

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

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# **Abstract**

## **Background**

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 attention. This study aimed to develop 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 domains of research utilisation, research activity, knowledge management, or organisational learning. 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 framework describing the absorptive and receptive capacities 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, 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 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 and management 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 measurement tools from the fields of knowledge management and organisational learning shows more content related to social mechanisms to facilitate knowledge recognition, translation and transfer between individuals and groups.

## Background

The context of managing the knowledge base for healthcare is complex. Healthcare organizations are composed of multi-level and multi-site interlacing networks, which despite central command and control structures, have strong front-line local micro-systems involved in interpreting policy direction [1]. The nature of healthcare knowledge is characterized by proliferation of information, fragmentation, distribution and high context dependency. Healthcare practice requires coordinated action in uncertain, rapidly changing situations, with the potential for high failure costs [2]. The public sector context includes the influence of externally imposed performance targets and multiple stakeholder influences and values, the imperative to share good practice across organisational boundaries, and a complex and diverse set of boundaries and networks [3]. Having strong mechanisms and processes for transferring information, developing shared meanings, and the political negotiation of action [4,5] are therefore crucially important in public sector/health care settings, but it is not surprising that there are reports of problems in the organizational capacity of the public sector to effectively manage best practice innovation [6-11], particularly around issues of power and politics between different professional groups [12-17].

The development of capacity to implement evidence-based innovations is a central concept in UK government programmes in healthcare [18]. Strategies to improve evidence-based decision making in health care have only recently shifted emphasis away from innovation as a linear and technical process dominated by psychological and cognitive theories of individual behaviour change [19], toward organisational level interventions [20], with attention shifting toward the development of inter-organisational clinical, learning and research networks for sharing knowledge and innovation [21-23], and attempts to improve capacity for innovation within the public sector [24].

Organisational capacity refers to the organisation's ability to take effective action, in this context for the purpose of continually renewing and improving its health care practices. Absorptive and receptive capacities are theorized as important antecedents to innovation in health care [25]. Broadly, the concept of absorptive capacity is the organization's ability to recognise the value of new external knowledge and to

assimilate it, while receptive capacity is the ability to facilitate the transfer and use of new knowledge [26-31]. Empirical studies have identified some general antecedent conditions [32-34], and have tested application of the concept of absorptive capacity to healthcare [35,36], although receptive capacities are less well studied. Empirically supported features of organisational context that impact on absorptive and receptive capacities in healthcare include processes for identifying, interpreting and sharing new knowledge; a learning organisation culture; network structures; strong leadership, vision, and management; and supportive technologies [25].

Public sector benchmarking is widely promoted as a tool for enhancing organisational capacity via a process of collaborative learning [37]. Benchmarking requires the collation and construction of best practice indicators for institutional audit and comparison. Tools are available to measure the organizational context for evidence-based healthcare practice [38-41], and components of evidence-based practice including implementation of organisational change [42-45], research utilization [46], or research activity [47]. While organisational learning and knowledge management frameworks are increasingly being claimed in empirical studies in health care [48-53], current approaches to assessing organisational capacity are more likely to be underpinned by diffusion of innovation or change management frameworks [54].

Nicolini and colleagues [2] draw attention to the similarity between the knowledge management literature and the discourse on supporting knowledge translation and transfer in healthcare [55-57], and between concepts of organisational learning and the emphasis on collective reflection on practice in the UK National Health Service [58,59], but suggests that “ecological segregation” between these disciplines and literatures means that cross-fertilisation has not occurred to any great extent.

Organizational learning and knowledge management literatures could be fruitful sources for improving our understanding of dimensions of organizational absorptive and receptive capacity in healthcare. We therefore aimed to support the development of a metric to audit the organizational conditions for effective evidence-based change by consulting the wider organizational learning and knowledge literatures, where the development of metrics is also identified as a major research priority [60], including the use of existing tools in healthcare [2].

Definitions of knowledge management vary, but many include the core processes of creation or development of knowledge, its movement, transfer or flow through the organisation, and its application or use for performance improvement or innovation [61]. Early models of knowledge management focused on the measurement of knowledge assets and intellectual capital, with later models focusing on processes of managing knowledge in organisations, split into models where technical-rationality and information technology solutions were central, and academic models focusing on human factors and transactional processes [62]. The more emergent view is of the organisation as ‘milieu’ or community of practice, where the focus on explanatory variables shifts away from technology towards the level of interactions between individuals, and the potential for collective learning. However, technical models and solutions are also still quite dominant in healthcare [63].

