What can management theories offer evidence-based practice? A comparative analysis of measurement tools for organisational context

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ABSTRACT

Background

Development of a composite tool to measure the organisational context for evidence-based practice in healthcare.

Methods

A structured search of the major healthcare and management databases for measurement tools from four conceptually related domains of research utilisation, research activity, knowledge management, or the development of a learning organisation. Included studies were reports of the development or use of measurement tools that included organisational factors. Tools were appraised for face and content validity, plus development and testing methods. Measurement tool items were extracted, merged across the four domains, and categorised within a constructed conceptual framework for the absorptive and receptive capacity of organisations.

Results

Thirty measurement tools were identified and appraised. Eighteen tools from the four domains were selected for item extraction and analysis. The constructed framework consists of seven categories relating to three core organisational attributes of vision, leadership and a learning culture, and four stages of knowledge need and capture, acquisition of new knowledge, knowledge sharing, and knowledge use. Measurement tools from research activity or research utilisation domains had more items relating to the categories of leadership, and acquisition of new knowledge; while tools from knowledge management or learning organisation domains had more items relating to vision, learning culture, knowledge need and capture, and knowledge sharing. There was equal emphasis on knowledge use in the different domains.

Conclusions

If the translation of evidence into knowledge is viewed as socially mediated, tools to measure the organisational context of evidence-based practice in health care could be enhanced by consideration of related concepts from the organisational sciences. Comparison of measurement tools across domains suggests that there is scope within evidence-based practice for supplementing the current emphasis on human and

technical resources to support information uptake and use by individuals. Consideration of the related fields of knowledge management and learning organisations shows more content related to mechanisms to facilitate knowledge recognition, translation and transfer between individuals and groups. Given the current emphasis on networks as vehicles for innovation and change in health service delivery, being able to conceptualise and measure organisational enablers for the social construction of knowledge merits further attention.

Background

Organisational context appears to be an important mediator of the successful implementation of evidence into practice [1], but the mechanisms of action that link individual knowledge, shared learning and practice change at a group or team level, and organisational performance effectiveness are unclear [2]. Knowledge management and organisational learning theories focus on this interplay between an individual worker's knowledge and organisational performance. This article reports a project to consider whether these theories could inform and improve the development of tool to measure the optimal organisational context for evidence-based practice in health care.

Organisational context refers to the physical, technical and socio-cultural environment for health care delivery, and the psychological and behavioural consequences of that context for the people who work in the organization [3]. Features of organisational context that can impact on whether new quality improvement initiatives such as evidence-based practice are incorporated into health care settings might include structures like access to library resources, systems like training provision or management support, processes like meetings or journal clubs, and organisational culture and climate – what is seen as important, and how that is transmitted to the members of the organization [4,5].

Examples of tools to measure organisational context are available for healthcare performance overall [6], and for different aspects of healthcare improvement processes, including implementation of organisational change [7-9], research utilization [10], or research activity [11]. Tools have also been developed specifically to measure features influencing evidence-based healthcare practice [12-15]. While many of these tools include items related to organisational features, they are multidimensional and also include characteristics of the individual user and knowledge source. These tools are likely to have been developed within a specific professional group or context, focus on items generated from self-reported barriers, emphasize research utilization rather than the use of wider forms of evidence, and have not been psychometrically tested. Tools to measure the organisational context of evidence-based practice are therefore of limited use, and while tools for measuring

components of evidence-based practice in the form of research utilization or research activity have a longer history, they also have their limitations.

The available measurement tools reflect a tendency to view the organisation as an inert structural container for individuals. The literature overall tends towards a rationalist view that it is desirable to maximize the use of knowledge, but ignores stages in the translation process from evidence to knowledge, how individual learning transfers to the group as the unit of adoption for knowledge-based innovation, and the socio-political context of knowledge transfer and exchange. A more emergent view is of the organisation as 'milieu' or community of practice, where the focus on explanatory variables shifts towards the level of interactions between individuals [16,17], the potential for collective learning [18-20], and the inter-relationships between the micro-level of the individual, the meso level of the organisation, and the macro level of public policy [21]. Knowledge transfer, sharing and use are seen to depend as much on relationships and conduits for information flows between the internal and external worlds of the organisation, as on the facilitative mechanisms for individual influence.

