop a five perspectives R&D model based on the soft measurement theory and a case study. The five perspectives comprise financial, customer, innovation and learning, internal business, alliances and networks. The following Table 6 illustrated the diverse innovation frameworks and their respective scope or limit.

Table 6. Innovation measurement frameworks and their respective scope or limit

Innovation measurement frameworks	Scope or limits
OECD (2005) [17]	Based on firm surveys. Best suited for benchmark and less for innovation process
BSC	Yet to be tested and validated, design for large organizations
Multicriteria decision model – AHP (analytic hierarchy process)	Well suited for portfolio management and less for the innovation process
Economical model – DEA (data envelopment analysis)	Well suited for benchmark – input/output oriented

Emerging models of innovation performance measurement are built with operations research tools such as Data Envelopment Analysis (DEA) or multicriteria analysis tools such as Analytic Hierarchy Process (AHP). By developing a function whose form is determined by the most efficient producers, DEA is well suited for innovation efficiency calculation and for benchmark (Cruz-Cazares et al., 2013 [23]). As a multicriteria analysis tool, AHP can be well-suited for innovation portfolio management.

Drawing on a systematic literature review and a Delphi study, Adams et al. (2006) [15] developed a synthesized framework of the innovation management process consisting of seven categories: inputs management, knowledge management, innovation strategy, organizational culture and structure, portfolio management, project management and commercialization; encompassing nineteen criteria for the seven categories. Adams et al. (2006) [15] proposed this framework to innovation managers in their attempt to construct a comprehensive measure of innovation performance. They stated: «*the measures proposed in the literature often seem to be proposed abstractly, with little consideration given to the use of measures as a management tool in the day to day context of managing innovation*».

Drawing on a survey among CEO of large companies, Mankin (2007) [30] observed a diversity of approaches that companies uses to measure innovation performance. He states: «*The challenge in effectively measuring innovation performance is one of abundance, rather of scarcity- there are so many approaches and no one of them is perfect…*». The following Table 7 illustrated that diversity.

Table 7. Innovation models from Mankin, 2007 [30]

Metrics models	Examples of indicators
Result-based metrics	sales, profits, market value, adoption rate, customer fidelity
Process-based metrics	Number of projects, number of funded ideas, market adoption rate, patents, leadership
Project-based metrics	Time to cash, options, cash curve
Portfolio-based metrics	Portfolio diversity, interrelated projects

Traditional and recent models of innovation performance measurement are still input/output oriented and the innovation process between is neglected (Adams et al., 2006) [15]. Their indicators focus on past innovation performance, stressing more on control rather than management purpose. One of the consequences of the lack of process-oriented innovation performance measurement framework is that the innovation dilemma is still not managed properly in the enterprises, particularly in the SMEs (Chang and Hughes, 2012) [31]. Furthermore, different models and frameworks are used to measure innovation performance projects but they don't take in account the global dimension or process of knowledge management. This can be considered as a gap because value creation is driven by knowledge management and only a purposeful management of knowledge base at every stage of project innovation process can deliver the enterprise expected results.

3 Discussion: A Need of a Unified Framework

3.1 Joining Innovation and Knowledge Management Projects: A Process-Driven and Effective Organization

Knowledge creation and evaluation are considered today as drivers of value creation in every organization. In the same vein, innovation projects are a solution to ensure the effectiveness of knowledge management projects. Therefore, measuring impacts or performance of knowledge management and innovation projects becomes an interesting challenge for both executives and scholars. It helps executives to determine impacts at different levels of the organization namely, productivity improvement, customer and employee satisfaction, new products and services development. It helps them also to use enterprise available knowledge as a multiplying effect of value creation.

Today, organizations must devote numerous resources to innovation management and for the effectiveness of that investment; they must consider innovation management as in line with knowledge management. In putting forward innovation projects, organizations bring creative solutions to their problems and identify new products and services which contribute to improve customer satisfaction, anticipate future needs; they also build synergy with the available knowledge and the needed one created through R&D activities. After all, whatever the nature of the innovation project, organizations deal with every activity of the knowledge management process, namely: a- knowledge identification – audit (cartography), b- codification – storage c- exploitation – transformation, d- acquisition – conservation, e- diffusion – disposition, f- transfer – exchange, g- use – re-use, h- integration – renewal. Therefore, taking into account those activities in a process approach helps to generate the results and outcomes expected in innovation and knowledge management projects.