Easterby-Smith and Lyles [64] consider knowledge management to focus on the content of the knowledge that an organisation acquires, creates, processes and uses, and organisational learning to focus on the process of learning from new knowledge. Nutley, Davies & Walker [54] define organisational learning as the way organisations build and organise knowledge and routines and use the broad skills of their workforce to improve organisational performance. Early models of organisational learning focused on cognitive-behavioural processes of learning at individual, group and organisational levels [65-67], and the movement of information in social or activity systems [68]. More recent practice-based theories see knowledge as embedded in culture, practice and process, conceptualising knowing and learning as dynamic, emergent social accomplishment [69-72]. Organisational knowledge is also seen as fragmented into specialised and localised communities of practice, “distributed knowledge systems” [73] or networks with different interpretive frameworks [74], where competing conceptions of what constitutes legitimate knowledge can occur [75], making knowledge sharing across professional and organization boundaries problematic.

While the two perspectives of knowledge management and organizational learning have very different origins, Scarbrough & Swan [76] suggest that differences are mainly due to disciplinary homes and source perspectives, rather than conceptual distinctiveness. More recently, there have been calls for cognitive and practice-based

theories to be integrated in explanatory theories of how practices are constituted, and the practicalities of how socially shared knowledge operates [77,78]. Similarly, there have been calls for integrative conceptual frameworks for organisational learning and knowledge [79,80], with learning increasingly defined in terms of knowledge processes [81,82].

Practice models have their limitations, particularly in relation to weaknesses in explaining how knowledge is contested and legitimated [83]. In a policy context that requires clinical decisions to be based on proof from externally generated research evidence, a comprehensive model for healthcare knowledge management would need to reflect the importance of processes to verify and legitimate knowledge. Research knowledge then needs to be integrated with knowledge achieved from shared interpretation and meaning within the specific social, political and cultural context of practice, and with the personal values-based knowledge of both the individual professional and the patient [84]. Much public sector innovation also originates from practice and practitioners, as well as external scientific knowledge [85,86]. New understandings generated from practice then require re-externalising into explicit and shared formal statements and procedures, so that actions can be defended in a public system of accountability.

Our own preference is for a perspective where multiple forms of knowledge are recognised, and where emphasis is placed on processes of validating and warranting knowledge claims. Attention needs also be directed towards the interrelationship between organisational structures of knowledge governance such as leadership, incentive and reward structures, or the allocation of authority and decision rights, and the conditions for individual agency [87-89]. Our own focus is therefore on identifying the organizational conditions that are perceived to support or hinder organizational absorptive or receptive capacities, as a basis for practical action by individuals.

The indicators for supportive organisational conditions are to be developed by extracting items from existing tools, as in previous tools developed to measure organisational learning capability [90]. Existing tools are used because indicators are already empirically supported, operationalised, and easily identified and compared,

and because our primary focus is one of utility for practice [91], by specifying “the different behavioural and organisational conditions under which knowledge can be managed effectively” [92p ix]. Measurement tools that were based on reviews of the literature in the respective fields of knowledge management and learning organisations were chosen as comparison sources, to assess the comprehensiveness of the current tools in healthcare, and to improve the delineation of the social and human aspects of evidence-based practice in healthcare. If this preliminary stage proves fruitful in highlighting the utility of widening the pool for benchmark items, future work aims to compare the source literatures for confirming empirical evidence, with further work to test the validity and reliability of the benchmark items.

## **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 organisational learning in the management or organisational science literature.

### **Search and screening**

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. 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...” [93]. 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” [94], 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...” [95] and “Employees have the chance to talk among themselves about new ideas...” [96]. After an initial failed attempt to categorize all items using an existing diffusion of innovation framework [25], 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 vision/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 [25], 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 number 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 [97,98], 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 constructed to account for all of the items from the measurement tools. 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 1 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 marked 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:* OL 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 OL/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 OL 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/OL tools included items related to leadership. The most representation was in RA tools.

*Knowledge need:* All of the OL 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 OL 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 OL/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 OL 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” and “knowledge sharing” were less well reflected across the RA tools. Two attributes of *recognising and valuing 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 [99], with 14 out of 26 attributes covered, and the KEYS Questionnaire [93] 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 [97,100].

*KM (knowledge management) tools:* The KM tools covered all of the categories, with more common representation in the categories of “learning culture”, “knowledge need”, “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 [101].