Evidence-based practice, research activity and research utilisation can be viewed as part of the wider theory of knowledge management, concerned with the creation, transfer, storage and use of all forms of knowledge to enhance organisational performance. Knowledge management (KM) theory describes factors relevant to the capacity of organisations to acquire, assimilate, transform and exploit new knowledge from the environment, referred to as the absorptive and receptive capacities of an organization [22-25]. KM theory focuses on organisational strategy and technological processes for managing knowledge, and the micro-processes by which knowledge is acquired, communicated and used in organizations [26]. Learning organisation (LO) theory focuses on learning as a human change process, the social architecture of knowledge exchange, and the movement of knowledge between organisational levels in social or activity systems [27,28].

Organisational context therefore potentially affects the processes of individual and organisational learning and innovation contained within evidence-based practice, by impacting on the link between cognition and action in individuals, the potential for

shared knowledge in groups, and the institutionalization of shared understandings [29]. These links are illustrated in Figure 1. Organisational learning occurs when the knowledge of individuals is incorporated into organisational routines, systems, structures, culture or strategy, in a form that is available to others and preserved over time [30]. Innovation occurs when individuals or groups within the organisation explore and learn new ways to improve care delivery based on new knowledge.

INSERT FIGURE ONE ABOUT HERE

While KM and LO frameworks are increasingly being used in empirical studies in health care [31-33], current approaches to assessing organisational context are more likely to be underpinned by diffusion of innovation or change management frameworks [34]. The use of KM and LO theories would direct more attention to supporting the processes by which tacit, individual, explicit and group knowledge are generated and transformed within organisations [35,36], including the interaction or connectedness [37,38] required to facilitate the sharing of expertise within "communities of practice" or "knowledge networks" [39]. This study therefore aimed to develop a tool to identify optimal conditions to support multidisciplinary evidence-based practice, by incorporating items from tools to measure KM and LO capabilities in organisations, in addition to items from existing tools to measure the context of research utilisation (RU) or research activity (RA) in healthcare.

Methods

A structured literature review was undertaken to collate measurement tools for organisational context from the domains of research use or research activity in health care, or for knowledge management or learning organisation context in the management or organisational science literature.

Search

A search of electronic databases from inception to March 2006 was carried out on MEDLINE, CINAHL, AMED, ZETOC, IBSS, Web of Science**,** National Research Register**,** Ingenta**,** Business Source Premier**,** and Emerald, using potential combinations of the terms:

1. (Research or knowledge) adj3 (utili$ or implement$ or disseminat$ or diffus$ or transfer$ or translat$)
2. knowledge and (management or sharing)
3. Evidence-based or "evidence based"
4. (absorptive or receptive) and capacity
5. "diffusion of innovation"
6. organi?ation$ and (context or culture)
7. or/1-6
8. scale or tool or measure* or metric* or survey or questionnaire or instrument*
9. 6 and 7

Inclusion and exclusion criteria

Measurement tools were included if they were designed to measure contextual features of whole organisations, or sub-units such as teams or departments. Tools needed to include at least one item relating to organisational factors influencing research utilization, research activity, knowledge management or organisational learning. To be included, papers had to report a structured method of tool development and psychometric testing.

Data extraction and analysis

Individual reviewers (BF, PB, LT) extracted items relating to organisational context from each measurement tool. Items were excluded if they focused solely on structural organisational factors not amenable to change e.g. organisational design, size; inter-organisational factors and environment e.g. political directives; or characteristics of the commercial context which were not applicable in a public service context. Some tools had items expressed as staff competencies e.g. "Staff in our organization have critical appraisal skills…", or organisational processes e.g. "Our organization has arrangements with external expertise…" [40]. Items such as these were included and interpreted in terms of the availability of an organisational resource e.g. facilities for learning critical appraisal skills, or availability of external expertise. However, some items were not expressed in a way that could be inferred as an organisational characteristic e.g. "Our employees resist changing to new ways of doing things" [41], and were excluded.

