

# A TAXONOMY OF KNOWLEDGE LEAKAGE: SOME EARLY DEVELOPMENTS

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The shift towards more knowledge-intensive work in the UK and growing trends of globalisation and outsourcing to other countries necessitates a rethink of the role of knowledge in practice. The UK also lags behind such developed economies as the USA and mainland Europe in terms of its productivity. This research represents a multi-disciplinary, multi-sectoral, UK government-funded project attempting to dissect the nature of knowledge and its impacts on the UK productivity gap. The central tenet is that knowledge flows between and within firms can have both positive and negative ramifications on the firm's productivity. The overarching research aims to develop a framework to explain how these knowledge flows bear consequences to a firm's long-term competitiveness and productivity, which should enable practitioners to map out, and optimise, their knowledge flows. This paper reports on the initial phase of the research, comprising a desk-top literature survey and a series of exploratory interviews with senior managers across a range of sectors covering both construction and manufacturing. Early findings show that knowledge leakage occurs through dynamic interactions between organisations and their suppliers, customers, competitors, non-competitive collaborators and human resources.

Keywords: competitiveness, knowledge leakage, productivity, taxonomy.

## INTRODUCTION

The advent of the knowledge worker especially in the developed world, according to the late Peter Drucker (1998), necessitates a productivity revolution where knowledge is a fundamental tool of production. Within much political rhetoric, the recognition of this productivity revolution has given rise to the emphasis of the knowledge economy (see e.g. the Lisbon agenda, 2000; Porter and Ketels, 2003). Despite much hype surrounding the role of knowledge in boosting the performance and competitiveness of the economy, several commentators have expressed dissatisfaction with a lack of understanding of the nature of knowledge. Kelloway and Barling (2000), for instance, commented, "as yet there is little consensus as to what constitutes 'knowledge work', making it difficult if not impossible to achieve (p. 287)". They added that the literature

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around the concept of knowledge has thus far repackaged “old wine in new bottles (p. 288)”. Indeed, the understanding of knowledge remains, at best, in the abstract. Taylor (2002) lamented on the level of abstraction and suggested that “honest probing is needed now, rather than glib answers”.

This paper reports on research that is attempting such honest probing. The intention is to develop greater specificity of knowledge through what is called knowledge leakage. The research is borne out of a UK-funded program that investigates the nature of the UK productivity gap with countries like USA (see [http://www.aimresearch.org/ideas\\_factory.html](http://www.aimresearch.org/ideas_factory.html)). Initial motivation of this particular research is concerned with growing trends of globalisation and outsourcing, and the fear that organisations which outsource may inadvertently leak knowledge to another organisation to the detriment of its productivity and competitiveness. The ultimate aim of research seeks to develop taxonomy of knowledge leakage to enable organisations to understand their organisational knowledge leakage and the resulting consequences.

This paper presents early findings from a scoping phase of the ongoing research, which included a multi-disciplinary literature review and interviews with senior personnel from a range of organisations from both the manufacturing and construction sectors. Notwithstanding sectoral differences, the findings suggest knowledge to result from the dynamic interactions between organisations and their suppliers, customers, competitors, non-competitive collaborations and human resources. The paper is organised as follows. First, the salient points of the literature will be presented. The review discusses the various definitions/perspectives of knowledge and its implications. The review reveals the research gap of ambiguity and level of abstraction that justify our research into understanding and assessing the impacts of knowledge leakage. The research process undertaken during the scoping phase is then outlined, before an analysis of the key findings is presented. The paper concludes with a description of future work.

## LITERATURE REVIEW

As with many concepts in the field of management, the growing research of knowledge has not provided increasing clarity on the issue, but rather adds to the level of abstraction and ambiguity. This section briefly distills the key definitions and perspectives of knowledge and examines the implications to business performance as highlighted in the literature. The section argues for the need to develop a greater level of specificity where organisational knowledge is concerned and proposes to address this through what is called knowledge leakage.

### Definitions of knowledge

Definitions abound (Grover and Davenport, 2001) and are usually presented as dichotomies. A recent definition suggests that knowledge refers to what is gained either through experience or study that enables a person to perform a specific task (Awad and Ghaziri, 2004). This echoes the well-known distinction between explicit and tacit knowledge (Polanyi, 1958; Nonaka and Takeuchi, 1995), where the former refers to knowledge that is codified into procedures and routines, whereas the latter remains in the heads of people and are either difficult to codify or simply not codified. Again, this bears semblance with what economists call disembodied and embodied knowledge (Zellner and Fornahl, 2002).

Other writers consider a continuum of knowledge that ranges, for example, from data to information to knowledge (Kogut and Zander, 1992; Kakabadse *et al.*, 2003).

