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Towards a framework for measuring the impact of knowledge management solutions applied to work processes

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According to Klein and Prusak (1994), one can define intellectual capital operationally as intellectual material that has been formalized, captured and leveraged to produce a higher value asset. Models, frameworks, and methodologies for measuring knowledge assets and intellectual capital (IC) exist in the domains of accounting, economics, human resource accounting and intellectual property. None of these models have been applied in the non-profit sector. The objective is thus to determine what can be learned from existing models and how they can be adapted to organizations in the development sector. We provide an overview of the various school and methodologies on IC but demonstrate in particular the Skandia model (Edvinsson and Malone 1997) as viable methodology for measuring the IC/knowledge management value proposition of an organization. In the development sector, benefits from knowledge products and services (KPS) are generated either directly by a development institution when it implements projects or indirectly when it supports stakeholders who implement projects. Based on the definition of knowledge, benefits are created when knowledge is used for effective action or decision. When a development institution is indirectly producing development results through its stakeholders, this knowledge-action-benefit framework can be expanded using the four-stage modified Kirkpatrick Model. The paper explains and provides examples on how this model can be used in measuring benefits from KPS.

Keywords: knowledge measurement; intellectual capital; impact measurement; knowledge products and services

Knowledge management (KM) as a field of practice has persisted for more than three decades[1] despite the fact that there is no agreement among the KM community on the core concepts of the field and no standard or commonly accepted framework for measuring the impact or benefit of the practice (Arisha and Ragab, 2013). The objective of this paper is to contribute to the discourse towards such a framework by drawing on empirical evidence and on observations of what works in actual practice.

Literature review

There is a plethora of definitions of the terms "knowledge" and "knowledge management." However, if we refer back to the definitions by the earliest and leading KM practitioners, a clear commonality and agreement among them can be seen.

> *"Knowledge is information that changes something or somebody — either by becoming grounds for action, or by making an individual (or an institution) capable of different or more effective action." (Drucker 1989)*
> *"Justified belief that increases an entity's capacity for effective action." (Nonaka, 1994)*
> *"I define knowledge as a capacity to act." (Sveiby 1997)*
> *"Knowledge is information in action." (O'Dell et al. 1998)*
> *"Knowledge is understanding the why, what, how, who, when, and where relative to taking some action." (Boom 2004)*

The commonality among them is that knowledge is information, understanding or belief that enables effective action. O'Dell's definition of "knowledge management" again refers to putting information into action:

> *"…conscious strategy of getting the right knowledge to the right people at the right time and helping people share and put information into action in ways that strive to improve organizational performance." (O'Dell et al, 1998)*

The earliest reviews of KM measurement frameworks provided some useful observations and conclusions. Measurements of KM impact can be grouped into three categories, namely those at the level of tasks or projects (outputs), those at the level of the

[1] Using the Google Books Ngram Viewer, one observes that the number of books published yearly with the phrase "knowledge management" in their title started in the 1980s.

organization (outcomes), and those about support systems. They can be further grouped into generic frameworks or those designed for specific KM initiatives (US Department of the Navy 2001). The discourse on knowledge, KM and KM measurement overlaps with that on intellectual capital and intellectual capital management (ICM). The big gap often observed between market values and book values[2] (FASB 2007) of corporations is one of the reasons behind the interest among corporate practitioners in tracking intangible assets – which are mostly knowledge assets or elements of intellectual capital (Starovic and Marr 2004; BEI Consulting 2003). Table 1 summarizes the results of a number of reviews of KM measurement. Most of the proposed methods of measuring the impact of KM are those at the organizational level.

Table 1: KM Measurement Frameworks

Level	Proposed KM Measurement
Organization	Knowledge Centric Organization Model (US Department of the Navy 2001) Balanced Scorecard (Kaplan and Norton 1992) Performance Prism (Adams and Neely 2000) Various ICM tools: Ericsson's cockpit communicator, Celemi's intangible assets monitor, Bates Gruppen Company IQ, Ramboll's holistic company model, Tobin's q, Baruch Lev method, Value-added IC coefficient, Knowledge Assets Map, etc. (Starovic and Marr 2004) Skandia Navigator (Edvinsson 1997)
Team or Group	Knowledge Centric Organization Model (US Department of the Navy 2001)
Individual	Kirkpatrick Model (Kirkpatrick and Kirkpatrick 1994) Success Case Method (Brinkerhoff 2003)

Reviews of ICM literature confirmed the consensus that three categories of intellectual capital can be distinguished: human capital, structural capital and relational capital (Grimaldi et al. 2013). There is also a relative lack of research on the impact of KM at the individual level (Arisha and Ragab 2013). Empirical data on factors that enable effective action at the individual level confirmed the three categories of intellectual capital or intangible assets but also showed that effective action is the result of the interplay of five factors. These are tangible assets, the three categories of intangible assets, and a cross-cutting factor related to motivation and attitudes (Talisayon 2009a and 2009b).