Category analysis

Initially, similar items from different measurement tools were grouped together e.g. "I often have the opportunity to talk to other staff about successful programmes…" [42] and "Employees have the chance to talk among themselves about new ideas…" [43]. After an initial failed attempt to categorize all items using an existing diffusion of innovation framework [1], the review team constructed categories of organisational attributes by grouping items from across all the measurement instruments, and refining, expanding or collapsing the groupings until a fit was achieved for all extracted items. The material is illustrated in Table 1 by items allocated to two attributes: *involving the individual*, and *shared goals* (tool source in brackets – see Table 2). While broadly similar, it can be seen that items from the different domains are expressed differently, and there was some judgement involved in determining the similarity of meaning across domains. It can also be seen that for some categories, particular domains of tool did not contribute any items, while other domains contributed multiple items.

INSERT TABLE 1 ABOUT HERE

We conducted three rounds of agreement with the fit of items to categories: an initial round using categories derived from the diffusion of innovation framework by Greenhalgh and colleagues [1], which was rejected because of the lack of fit for numerous items; a second round with our own constructed categorization framework built from grouping items; and a third and final round for reviewers to check back that all items from their measurement tools had been included and adequately categorized in the constructed framework. Between each round, joint discussions were held to agree refinements to categories and discuss any disagreement. Using this process, agreement was reached between all reviewers on the inclusion and categorization of all items. An independent reviewer (LP) then checked validity of extraction, categorization and merging, by tracing each composite attribute back to the original tool, agreeing its categorization, then reviewing each tool to ensure that all relevant items were incorporated. Items queried were re-checked.

Results

Thirty tools were identified and appraised. These are listed in Additional Table 1. Based on the inclusion criteria for tool development and testing, 18 tools with 649 items in total were selected. These are listed in Table 2, with information on development and psychometric testing in Additional Table 2. The abbreviated name of the tool from Table 2 will be used in subsequent tables.

INSERT TABLE TWO ABOUT HERE

In total, 261 items related to organisational context were extracted from the measurement tools. For two tools [44,45], the full text of each item was not available, so the names of the categories of measurement for which results were reported were used as items e.g. Organisational Climate for Change.

Final model

Figure 2 illustrates the final category structure. Seven broad categories gave a best fit for the items. The central white circle of the diagram shows three core categories of vision, leadership and a learning culture. The middle ring shows four categories of activity: 'knowledge need and capture' and 'acquisition of new knowledge' (relating to organisational absorptive capacity); and 'knowledge sharing' and 'knowledge use' (related to organisational receptive capacity). The outer ring illustrates the organisational attributes contributing to each category.

INSERT FIGURE 2 ABOUT HERE

Tool item analysis

Table 3 summarises the organisational attributes for each category. Attributes are based on a composite of items extracted from the tools across the four domains. An example of a single tool item is given to illustrate the source material for each attribute.

INSERT TABLE THREE ABOUT HERE

The shaded areas in Table 4 identify the measurement tool source of each organisational attribute. The percentages are derived from the number of times an item is included in a category, compared with the total possible in each domain e.g. there were two items from research activity tools included in the learning culture category, out of a possible total of 16 items. The results for each category are discussed below:

INSERT TABLE FOUR ABOUT HERE

Learning culture: LO and KM tools were the most frequent source of these attributes, with seven out of nine tools covering attributes in this category, although none of the tools covered all of the attributes. Three RA/RU tools covered the attribute of *involving the individual*, with one of the RU tools also including the attribute of *valuing the individual*. Each attribute was sourced from between three and five tools across all domains. The most representation was sourced from KM tools.

Vision: Eight out of nine of the LO/KM tools, and five out of nine RA/RU tools included attributes from this category. The most common attribute was *shared vision/goals* (eight tools), and the least common was *policies and infrastructures* (three tools). The most representation was sourced from LO tools.

Leadership: All of the domains included some reference to attributes of management or leadership. Five out of nine RA/RU tools and four out of nine KM/LO tools included items related to leadership. The most representation was in RA tools.

Knowledge need and capture: All of the LO tools and three out of four of the KM tools included items related to attributes of this category. They were less commonly sourced from RA and RU tools. The most common attribute was *learning from experience* (seven tools). The most representation was sourced from LO tools.

Acquiring new knowledge: Attributes in this category were more commonly sourced in RA/RU tools. Attributes were sourced from between five and nine tools out of the total of 18 tools across all domains, and each attribute was covered in each domain,

except *accessing information*, which was not covered in any KM tool. The most representation was sourced from RU tools.