*OL (organisational learning) tools:* OL tools covered all categories, and generally had more consistent coverage than other domains of the categories “vision”, “knowledge need” 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 [102] 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 OL 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/OL, 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 2 illustrates that the KM and OL literature focus more on *learning culture, vision, knowledge need, and knowledge sharing*. The RA and RU literatures have a stronger emphasis on *leadership, acquiring new knowledge, and knowledge use*.

INSERT FIGURE 2 ABOUT HERE

## **Discussion**

The importance of understanding context has been reiterated by the High Level Clinical Effectiveness group [18]. 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 recognizing, valuing and building shared knowledge. This is congruent with the culture of “rationality, verticality and control” [6 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 [103].

The emphasis in KM and OL tools on shared vision, learning culture 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 [4,104], without additional mechanisms to support the transfer of practice and process knowledge [73].

Since this search was conducted, three additional tools to measure organisational context in quality improvement related areas have been reported [105-107]. 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.

A potential weakness in using existing tools as sources in this study is that they might not reflect the latest theories and concepts, because tool development tends to lag behind conceptual development. This might result in inadvertent bias towards earlier more technical models, and we acknowledge that the existing tools do largely adopt a structuralist perspective. While the items contained in the existing measurement tools can only ever provide a rather simplistic reflection of complex phenomena, we felt that including them was better than not attempting to express them at all. However, while new perspectives are worth investigating, the unquestioning interdisciplinary transfer of theory also needs care. 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. Knowledge management 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. A number of studies have identified some of the difficulties of knowledge sharing in the public sector [1,6,11,16,48,108,109]. Organisational 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 with the aim of improving organizational conditions is postulated as a first step in supporting a research informed decision making culture. Foss [87] 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 knowledge management and organizational learning tools include as standard, 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; encourage and reward individuals and groups to ask questions; 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 also 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
OL	Organisational learning
RA	Research activity
RU	Research utilisation
EBP	Evidence-Based Practice

## **Competing interests**

The authors declare that 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 categories and organisational attributes**

**Figure 2: Comparison of RA/RU versus KM/OL measurement tools**

## Tables

**Table 1 Example of categorisation of items extracted from measurement tools**

<b>Research activity</b>	<b>Research utilisation</b>	<b>Knowledge management</b>	<b>Organisational learning</b>
<b>Involving the individual</b>			
<p>Organisation ensures staff involvement in discussion on how research evidence relates to organisational goals (KEYS)[93]</p> <p>Expectation from organisation for staff involvement (ABC)[99]</p>			<p>Managers in this organisation frequently involve employees in important decisions (OLS2)[95]</p> <p>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 (OLC2)[96]</p>
<b>Shared vision/goals</b>			
<p>What I do links with the Directorate's plans (ABC)[99]</p> <p>The development work of individuals links with the Directorate's plans (R&amp;D)[47]</p>		<p>I usually agree with the direction set by this organisation's leadership (KMS)[110]</p>	<p>Senior managers and employees share a common vision of what our work should accomplish (OLS2)[95]</p>

**Table 2 Measurement tools included for item extraction**

<b>Number</b>	<b>Short name</b>	<b>Research activity</b>
<b>1</b>	<b>ABC</b>	ABC Survey [99]
<b>2</b>	<b>BARR</b>	BARRIERS Scale [46]
<b>3</b>	<b>BART</b>	Barriers and Attitudes to Research in Therapies [111]
<b>4</b>	<b>KEYS</b>	KEYS - Knowledge Exchange Yields Success Questionnaire [93]
<b>5</b>	<b>NDF</b>	Nursing Department Form [98]
		<b>Research utilization</b>
<b>6</b>	<b>RUS</b>	Research Utilization Scale [112,113]
<b>7</b>	<b>RUSI</b>	Research Utilization Survey Instrument [97,100]
<b>8</b>	<b>RUIN</b>	Research Use in Nursing Practice Instrument [114]
<b>9</b>	<b>R&amp;D</b>	R&D Culture Index [47]
		<b>Knowledge Management</b>
<b>10</b>	<b>CCS</b>	Collaborative Climate Survey [115]
<b>11</b>	<b>KMAT</b>	Knowledge Management Assessment Tool [116]
<b>12</b>	<b>KMQ</b>	Knowledge Management Questionnaire [101]
<b>13</b>	<b>KMS</b>	Knowledge Management Scan [110]
		<b>Organisational Learning</b>
<b>14</b>	<b>OLC1</b>	Organisational Learning Capacity [117]
<b>15</b>	<b>OLC2</b>	Organizational Learning Capability Scale [96]
<b>16</b>	<b>OLC3</b>	Organizational Learning Construct [94]
<b>17</b>	<b>OLS1</b>	Organizational Learning Scale [102]
<b>18</b>	<b>OLS2</b>	Organizational Learning Survey [95]