3.2 Challenges Related to Innovation and Knowledge Management Projects

The joined management of innovation and knowledge projects generate specific challenges at the organizational and operational level, impacts and outcomes measurement level. Three particular challenges need to be addressed with a specific measurement framework.

First of all, innovation projects required extensive human, financial, informational and material resources without certainty of results. Furthermore, executives reported a high percentage of project innovations failure (Schentler et al., 2010) [20]. Secondly, innovation projects investments are competing with available but limited resources required also for traditional products and services portfolio which must be adequately managed in order to generate cash flow for the survival of the business. Consequently, innovation projects viability must be reinforced through the knowledge management projects so that the knowledge capital already available in the enterprise is used genuinely and generates synergy across units.

Thirdly, small and medium enterprises face more severe human, informational and financial resource limitation (Hudson Smith et al., 2001) [32]. Furthermore, they have poor marketing and strategic capacities and could gain benefits from a performance measurement framework for better decision analysis. Almost all performance measurement models are designed for large companies and not for SMEs.

Finally, innovation projects are an imperative for enterprises and knowledge management can be a strategy to strengthen their viability by improving the executive decision skills and favouring positive results through new knowledge creation, productivity improvement, solutions to customer needs, new and customized products and services.

3.3 A Conceptual Model to Assess KM and Innovation Projects

We notice earlier an abundant literature on the need of measurement of knowledge management projects and on innovation projects. Frameworks for both measurements remain separated despite similarities and the fact that they share the same purpose of organizational performance. They also share a similar logic and mutual influence. An innovation project can be strengthened and consolidated by knowledge management activities as innovation requires mainly generating knowledge in order to produce new solutions embedded in enterprise new products and services.

We advocate a new performance measurement framework to combine knowledge management and innovation projects to fill a gap in the literature, as the two actual generic measurement models consider them separately despite similarities and complementarities. First of all, the input/output model emphasizes the production function related to the process from the input to the output. It identifies the results and the impacts. Secondly, the balance scorecard model emphasizes the dimensions and criteria measuring the performance. It helps to put a holistic view on the organization and recognizes that performance must be tailored at different levels of the organization with transformative projects such as innovation and knowledge management projects. The following Table 8 illustrated the two performance models for both innovation and knowledge management.

Table 8. KM and innovation performance models

Models	Performance measurement models	
	Knowledge management projects	Innovation projects
Input/output models	Hanley and Malafsky (2004) [8]	Cruz-Cazares et al. (2013) [23]
Balance scorecard models	Wu (2005) [13]; Chen and Chen (2005) [9]	Lazzarotti et al. (2011) [19]

Joining innovation and knowledge management projects can be achieved through a process-based approach that allows the measurement of results of activities involved in the input-process-output-outcome cycle, at every stage of the innovation process. Our unified framework is built from structural concept of the balance scorecard as it takes in account multiple dimensions of the performance measurement. It links innovation and

knowledge as a continuum. In fact, innovation consists in the production of new knowledge which is embedded in new products and services. Furthermore, the unified framework established that innovation and knowledge projects are convergent.

Our unified framework is based on the renowned Nonaka and Takeuchi (1995) [2] knowledge model and on the Hansen and Birkinshaw (2007) [1] innovation value chain model. The Nonaka and Takeuchi model of knowledge management can be related to the input-output model, from tacit knowledge (input) to explicit knowledge (output). The knowledge transformation process comprises four stages: socialization (from tacit to tacit), externalization (from tacit to explicit), combination (from explicit to explicit) and internalization (from explicit to tacit). It favours the creation of new knowledge which is embedded in new products and services through innovation projects. The Hansen and Birkinshaw innovation value chain is inspired by the Porter value chain model of input-process-output and is characterized with three stages: idea generation, conversion and diffusion. In order to evaluate the performance of an innovation and knowledge management project, our unified framework combine Nonaka and Takeuchi model (1995) [2] and Hansen and Birkinshaw (2007) [1] model in a 3 lines (innovation value chain) and 4 columns (knowledge management process) framework and table.