Knowledge sharing: Most LO/KM tools included multiple attributes from this category, all RA tools included one or two items, but only two out of five RU tools included one attribute. *Promoting internal knowledge transfer* was the most common attribute, included in 13 out of 18 tools, with *promoting external contacts* included in seven tools. The other items were included in five tools. The most representation for this category was sourced from LO tools.

Knowledge use: Overall, this was the largest and most populated category. The most common attributes referred to were *encouraging innovation*, included in 14 out of 18 tools, and *role recognition/reward*, referred to in 13 tools. Each of the other attributes was also referred to in at least eight tools. All attributes were sourced from all domains. The most representation for this category was sourced from RA tools.

Analysis of tool coverage

Table 4 also summarises how well each tool domain covers the constructed categories and attributes. The results for each domain are discussed below:

RA (research activity) tools: The category with the most representation in the RA tools was "knowledge use", with items in the category of "acquiring new knowledge" and "vision" also well represented. The categories of "knowledge need/capture" and "knowledge sharing" were less well reflected across the RA tools. Two attributes of *capturing existing knowledge* and *knowledge transfer technology* did not appear in any RA tool. Five attributes appeared in only one of the tools. Four attributes of *developing expertise, role recognition and reward, support/access to expertise*, and *access to resources* were common to all tools. Two tools had relatively good coverage of the attributes: the ABC survey [46], with 14 out of 26 attributes covered, and the KEYS Questionnaire [40] with 15 out of 26 attributes covered.

RU (research utilisation) tools: This was the domain with the least coverage overall, commonly centered in the categories of "acquiring new knowledge" and "knowledge use". The other categories were poorly represented. The attribute of *accessing*

information was common to all tools, with *role recognition/reward,* and *support/access to expertise* common to four out of five tools. The tool which covered the most attributes (10 out of 26) was the Research Utilization Survey Instrument [44,47].

KM (knowledge management) tools: The KM tools covered all of the categories, with more common representation in the categories of "learning culture", "knowledge need/capture", "knowledge sharing" and "knowledge use", but individual tools varied in their emphasis. The categories of "leadership" and "acquisition of new knowledge" were the least well represented. Two attributes were included in all four tools: *promoting internal knowledge transfer*, and *encouraging innovation*. *Learning climate* and *access to resources* were included in three out of four tools. Five attributes were not represented in any tool: *involving the individual, policies and infrastructures, managerial attributes, accessing information,* and *supporting teamwork.* The tool with the best overall coverage of the attributes (13 out of 26) was the Knowledge Management Questionnaire [48].

LO (learning organisation) tools: LO tools covered all categories, and generally had more consistent coverage than other domains of the categories "vision", "knowledge need/capture" and "knowledge sharing". Single attributes relating to *promoting internal knowledge transfer*, and *encouraging innovation* were covered in all five tools, with the attributes of *communication, shared vision and goals*, *learning from experience*, and *promoting external contacts/networks* covered in four out of five tools. *Key strategic aims, policies and infrastructures, questioning culture,* and *accessing information,* and *exposure to new information* were only covered in one out of the five tools. The Organizational Learning Scale [49] covered 17 out of the 26 possible attributes. The other four tools covered between 8 and 11 attributes.

Comparison of support for benchmark items: what can EBP tools learn from the KM and LO literature?

While each of the composite attributes is supported by items extracted from at least three measurement tools, there are differences in emphasis across the domains. To consider the potential contribution of the newer domains of KM/LO, the number of items from these domains have been pooled and compared against the number of

items sourced from the domains commonly represented in the healthcare literature i.e. RA/RU. Figure 3 illustrates that the KM and LO literature focus more on *learning culture*, *vision*, k*nowledge need and capture,* and *knowledge sharing*. The RA and RU literatures have a stronger emphasis on *leadership*, *acquiring new knowledge*, and *knowledge use*.