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

<b>Category</b>	<b>Attribute</b>	<b>Examples of individual tool items + source</b>
<b>Organisational learning culture</b>	Climate: e.g. openness, respect, trust	Open communication is a characteristic of the Department (CCS)[115]
	Learning as a key value	The basic values of the Department include learning as a key to improvement (OLC3)[94]
	Involving the individual	Managers frequently involve staff in important decisions (OLS2)[95]
	Valuing the individual	The organisation considers individuals to be an asset (OLS1)[102]
<b>Vision</b>	Existence of key strategic aims	Managing knowledge is central to the organisation's strategy (KMAT)[116]
	Existence of policies and infrastructures	There are specific infrastructures to support the research process (ABC)[99]
	Communication	Management clearly communicates key research strategy and priorities (BART)[111]
	Shared vision/goals	There is widespread support and acceptance of the organisation's mission statement (OLS2)[95]
<b>Leadership</b>	Presence of leadership	Strong professional leadership (KEYS)[93]
	Existence of committees and representation	Nursing representation on research committee, council etc (ABC)[99]
	Managerial processes and attributes	Management proactively addresses problems (OLC1)[117]
<b>Knowledge need</b>	Existence of a questioning culture	Nurses are encouraged to question their practices (ABC)[99]
	Learning from experience	Problems are discussed openly and without blame (OLS1)[102]
	Recognising and valuing existing knowledge	There are best practice repositories in my organisation (KMQ)[101]
<b>Acquisition of new knowledge</b>	Accessing information	Network access to information databases available to all (OLS1)[102]
	Information dissemination	Use of communication skills to present information in a 'user friendly' way (BART)[111]
	Exposure to new information	Attendance at conferences/presentations that give information (RUS)[112,113]
<b>Knowledge sharing</b>	Promoting internal knowledge transfer	Employees are encouraged to discuss experiences/expertise with colleagues (KMS)[110]
	Supporting teamwork	Multi-professional review and audit (ABC)[99]

	Knowledge transfer technology/mechanisms	Technology to support collaboration is available and placed rapidly in the hands of employees (KMAT)[116]
	Promoting external contacts	We have a system that allows us to learn successful practices from other organisations (OLS2)[95]
<b>Knowledge use</b>	Encouraging innovation	This firm promotes experimentation and innovation as a way of improving the work processes (OLC2)[96]
	Developing expertise	We are encouraged to attend training programmes (KMQ)[101]
	Role recognition and incentives/reward	Nurses who participate in the research process receive recognition for their involvement (ABC)[99]
	Support and access to expertise a) internal-management b) internal – peers c) internal - others b) external	Cooperative agreements with Universities etc formed (KMS)[110]
	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)[47]