[2] The book value of an asset is its original purchase cost, adjusted for any subsequent changes, such as for impairment or depreciation. Market value is the price that could be obtained by selling an asset on a competitive, open market.

Statement of the problem

If knowledge enables effective action, then the impact of a KM solution in a workplace should be measurable in terms of performance of that action. Multilateral development banks have defined value for money to describe both the effectiveness and efficiency dimensions of performance of an action either by an individual knowledge worker or by a team (AfDB 2016)[3]. Actions in the workplace are often organized into a business process in the private sector or into a work process in the public or development sector. In the private sector, value is created by the corporations' core business processes, hence a KM measurement framework applied to business or work processes may be translatable to impacts or benefits at the organizational level.

This paper proposes an approach for measuring the impact or benefit from using a KM solution or KM tool at the level of individuals and teams in a workplace. It will not look into the problem of measurement of the stock or flow of knowledge assets, nor will it look into the problem of measuring characteristics of knowledge processes. It will focus only on measuring the impact of applying a KM solution or tool at the level of a business or work process. Specifically, it will test the applicability of the Kirkpatrick model to this measurement issue.

Conceptual Framework

The assumptions behind the focus on the workplace are:

a) The impact of knowledge when applied in action or performance of a work or business process is the consequent improvement in the effectiveness of the action,
b) The action by an individual or the work process performed by a team is an appropriate and basic level for measuring KM impact, and
c) Because the work or business process is embedded in an organization and justified by organizational goals, impact at the level of the organization can be measured through KM impact at the team process level, or at the individual action level if only one person is performing the work or business process sanctioned by the organization.
d) The outcome is value creation at the level of the organization.

The KM logical framework consists of three elements (Talisayon 2008):

[3] The African Development Bank is leading the effort of the MDB's to define value for money.

Knowledge Assets	→	**Effective action/Performance of a work process**	→	**Value creation in outputs and outcomes**

This framework is consistent with the value for money framework of MDBs applied to efficiency and effectiveness of an action or project. It is also consistent with the value creation framework for communities of practice (Wenger et al. 2011) where knowledge sharing-receiving (Cycle 2) is followed by change in behavior and work performance (Cycles 3 and 4). It must be noted that the proposed KM logical framework can be viewed as an upstream extension of the common project logical framework in results-based management.

The KM logical framework is also consistent with the Kirkpatrick model. Among learning and development and human resource development practitioners in the private sector, a common framework used for measuring the impact of a training course is the Kirkpatrick model (Kirkpatrick and Kirkpatrick 1994). In this framework impact is measured at four levels:

Level 1 or *Reaction*: Is the student satisfied?
Level 2 or *Learning*: Did the student learn the concepts and theories?
Level 3 or *Behavior*: Did the student apply what he learned in his work in the organization?
Level 4 or *Results*: Did the application result or contributed to a concrete benefit to the organization?

Kaufman (1996) suggest a fifth level, pertaining to the utility to consumers or the public of the end product or service produced by the organization.

Methodology

This paper will proceed in two stages: (a) survey of factors that influence effective action by teams, and (b) survey of impacts of KM solutions applied to work or business processes.

The first two authors are mentors, while the third author is e-learning associate, of an online KM Practitioner Certification Course (KMPCC) implemented under a KM consulting organization, the Community and Corporate Learning for Innovation (CCLFI) since 2013. The second author developed a blended graduate course in KM, Technology Management 298 (TM 298), at the University of the Philippines Technology

Management Center and has been implementing it since 2002. In both cases, our students implemented a workplace KM practicum where each selected a KM solution or tool that addresses a problem of the work process or business process they were currently performing in their workplace. The KM practicum applies the KM concepts learned earlier by the student.