INSERT FIGURE 3 ABOUT HERE

Discussion

The importance of understanding context has been reiterated by the High Level Clinical Effectiveness group [50]. This project was developed in response to perceived limitations in the conceptualisation and measurement of organisational context for evidence-based practice in healthcare. We wanted to move away from the rather narrow focus on research utilisation and change management, to include wider process and practice-based perspectives from the knowledge management and organisational learning literature. Our analysis of existing measurement tools has confirmed differences in emphasis across the domains. Measurement tools for research activity and research utilization focus more on access to new information, leadership and resources for change, and less on capturing and building shared knowledge. This is congruent with the culture of "rationality, verticality and control" [18 p660] in health care, but the lack of attention to social context may be one reason why attempts to improve practice by influencing the behaviour of individual practitioners have variable results [51].

The emphasis in KM and LO tools on shared vision, learning culture and capturing and sharing existing knowledge reflects a more socially mediated view of knowledge. If it is groups and networks that generate the meaning and value to be attached to evidence, organisational efforts to improve evidence based practice would need to do more to shift towards supporting horizontal knowledge transfer. Networks have emerged as a recent UK government strategy for moving health research into action by creating clusters that break down disciplinary, sectoral and geographic boundaries, but communication structures alone are unlikely to be successful for knowledge

transfer across specialized domains [52,53], without additional mechanisms to support the transfer of practice and process knowledge [54].

Since this search was conducted, three additional tools to measure organisational context in quality improvement related areas have been reported. The *Developing Evidence-Based Practice* Questionnaire [55] acknowledges the need to consider wider sources of knowledge. The *Context Assessment Index* [56] to assess the practice context for evidence-based care emphasizes the importance of channels for communication and feedback. The *Practice Learning Inventory* [57] is a diagnostic instrument to identify a primary care practice's capacity for collective learning and change. Each of these tools has strengths, including attributes such as feedback that are not included in our model, but none have comprehensive coverage of all of the attributes identified in this study.

This project attempted to cast a wider net for potential enablers to knowledge use in health care organisations. While new perspectives may be worth investigating, the interdisciplinary transfer of theory also needs care. KM and LO are still largely private sector initiatives. Compared with the public sector, there are differences in the types of problems, the availability of information and resources, and the motivations for evidence uptake and use. KM theory supposes an identified knowledge need, scarce information, and a workforce motivated by external incentive in a resource rich environment. Evidence-based practice on the other hand requires compliance with externally produced information for predominantly intrinsic reward, with high innovation costs in a resource-limited environment. Taylor and Wright [17] studied organisational readiness for knowledge sharing in healthcare managers. They found that the factors blocking potential for knowledge sharing included the difficulties of creating an open and innovative climate in a hierarchical structure, the fear of public failure, and poor information infrastructures. Performance targets and the pace of change also mitigated against knowledge sharing. Bate & Robert [18] studied the Breakthrough Collaboratives in the NHS, designed to promote inter-organisational knowledge transfer to maximize the use of intellectual capital. They found that their agenda had been dominated by the target driven agenda of the NHS, rather than aspirations to transfer knowledge. KM and LO theory may not transfer well into healthcare if evidence-based practice is viewed as a process of social and political

control to promote compliance with centrally derived policy, rather than a generative process to make best use of available knowledge.

Conclusions

Assessing organisational absorptive and receptive capacity is the first step in making a research informed decision making culture. Foss [58] suggests the emergence of a new approach referred to as knowledge governance: the management of the mechanisms that mediate between the micro-processes of individual knowledge and the outcomes of organisational performance. But what would this mean in practice? The kinds of support which KM and LO tools include but that are not well reflected in existing tools to measure context in healthcare would include effort to detect and support emergent and existing communities of practice, to encourage and reward individuals and groups to ask questions, to discuss and share ideas across knowledge communities, and to support the progression, testing and adopting of new ideas by embedding them in systems and processes. The processes by which individual and group level knowledge are collated into organisational level capability to improve care are less clear. If social networks of individuals are to be facilitated to undertake repeated, ongoing and routine uptake of evidence within their daily practice, we need to extend our thinking even further toward considering the organisational contextual features which would support the collective sensemaking processes of key knowledge workers.

List of abbreviations used

KM Knowledge management

LO Learning organisations

RA Research activity

RU Research utilisation

EBP Evidence-Based Practice

Competing interests

The authors declare they have no competing interests.