Table 9. Performance measurement framework for KM and innovation projects: key questions

	Socialization	Externalization	Combination	Internalization
Idea generation	What are the current employee knowledge? What are the experiential media delivering that employee knowledge?	What and how much activities are put in place in order to generate new ideas?	How new ideas are combined?	How is the available knowledge used in ideations sessions?
Conversion	What are the solutions and alternatives known from the stakeholders? Which of them are well controlled?	What are the bottlenecks? How to overcome them?	What are the knowledge bases needed to combine options? What the effective results of the combination?	What are the reports issued by each participant? What are the new knowledge created in the process?
Diffusion	What are the tacit practices generated by the innovation?	What are the explicit practices generated by the innovation?	What are the group activities for the knowledge diffusion?	What are the individual activities for the knowledge diffusion?

Table 10. Criteria and indicators for the innovation and knowledge management projects

	Socialization	Externalization	Combination	Internalization
Idea generation	Individuals across units brainstrom Companies tap external partners for ideas	Market studies Mails, meeting reports Trends analysis	Combining insights and knowledge from different parts of the same company to develop new products and businesses	Employee Trainings Use of big data in ideation sessions
Conversion	Number of projects developed in partnership	Designs Patents Papers News	Ideas screening Budgeting and Funding Prototyping Development of products and services	Prototype testing
Diffusion	Customer or user training Customer or user feedback	Customer feed-back New Sales or productivity improvement	Marketing campaign (ads, brochure,…)	Product and market test

The following Table 9 identifies the questions related to the decision process and Table 10 identifies the relevant financial and non-financial criteria and indicators.

The idea generation stage purpose is to generate as much idea as possible from within the company across units and from its partners. Here, we have four links to the knowledge management process:

(a) Ideation and socialization: Tacit knowledge contributes to the idea generation. The input is the individual and inherent competencies of the organizational stakeholders. Those competencies are gained from their involvement in previous projects. The key questions are: What is the available knowledge of the employees? How do they get that knowledge? etc. The tacit knowledge is combined within the company through cross unit brainstorming meetings. Also the tacit knowledge of the customers and other partners are combined through networking events or customer relationships. Here, indicators could be the number and quality of cross-unit relationship within the company and the number and quality of networking events.

(b) Ideation-Externalization refers to the number of ideas that are exchanged, the institutional media available and the externalization activities that are organized. The key questions are: what are the ideas generated by the group? What are the idea generation activities? What are the knowledge available for the sake of idea generation? etc. The tacit knowledge gained in the previous stage can be expressed through indicators like market studies, meeting reports, mails or trends analysis.

(c) Ideation-Combination refers to the first screening of the explicit knowledge generated from the idea generation. The key questions are: what are the combination bases of the new idea? What are the ways and means of that combination? The available knowledge in different units of the organization can be shared and combined to design new or improved products and services.
(d) Ideation and internalization: sometimes, training of employee is required to improve the absorption capacity of the enterprise while facing new knowledge mandatory in the design process. Also, the use of bid data in ideation sessions in an interesting new concept.

The conversion generation stage purpose is to choose the relevant ideas and transform them into new products and services. The Conversion/Transformation stage refers to the selection of idea and their development with the required financial resources, individual and collective competencies. We describe hereunder how socialization, externalization, combination and internalization contribute to the conversion stage.