The main objective in both KMPCC and TM 298 classes is to learn KM by doing KM. The following procedures were followed by each student:

a) The early part of the course is devoted to KM concepts and theories, and the latter part is spent in performing a selected KM tool or solution in the student's workplace.
b) The student is required to get permission from, and coordinate with, the superior in the selection of the work or business process as well as the appropriate KM tool or solution. In TM 298 most of the students are from the private sector in the Metro Manila. Often when a student works in the private sector, the permission is granted on condition of confidentiality of data and results. In KMPCC, most of the students are from the public and development sectors from the Philippines as well as from more than twenty other countries across Africa, Europe, South America, Asia and North America.
c) The selection of the KM tool is determined by three factors: (a) time constraint of eight weeks, (b) result of a KM assessment of the work or business process, and (c) the judgment of the superior. In TM 298, the KM assessment tool is the Quick Business Process Assessment© (QBPA) which asks two questions each to two sets of respondents, those performing the process and those using the output of the process. The answers of the first set of respondents often pertain to efficiency issues, while those of the second set pertain to effectiveness issues. In KMPCC, there are six other KM assessment tools used in addition to the QBPA. As a result a variety of KM tools or solutions were used.
d) Organizations often periodically measure KPI or other performance metrics on their work or business process. This performance metric is measured before and after the workplace KM practicum.
e) The final report is in the form of an actionable guideline or manual which can facilitate the replication of the KM solution elsewhere in or outside the organization.
f) In KMPCC, the practicum is a requirement. In TM 298, this requirement cannot be enforced and the student may submit an ordinary research or term paper instead of a practicum report. It cannot be enforced in cases where the student (a) is not employed, (b) is transitioning between two employments, and (c) the superior does not approve for reasons of company confidentiality.

g) At the end of the course in TM 298, the supervisor of the student emails the teacher, who is one of the authors (Talisayon), his evaluation of the work of the student. The superior's evaluation is a big factor in determining the grade of the student in the course.

In both KMPCC and TM 298, students learned (a) how to identify workplace problems using a demand-driven or problem-driven KM framework, and (b) how to select the right KM tool that matches the workplace problem. For the first step, two inputs are considered most important: (a) the QBPA results which identify problems from the perspective of process performers and of output users, and (b) the advice of the superior who has good tacit knowledge of the kinds of issues experiences in and around the business or work process. For the second step, students were provided five KM tool menus. Menus are organized according to the type of use or problem, and the choices of KM tools corresponding to each use or problem.

Before the start of KMPCC, students answer an open-ended survey consisting of only one question: "What things or people, factors, conditions, inputs, etc. help your team do its job well?"

An online survey was issued to graduates of KMPCC and TM 298. The Kirkpatrick framework guided the formulation of the evaluative survey. The survey questions were along the following a concerns:

a) Whether the student shared the knowledge gained;
b) The impact on the student's workplace: whether the student applied the knowledge in a work or business process of the organization and what was the result;
c) The impact on the student's organization: whether the practicum was replicated by other teams or over the entire organization; and
d) Comments on other impacts.

Results and analyses

Survey on factors that affect team performance

This survey is parallel to that reported by Talisayon (2009a); the earlier work asked the same question but addressed to the individual knowledge worker: "What things or people, factors, conditions, inputs, etc. help you do your job well?"

The answers are summarized in Table 2. The categories that emerge are the same as those from the earlier study. The following observations can be made from the results:

a) Many subcategories correspond to either tacit or explicit knowledge. This supports the view that knowledge enables effective action or performance of a team as well as it does of an individual.
b) Effective team action is influenced by categories that correspond very closely to the three IC categories of human, structural and relational capital, with the following additional categories: (i) tangible assets and (ii) a cross-cutting category that may be labelled as motivational factors (sub-categories in bold italics in Table 2). Motivational factors similarly emerged in a meta-analysis of success factors in KM case studies drawn from Asia and the Philippines (Talisayon, 2008; Talisayon, 2009b). These findings suggest that effective action at the workplace is the product not only of cognitive or knowledge factors but also of affective factors. They are consistent with the experience of KM practitioners who find it more effective to accompany KM programs with change management initiatives.
c) The answers confirm the overlap between knowledge and IC, and between KM and ICM.