Authors' contributions

BF, LHT and PB undertook searching, data extraction and categorisation. LP undertook external auditing of data analysis. BF drafted the final paper. CRB, LP and HR contributed to the conceptual design of the overall project, and acted as critical readers for this paper. All authors approved the final version of the manuscript.

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Figure legends

Figure 1 Model of the interaction between individual, group and organisational knowledge (adapted from Crossan et al. 1999)

Figure 2 Model of categories and organisational attributes

Figure 3: Comparison of RA/RU versus KM/LO measurement tools

Tables

Table 1 Example of categorisation of items extracted from measurement tools

Research activity	Research utilisation	Knowledge management	Learning organisation
Involving the individual			
Organisation ensures staff involvement in discussion on how research evidence relates to organisational goals (KEYS)[40] Expectation from organisation for staff involvement (ABC)[46]			Managers in this organisation frequently involve employees in important decisions (LOS2)[42] Part of this firms' culture is that employees can express their opinions and make suggestions regarding the procedures and methods in place for carrying out tasks (LOC2)[43]
Shared vision/goals			
What I do links with the Directorate's plans (ABC)[46] The development work of individuals links with the Directorate's plans (R&D)[11]		I usually agree with the direction set by this organisation's leadership (KMS)[59]	Senior managers and employees share a common vision of what our work should accomplish (LOS2)[42]

Table 2 Measurement tools included for item extraction

Short name	Research activity/research utilization
ABC	ABC Survey [46]
BARR	BARRIERS Scale [10]
BART	Barriers and Attitudes to Research in Therapies [60]
KEYS	KEYS - Knowledge Exchange Yields Success Questionnaire [40]
NDF	Nursing Department Form [45]
RUS	Research Utilization Scale [61,62]
RUSI	Research Utilization Survey Instrument [44,47]
RUIN	Research Use in Nursing Practice Instrument [63]
R&D	R&D Culture Index [11]
	Knowledge Management & Learning Organisation
CCS	Collaborative Climate Survey [64]
KMAT	Knowledge Management Assessment Tool [65]
KMQ	Knowledge Management Questionnaire [48]
KMS	Knowledge Management Scan [59]
LOC1	Organisational Learning Capacity [66]
LOC2	Organizational Learning Capability Scale [43]
LOC3	Organizational Learning Construct [41]
LOS1	Organizational Learning Scale [49]
LOS2	Organizational Learning Survey [42]

Table 3 Details of attributes in each category, and example of tool items

Category	Attribute	Examples of individual tool items + source
Organisational learning culture	Climate: e.g. openness, respect, trust	Open communication is a characteristic of the Department (CCS)[64]
	Learning as a key value	The basic values of the Department include learning as a key to improvement (LOC3)[41]
	Involving the individual	Managers frequently involve staff in important decisions (LOS2)[42]
	Valuing the individual	The organisation considers individuals to be an asset (LOS1)[49]
Vision	Existence of key strategic aims	Managing knowledge is central to the organisation's strategy (KMAT)[65]
	Existence of policies and infrastructures	There are specific infrastructures to support the research process (ABC)[46]
	Communication	Management clearly communicates key research strategy and priorities (BART)[60]
	Shared vision/goals	There is widespread support and acceptance of the organisation's mission statement (LOS2)[42]
Leadership	Presence of leadership	Strong professional leadership (KEYS)[40]
	Existence of committees and representation	Nursing representation on research committee, council etc (ABC)[46]
	Managerial processes and attributes	Management proactively addresses problems (LOC1)[66]
Knowledge need and capture	Existence of a questioning culture	Nurses are encouraged to question their practices (ABC)[46]
	Learning from experience	Problems are discussed openly and without blame (LOS1)[49]
	Capturing existing knowledge	There are best practice repositories in my organisation (KMQ)[48]
Acquisition of new knowledge	Accessing information	Network access to information databases available to all (LOS1)[49]
	Information dissemination	Use of communication skills to present information in a 'user friendly' way (BART)[60]
	Exposure to new information	Attendance at conferences/presentations that give information (RUS)[61,62]
Knowledge sharing	Promoting internal knowledge transfer	Employees are encouraged to discuss experiences/expertise with colleagues (KMS)[59]
	Supporting teamwork	Multi-professional review and audit (ABC)[46]
	Knowledge transfer technology/mechanisms	Technology to support collaboration is available and placed rapidly in the hands of employees (KMAT)[65]