(a) Conversion – socialization refers to tacit knowledge required for the development of the selected ideas. It encompasses activities on internal or external solutions previously adopted in previous projects. The key questions are: what are available solutions and alternatives from the participants involved? How can they be adapted? The tacit knowledge available or acquired in the ideation session is transformed in design, patents or journal papers.
(b) Conversion – Externalization refers to the development activities and emphasizes the number of explored solutions and the resources needed for their development. The conversion is no more individual but collective by the sharing of solutions. The key questions are: What are the bottlenecks? What are the different solutions discussed by the team? Which solutions were adopted and what are their knowledge bases? What are the traps to be avoided?
(c) Conversion-Combination refers to the optimization of the identified solutions and the matching between the resources and the validated alternatives. The key questions in this iterative process are: what are the knowledge bases required for the combination of alternatives? How effective are the results of that combination? The processes of idea selection, budgeting, prototyping and product development are characterized by the uses of numerous templates, procedures and business cases.
(d) Conversion-Internalization refers to individual follow-up of the precedent externalization and combination stages. The key questions are: what are the activities or actions to put in place in order for the employees to leverage the developed knowledge and solutions? What are the individual reports gathered from their respective participation? What are the new knowledge gained in the process? Testing the prototype gives the opportunity to gain some insight from the customer, sometimes a lead user.

The diffusion generation stage purpose is to fasten the adoption of the new solution within the company and in the market. We describe hereunder how socialization, externalization, combination and internalization also contribute to the diffusion stage.

(a) Diffusion-Socialization refers to individual activities where the new knowledge is transferred in the current individual practices. The key question is: what are the tacit practices induced by the innovation solution. The tacit knowledge gained within the company in the process of creation of the new product or service must also be transferred to the user or the customer by training or launching events.
(b) Diffusion-Externalization refers to activities where the new knowledge generated is shared and transferred to the current practices of the organization. The key questions are: what are the explicit practices induced by the innovation solution? The customer or user feedback can be related to sales increased or productivity improvement. The buying process is the conversion of tacit knowledge to explicit knowledge.
(c) Diffusion – Combination refers to simulation, reconfiguration and reexploitation of the new tacit and explicit knowledge generated by the innovation project. The key questions are: what are the group activities put in place for the new knowledge diffusion? How can the new knowledge contribute to solve new problems? The available knowledge embodied in new products and services can be transformed in marketing campaigns to attract more customers.
(d) Diffusion-Internalization refers to individual activities used to diffuse the new knowledge. The key questions are: what are the individual activities put in place to share the new knowledge? How does each participant individually contribute to the diffusion of the new knowledge issued from innovation solution? Furthermore, new products and services are tested in pilot market to get insights from lead customers.

4 Conclusion

The challenge addressed by this paper is that innovation and KM initiatives must be considered as intertwined projects. But the literature measurements frameworks evaluate them separately. The unified framework we proposed is process-based and an integrated conceptual model combining the value innovation chain (ideation, conversion and diffusion) and the SECI KM model (socialization, externalization, combination and internalization). Our next challenge is to test this model on an empirical basis on different business context.

References

1. Hansen, M.T., Birkinshaw, J.: The innovation value chain. Harvard Bus. Rev. **85**(6), 121 (2007)
2. Nonaka, I, Takeuchi, H: The Knowledge-Creating Company: How Japanese Companies Create The Dynamics of Innovation, 284 p. Oxford University Press (1995)
3. Andreeva, T., Kianto, A.: Does knowledge management really matter? Linking knowledge management practices, competitiveness and economic performance. J. Knowl. Manage. **16**(4), 617–636 (2012)