In the private sector, performance of a business process by a team is viewed as "effective" if the output or result creates value or satisfies internal or external customers. Hence, the desired outcome of managing knowledge assets or knowledge processes is value creation. This suggests that linking KM to workplace processes is the way to align KM to organizational objectives – a suggestion that is explored further in the next survey.

Survey of impact of KM practicum on the workplace

Adoption of KM solution

39 of the 55 TM 298 students (71%) who responded to the follow-up survey said they did a workplace KM practicum; the rest submitted a research paper. Examples of work process demand-driven KM solution or tool adopted as their KM practicum were as follows:

- Adding a "Lessons Learned" session at the end of each work cycle
- Setting up an expertise directory using micro-competencies for a work process
- Using Google worksheet for M&E among a work team
- Improving on-boarding procedure to shorten learning curves of new hires
- Collecting reusable macros/scripts/routines from software development teams
- Participatory procedure for building up a tagging dictionary (knowledge taxonomy)

- Collecting and organizing work templates and guidelines by process steps
- Harvesting successful sales techniques by high-performing sales personnel
- Piloting an IQC (innovation and quality circle)
- Compiling a searchable web-based problem-solution logbook

Table 2: Categorization of answers to the survey question

Categories	Sub-categories	Frequency	
HUMAN CAPITAL	Character, attitude, creativity	63	
	Knowledge, skills, experiences	65	← tacit knowledge
	Health, recreation	10	
	Human capital of colleagues	82	← tacit knowledge
	Good and capable leader, champion	65	← tacit knowledge
	Self-motivation, commitment	59	
STRUCTURAL CAPITAL	Access to information	37	← explicit knowledge
	Business processes, SOPs	124	← explicit knowledge
	Policies, systems/structures, tools, guidelines and support systems	48	← explicit knowledge
	Training, feedback, learning and innovation processes; career growth	81	← explicit knowledge
	Vision and direction; fair, caring and empowering	63	
RELATIONAL CAPITAL	External linkages: partners, customers, suppliers, government support, Internet	63	← mixed tacit and explicit knowledge
	Communication; shared understanding of policies, standards, procedures	133	← mixed tacit and explicit knowledge
	Supportive culture/informal practices: teamwork, morale, cooperation and interpersonal relationships	121	
	Support, inspiration, motivation, recognition and trust from superiors	62	
	Support from family, friends and community	4	
TANGIBLE ASSETS	Technology, equipment, facilities, books and other commercial information	99	← explicit knowledge
	Financial resources	45	
	Physical Accessibility	6	
	Conducive workplace	52	
	Good pay, benefits, incentives, perks	36	
	Total	1318	

The KM tool or solution used in the practicum was adopted by other teams in the organization to varying degrees. Its impact generally went beyond the immediate workplace or work process performed by the student. In contrast, organization-wide adoption of the KM solution used in practicum was the most frequently mentioned outcome of the 25 graduates of the online KMPPC (Table 3).

Table 3: Summary of KM solution adoption

Item	What Happened after the Practicum	TM 298	KMPCC
1	The KM solution or tool was adopted as part of the regular or standard operating procedures of the whole organization	5	10
2	It was adopted in whole or in part by some teams	18	5
3	It was adopted only by one team	8	2
4	It was adopted for some time and then it was stopped	4	3
5	It was not adopted nor sustained	2	3
6	The student lost track or was not aware of what had happened after he/she did the KM practicum	1	1
7	Others	5	2

Benefits of KM solution

34 (or 87%) TM 298 students who performed a workplace KM practicum and 25 KMPCC graduates claimed that it generated benefits in one form or another (Table 4).

Table 4: Benefits of workplace practicum

Item	Benefit Reported	TM 298	KMPCC
1A	Information/documentation about the KM practicum (e.g. what for, how and results) were shared with officemates.	16	12
1B	Documentation of the KM practicum was uploaded/stored in the company intranet, database or shared folders.	13	7
2A	According to KPI or other performance indicators the KM practicum resulted in better performance	11	5
2B	Users or internal customers of the business process (where the KM practicum was applied) expressed higher satisfaction as a result of the KM practicums	13	10
3A	Officemates and/or managers expressed satisfaction with the KM practicum and its results	12	7
3B	Other teammates or officemates repeated or applied my KM practicum in their respective workplaces	12	11
	Others	6	5

Knowledge sharing. Items 1A and 1B show the number of respondents who reported are benefits associated with knowledge sharing behavior.