	Promoting external contacts	We have a system that allows us to learn successful practices from other organisations (LOS2)[42]
Knowledge use	Encouraging innovation	This firm promotes experimentation and innovation as a way of improving the work processes (LOC2)[43]
	Developing expertise	We are encouraged to attend training programmes (KMQ)[48]
	Role recognition and incentives/reward	Nurses who participate in the research process receive recognition for their involvement (ABC)[46]
	Support and access to expertise a) internal- management b) internal – peers c) internal - others b) external	Cooperative agreements with Universities etc formed (KMS)[59]
	Access to resources a) funding b) time c) evaluation and data capture technology d) authority	My organisation provides resources for the utilisation of nursing research (R&D)[11]

Table 4: Categorisation of measurement tool items

Domain:	RA				RU					KM				LO				
*Tool:	ABC	BART	KEYS	R&D	NDF	BARR	RUIN	RUS	RUSI	CCS	KMAT	KMQ	KMS	OLC1	OLC2	OLC3	OLS1	OLS2
Learning culture																		
Climate																		
Learning as a key value																		
Involving the individual																		
Valuing the individual																		
% coverage	**12%**				**5%**					**37%**				**30%**				
Vision																		
Key strategic aim																		
Policies and infrastructures																		
Communication																		
Shared vision/goals																		
% coverage	**44%**				**10%**					**25%**				**50%**				
Leadership																		
Leadership																		
Committees/representation																		
Managerial attributes																		
% coverage	**33%**				**12%**					**17%**				**13%**				
Knowledge need/capture																		
Questioning culture																		
Learn from experience																		
Capture existing knowledge																		
	17%				**13%**					**42%**				**53%**				
Acquiring new knowledge																		
Accessing information																		
Information dissemination																		
Exposure to new information																		
% coverage	**50%**				**60%**					**17%**				**27%**				
Knowledge sharing																		
Internal knowledge transfer																		
Supporting teamwork																		
Transfer technology																		
External contacts																		
% coverage	**31%**				**10%**					**50%**				**75%**				
Knowledge use																		
Encouraging innovation																		
Developing expertise																		
Role recognition/reward																		
Support/access to expertise																		
Access to resources																		
% coverage	**90%**				**60%**					**65%**				**64%**				

*See Table 2 for full names and references for measurement tools

Description of additional data files

Additional file 1: Measurement tools identified by the search

Additional file 2 : Details of development and psychometric testing of included measurement tools

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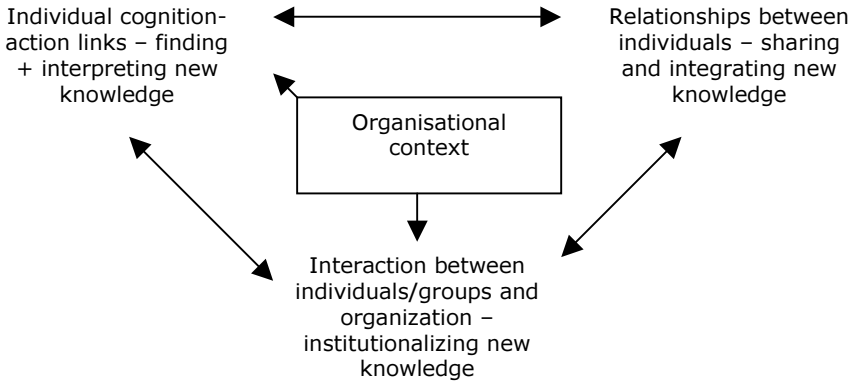

Figure 1 Model of the interaction between individual, group and organisational knowledge (adapted from Crossan et al. 1999)