**Table 4: Categorisation of measurement tool items**

Domain:	Research activity (RA)				Research utilisation (RU)					Knowledge management (KM)				Organisational Learning (OL)				
*Tool:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
<b>Learning culture</b>																		
Climate										x	x	x						
Learning as a key value											x				x	x		
Involving the individual	x		x						x						x			x
Valuing the individual									x	x		x					x	x
<b>% coverage</b>	<b>12%</b>				<b>5%</b>					<b>37%</b>				<b>30%</b>				
<b>Vision</b>																		
Key strategic aim	x		x						x		x					x		
Policies and infrastructures	x					x												x
Communication	x		x									x			x	x	x	x
Shared vision/goals			x	x						x			x		x	x	x	x
<b>% coverage</b>	<b>44%</b>				<b>10%</b>					<b>25%</b>				<b>50%</b>				
<b>Leadership</b>																		
Leadership			x	x									x					
Committees/representation	x					x		x		x								
Managerial attributes			x					x						x				x
<b>% coverage</b>	<b>33%</b>				<b>12%</b>					<b>17%</b>				<b>13%</b>				
<b>Knowledge need</b>																		
Questioning culture	x			x				x			x							x
Learn from experience				x								x	x		x	x	x	x
Existing knowledge									x		x	x		x	x			x
<b>% coverage</b>	<b>17%</b>				<b>13%</b>					<b>42%</b>				<b>53%</b>				
<b>Acquiring new knowledge</b>																		
Accessing information	x	x	x			x	x	x	x	x								x
Information dissemination			x				x					x		x				x
Exposure: new information	x	x				x			x	x			x					x
<b>% coverage</b>	<b>50%</b>				<b>60%</b>					<b>17%</b>				<b>27%</b>				
<b>Knowledge sharing</b>																		
Internal knowledge transfer	x			x				x	x	x	x	x	x	x	x	x	x	x
Supporting teamwork			x												x	x		x
Transfer technology											x	x		x				x
External contacts				x								x	x	x	x			x
<b>% coverage</b>	<b>31%</b>				<b>10%</b>					<b>50%</b>				<b>75%</b>				
<b>Knowledge use</b>																		
Encouraging innovation	x			x				x	x	x	x	x	x	x	x	x	x	x
Developing expertise	x	x	x	x				x		x			x	x				x
Role recognition/reward	x	x	x	x				x	x	x	x	x			x	x		x
Access to expertise	x	x	x	x				x	x	x	x			x	x			x
Access to resources	x	x	x	x				x		x			x					x
<b>% coverage</b>	<b>90%</b>				<b>60%</b>					<b>65%</b>				<b>64%</b>				