Knowledge use in the workplace. Items 2A and 2B are the number of respondents who observe or claim impacts of their practicum in their own workplace or work process. Performance indicators (Item 2A) often reflects efficiency. A KM solution from TM 298, reduced turn-around time from 117 to 18 minutes. A student reported "annual savings of approximately USD 60,000 based on number of man-hours saved." Behavioral or qualitative impacts on team members are reflected in comments such as "…I also was able to influence my teammates to consistently record both open and closed incidents using the tracker" and "It served as a basis of our team's Manual of Operation."

KMPCC graduates shared how various ways their KM practicum positively affected their operations. The results of applications of KM solutions to a work or business process are often observed to overlap with quality management solutions and benefits.

> *"The Integrated Database made reporting system of the regular status of LFPs easy and convenient with high accuracy."*
> *"Much smoother flow of office transaction due to KM product."*
> *"Validation of both our financial and physical accomplishments in the implementation of the scholarship programs in the region is easier than before. Real time updating is also made possible."*
> *"The online monitoring of management review allowed us to gauge how far our regional offices are being compliant to the inputs on management review per ISO 9001:2015 standards."*

Knowledge use in the rest of the organization. Feedback from users of an output (Item 2B) are indicators of effectiveness of the process which produces the output. Items 3A and 3B pertain to actions or events where the practicum results were observed beyond the immediate workplace of the student, or to the rest of the organization.

For TM 298 students, these wider scopes of impact are reflected in the following comments: "it led to other process improvement initiatives and standardization in our department" and "new teams transitioning are now integrating KM as part of the SOP [standard operating procedure]."

In one case, the KM practicum was expanded and its outputs were shared to the rest of the organization: "One of my two KM practicums was the creation of internal job aids. Our team continues to create job aids that will help both existing and new members of our team. Recently, my manager asked us to also create recordings (video presentation) in

conjunction with the job aids. We now share both job aids including recordings to users who need them."

An organization-wide cultural change was observed by one respondent: "...a Lessons Learned session became the norm of our group and some groups in the bank. [After] every project where we get positive and negative learnings, we collate them, share them to one another and use one drive as future reference in case we encounter the same. We became more open to fixing things as a team rather than pointing fingers." "Pointing fingers" means blaming people."

Many graduates of the KMPCC also reported that their workplace KM practicum led to adoption by other units in their organization.

> *"From my KM practicum… I was able to develop a tool for assessment of KM competencies. This was applied to 9 Offices/Bureaus and 1 Field Office…"*
> *"[After transferring to another office] the project I had during the KM Course is being adopted also in my new office. [My former office] is continually using my KM project."*
> *"My practicum… was adopted for other processes… This has subsequently led to some improvements in the processes every quarter/year."*

Impacts beyond the organization were also reported. A TM 298 student shared, "from a Document Management System that served as a central storage for corporate manuals, I learned that they built a Knowledge Management Center in lieu of a library, not just to serve internal clients but external parties as well."
A KMPCC graduate said, "[My KM practicum] now has official tie-in to our official website... and has reported continually increasing views and downloads from staff and external audience. The increasing downloads indicate an interest in our materials"

Negative consequences were also mentioned: "not all departments are open to change. KM practicum became a threat"; "I think in our organization in terms of KM awareness, it is very difficult to motivate others to participate; the push must come from top management"; and "most of the Google Docs are still underutilized due to current team members' preference for analog storage." The negative consequences were more the result of resistance or lack of appreciation by managers or personnel in the organization.

For KMPCC graduates, some negative consequences were the result of external factors such as changes in policy or leadership

"The KM practicum project was adopted and utilized for some time. However, due to changes in the quality objectives of branches, the consolidation of the results was not necessary anymore."
"Knowledge Management didn't seem to be a priority of the new leadership…"

Conclusions and recommendations

This study supports the observation that KM exerts impacts at various levels or scopes. The scope of the impact can be arranged or ordered into levels, and quantitative measures can be adopted at each level (Table 5). Qualitative impacts are also observable at each level, which can be positive or negative.