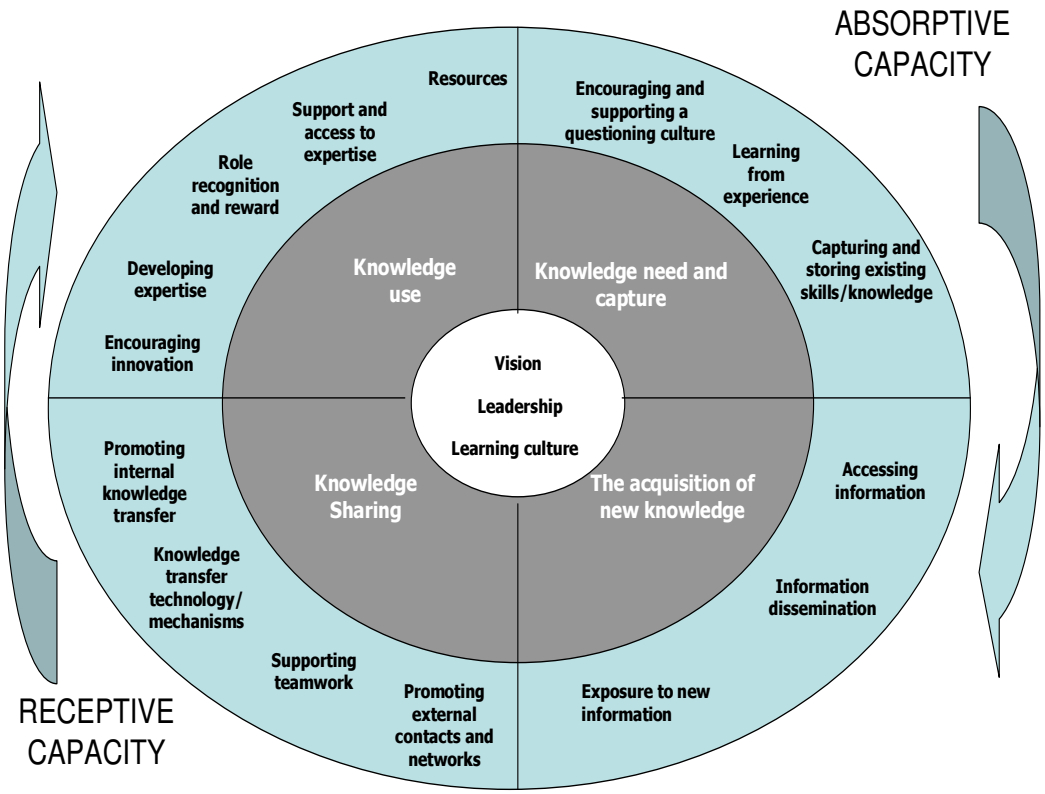

Figure 2 Model of categories and organisational attributes

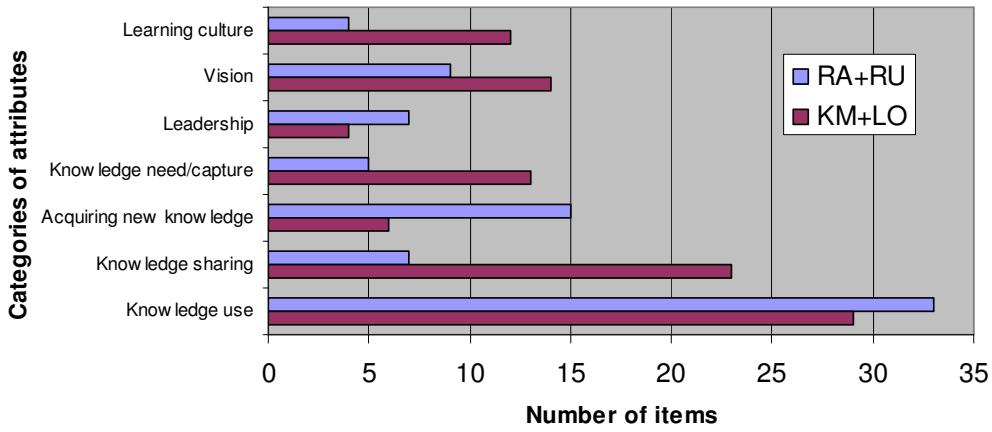

Figure 3: Comparison of RA/RU versus KM/LO measurement tools

Figure 3

Additional files provided with this submission:

Additional file 1: additional file 1.doc, 61K
http://www.implementationscience.com/imedia/1495655719221855/supp1.doc
Additional file 2: additional file 2.doc, 77K
http://www.implementationscience.com/imedia/6583596952218559/supp2.doc