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

## **Additional files**

**Additional file 1: (.doc) Measurement tools identified by the search**

**Additional file 2 : (.doc) Details of development and psychometric testing of included measurement tools**

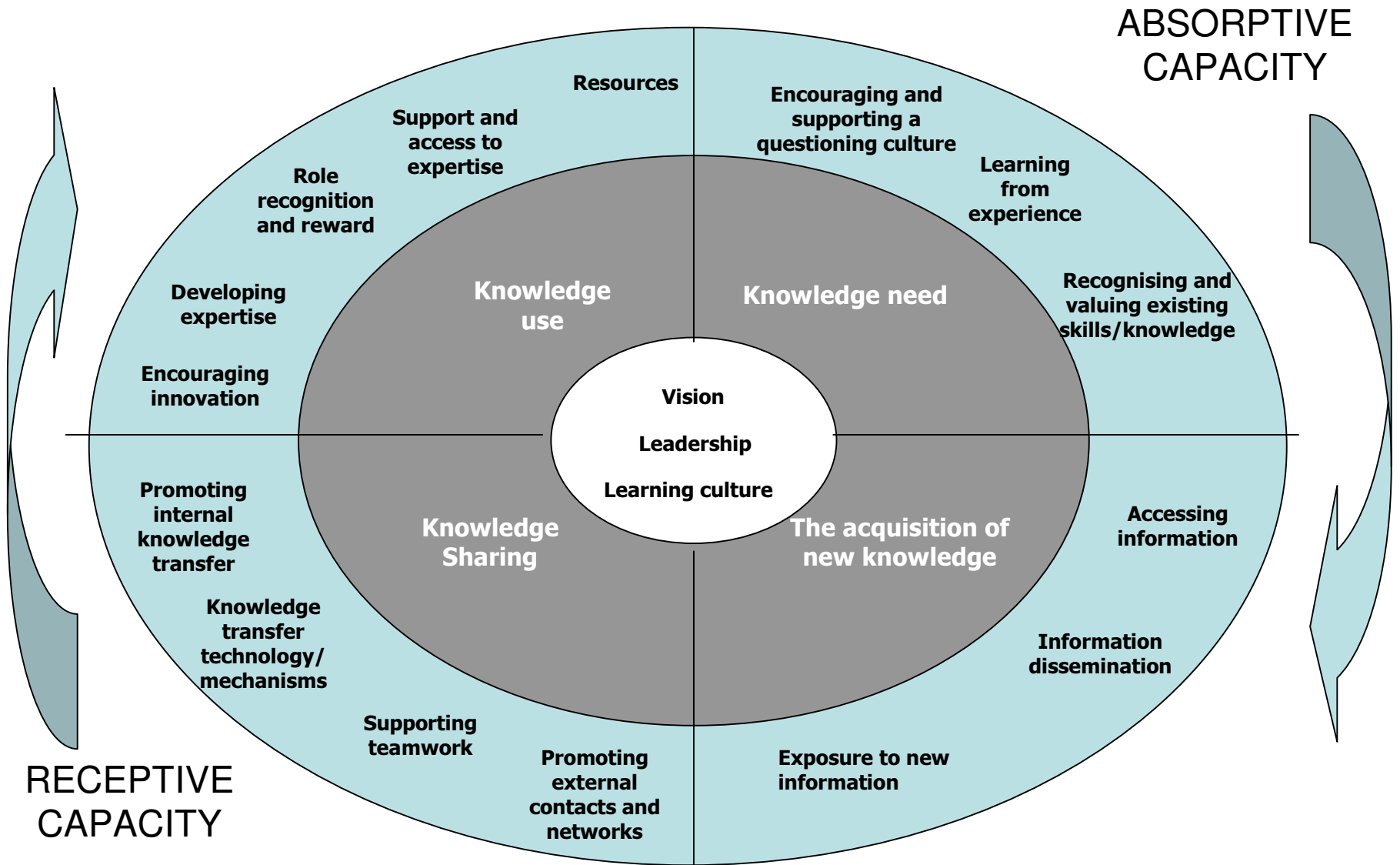


Figure 1

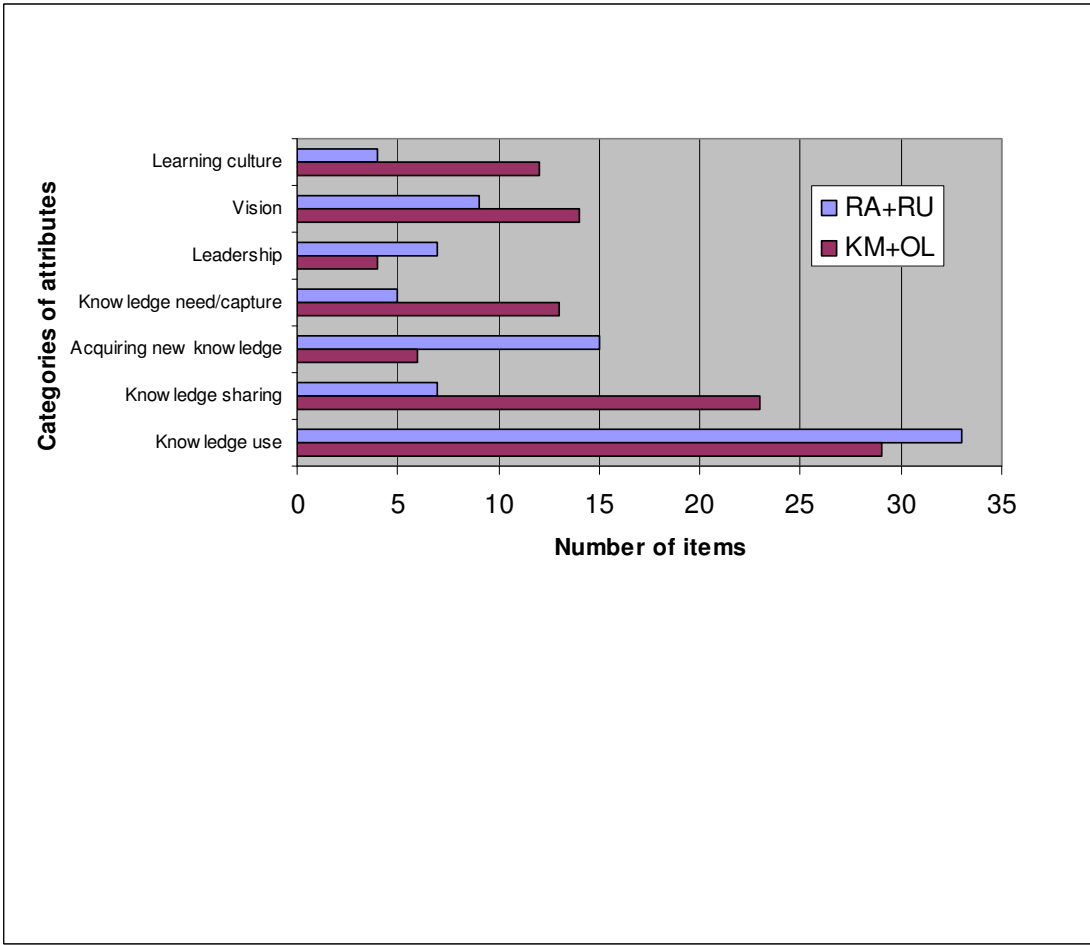


Figure 2

**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>