Table 5: Modified Kirkpatrick levels of impacts

Level	Beneficiary	Nature of Impact	Quantitative Measure(s)
1	Student	Learning by student	Academic grade
2	Team mates	Learning by knowledge sharing	Number of downloads, number of receivers
3A	Organization: student's workplace	Knowledge use in a work or business process	KPI, turn-around time, satisfaction of internal customers, cost savings
3B	Other units in the organization	Replication of knowledge use elsewhere in the organization	
4	Entities outside the organization	Consumption of product/service	Number of buyers or clients served, Customer satisfaction

The above measurement scheme is a modified version of the Kirkpatrick levels. It is a combination of an ordinal scale (Levels 1 to 4) and various measurements (cardinal scale) specific to each level; hence it can be described as a taxonomic scale (Figure 1).

Levels 3 to 4 impacts are possible in KMPCC and TM 298 because, by instructional design, the KM tool or solution is required to be applied in the workplace and specifically on a business or work process. If a KM tool, such as knowledge sharing within a community of practice or knowledge sharing by uploading in the company intranet, is disconnected from company operations then the benefit is only up to Level 2. For this reason, the KM solution must be work demand driven so that it can generate wider impacts beyond the individual student or his team mates. By designing the KMPCC and TM 298 courses to be work demand driven, both the student and his or her organization

benefits (Figure 2). The business or work process is the link between individual or team benefits and organizational benefits.

Figure 1: Taxonomic scale

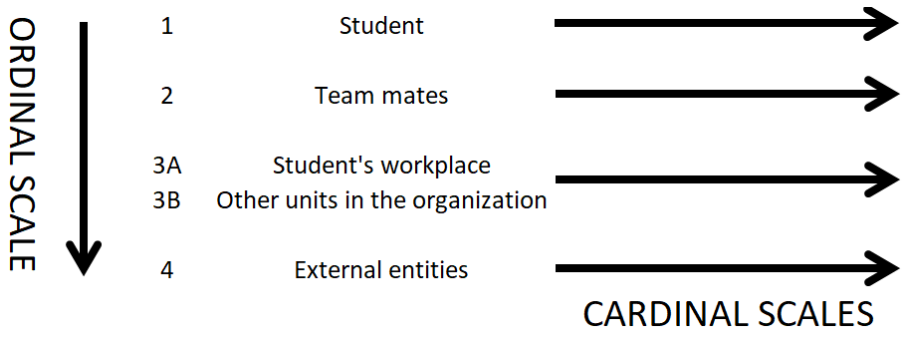
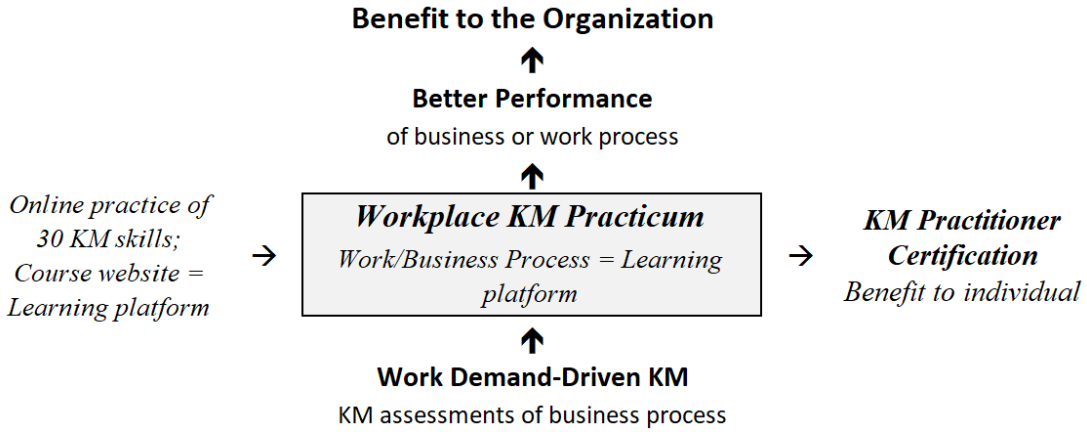


Figure 2: Work or business process: link between individual and organizational benefit



This study demonstrates the advantages of workplace demand- or problem-driven KM, where the KM tool or solution is determined by a workplace problem. By linking the KM solution to the business or work process, the impact of the KM solution to the organization can be measured in terms of KPI or other performance indicators that many organization adopt to periodically evaluate those processes. The modified Kirkpatrick model is a useful framework for measuring the impact of learning in the two KM courses studied here. Further studies can be done to see if this model can be used to measure the impact of other forms of transfer, delivery and consumption of knowledge products and services.

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