4. Bontis, N.: Assessing knowledge assets: a review of the models used to measure intellectual capital. Int. J. Manage. Rev. **3**(1), 41–60 (2001)
5. Bose, R.: Knowledge management metrics. Ind. Manage. Data Syst. **104**(6), 457–468 (2004)
6. Carlucci, D., Schiuma, G.: Knowledge asset value spiral: linking knowledge assets to company's performance. Knowl. Process Manage. **13**(1), 35–46 (2006)
7. Nelson, R.R., Winter, S.G.: An Evolutionary Theory of Economic Change. Belknap, Cambridge (1982, 2005)
8. Hanley, S., Malafsky, G.: A guide for measuring the value of KM investments. In: Holsapple, C.W. (ed.) Handbook on Knowledge Management, pp. 369–390. Springer, Heidelberg (2003)
9. Chen, M.Y., Chen, A.P.: Integrating option model and knowledge management performance measures: an empirical study. J. Inf. Sci. **31**(5), 381–393 (2005)
10. Kaplan, R.S., Norton, D.P.: Using the balanced scorecard as a strategic management system. Harvard Bus. Rev. **74**(1), 75–85 (1996)
11. Alavi, M., Leidner, D.E.: Knowledge management systems: issues, challenges, and benefits. Commun. AIS **1**(2es), 1 (1999)
12. Liebowitz, J. (ed.): Knowledge Management Handbook. CRC Press, Boca Raton (1999)
13. Wu, A.: The integration between balanced scorecard and intellectual capital. J. Intellect. Capital **6**(2), 267–284 (2005)
14. Freeman, R.E., Harrison, J.S., Wicks, A.C., Parmar, B.L., De Colle, S.: Stakeholder Theory: The State of the Art. Cambridge University Press, Cambridge (2010)
15. Adams, R., Bessant, J., Phelps, R.: Innovation management measurement: a review. Int. J. Manage. Rev. **8**(1), 21–47 (2006)
16. Tidd, J., Bessant, J., Pavitt, K.: Management de l'innovation: Intégration du Changement Technologique, Commercial et Organisationnel. De Boeck Université, Bruxelles (2006)
17. OECD: OECD SME and Entrepreneurship Outlook 2005. OECD Publishing (2005). doi:10.1787/9789264009257-en
18. Alegre, J., Lapiedra, R., Chiva, R.: A measurement scale for product innovation performance. Eur. J. Innov. Manage. **9**(4), 333–346 (2006)
19. Lazzarotti, V., Manzini, R., Mari, L.: A model for R&D performance measurement. Int. J. Prod. Econ. **134**(1), 212–223 (2011)
20. Schentler, P., Lindner, F., Gleich, R.: Innovation Performance Measurement. In: Gerybadze, A., Hommel, U., Reiners, H.W., Thomaschewski, D. (eds.) Innovation and International Corporate Growth, pp. 299–317. Springer, Heidelberg (2010)
21. Edison, H., Bin Ali, N., Torkar, R.: Towards innovation measurement in the software industry. J. Syst. Softw. **86**(5), 1390–1407 (2013)
22. Dyer, J., Gregersen, H., Christensen, C.M.: The Innovator's DNA, p. 87. Harvard Business Review Press, Boston (2011)
23. Cruz-Cázares, C., Bayona-Sáez, C., García-Marco, T.: You can't manage right what you can't measure well: technological innovation efficiency. Res. Policy **42**(6), 1239–1250 (2013)
24. Guan, J.C., Yam, R.C., Mok, C.K., Ma, N.: A study of the relationship between competitiveness and technological innovation capability based on DEA models. Eur. J. Oper. Res. **170**(3), 971–986 (2006)
25. Hashimoto, A., Haneda, S.: Measuring the change in R&D efficiency of the Japanese pharmaceutical industry. Res. Policy **37**(10), 1829–1836 (2008)
26. Jayanthi, S., Witt, E.C., Singh, V.: Evaluation of potential of innovations: a DEA-based application to US photovoltaic industry. IEEE Trans. Eng. Manage. **56**(3), 478–493 (2009)
27. Alegre, J., Lapiedra, R., Chiva, R.: A measurement scale for product innovation performance. Eur. J. Innov. Manage. **9**(4), 333–346 (2006)

28. Bakhtiar, A., Purwanggono, B., Metasari, N.: Maintenance function's performance evaluation using adapted balanced scorecard model. World Acad. Sci. Eng. Technol. **58**, 16–20 (2009)
29. Kerssens-van Drongelen, I.C., Bilderbeek, J.: R&D performance measurement: more than choosing a set of metrics. R&D Manage. **29**(1), 35–46 (1999)
30. Mankin, E.: Measuring innovation performance. Res. Technol. Manage. **50**(6), 5 (2007)
31. Chang, Y.Y., Hughes, M.: Drivers of innovation ambidexterity in small- to medium-sized firms. Eur. Manage. J. **30**(1), 1–17 (2012)
32. Hudson Smith, M., Smart, A., Bourne, M.: Theory and practice in SME performance measurement systems. Int. J. Oper. Prod. Manage. **21**(8), 1096–1115 (2001)