Styhre (2004) believes that the demarcation between explicit and tacit knowledge is a false dichotomy and that explicit and tacit knowledge is intertwined; a continuum between intellect (objective knowledge) and intuition (subjective knowledge). This resonates with Popper's (1983) philosophical suggestion that knowledge revolves around a continuum of three worlds; the world of objective knowledge (world 3), which can be derived from the physical world of objects and states (world 1), but which is only effective through subjective human experience (world 2). Popper's (1983) perspective of knowledge is not dissimilar to Gibbons *et al.* (1994) Mode I (scientific knowledge) and Mode II (application oriented) knowledge; or Mukherjee *et al.* (1998) distinction between conceptual and operational knowledge.

It is observed that the dominant discourse surrounding the management of knowledge has tended to focus on structuring and codifying knowledge. Put another way, there seems to be a preference for a shift away from tacit (or embodied or intuitive) knowledge. In a recent review into the use of knowledge in small and medium-sized firms, for example, Thorpe *et al.* (2005) proffered a framework for finding, creating, packaging and applying knowledge, thereby suggesting that knowledge is a commodity that can be handled like any tangible product. Arguably, such an approach treats knowledge in a reductionistic way that can be too prescriptive in practice. Given Nelson and Winter's (1982) suggestion that organisational knowledge can never be complete, it is therefore unclear whether the mere codification of knowledge can lead necessarily to performance improvements. Furthermore, Egbu *et al.* (2005) suggested that tacit knowledge dominate most organisations; and Chan and Cooper (2005) highlighted that any learning that takes place in organisations resides in people's heads. The next section will review the literature on knowledge in relation to its implications.

### **Implications of knowledge: different perspectives**

The literature discussing implications of knowledge can be approached from a number of perspectives, including dynamic capabilities and core competences, firm-level business improvement, knowledge intensity and human resources management (HRM). This section will briefly revisit these perspectives in relation to the knowledge literature.

#### *Dynamic capabilities and core competences*

Dynamic capabilities and core competences stem largely from the resource-based view of the firm, informed by the work of Barney (1991). Teece *et al.* (1997) argue that “[w]inners in the global marketplace have been firms that can demonstrate timely responsiveness and rapid and flexible product innovation, coupled with the management capability to redeploy internal and external competences (p. 7)”. Prahalad and Hamel (1990), on the other hand, talk about core competences as capabilities that are inimitable by rivals, providing organisations with competitive advantage. Scarbrough (1998), however, attacks the resource-based view of the firm for resulting in a weak link between competencies and performance, as he maintains “little attempt to demonstrate the *mechanical* links, between competencies and performance, other than in the broad terms of the root and branch metaphor propounded by Prahalad and Hamel (p. 224: original emphasis)”.

#### *Business improvement*

In terms of business improvement methodologies, the evidence of the link between these methodologies (e.g. TQM, business process reengineering) and organisational

performance is mixed. Neely *et al.* (2004), for instance, examined the impacts of implementation of a performance measurement technique known as the Balanced Scorecard (Kaplan and Norton, 1992) over a 12-month period within a construction supplier and found very little improvements to the performance of the business. Neely *et al.* (2004) suggested that the observation time period was perhaps not sufficient for the organisation to learn and develop its knowledge of the new performance measurement technique, thereby diminishing the potential for improvements to occur. On the subject of learning, Chan *et al.* (2005) conceptually reviewed the relevance of organisational learning in project-based construction and argued that the emphasis on continuous improvement of the organisation led to little concern over the role of employees and their knowledge in undertaking such improvements.

#### *Knowledge intensity*

Given the flurry of interest in knowledge work, the study of knowledge intensity has drawn great attention. Research undertaken by the Work and Employment Research Centre (WERC) in Bath has focused on knowledge sharing among employees of research and technology organisations. For example, Swart and Kinnie (2003) examined how HR practices enabled knowledge sharing and found that two main issues matter: that knowledge workers have to be provided with interesting work and that they have to be involved from the bottom-up. Other writers talk about the need for organisations to take advantage of sources of information (Yanow, 2004) and to consider the knowledge that can be reaped from partner organisations (Roper and Crone, 2003). Brown and Eisenhardt (1997) studied 12 major computer firms and noted that successful firms considered their knowledge transfers and limited these to the most strategically valuable information, rather than all possible information.

#### *Human resources management (HRM)*

The link between knowledge and HRM is yet to be fully explored. Like Swart and Kinnie (2003), Storey and Quintas (2001) focus on knowledge sharing between employees as a means to manage knowledge effectively. There is a need for organisations to harness the knowledge capabilities of the workforce. For instance, there is the growing fear of the economic impacts of an aging Europe (Farrell, 2005). Furthermore, Taylor (2002) observed that 90% of the UK workforce stays in the same organisation for merely an average of seven years and four months. Other writers have looked at the impacts of knowledge loss as a result of employee attrition due to restructuring (Treleaven and Sykes, 2005) or downsizing (Littler and Innes, 2003).

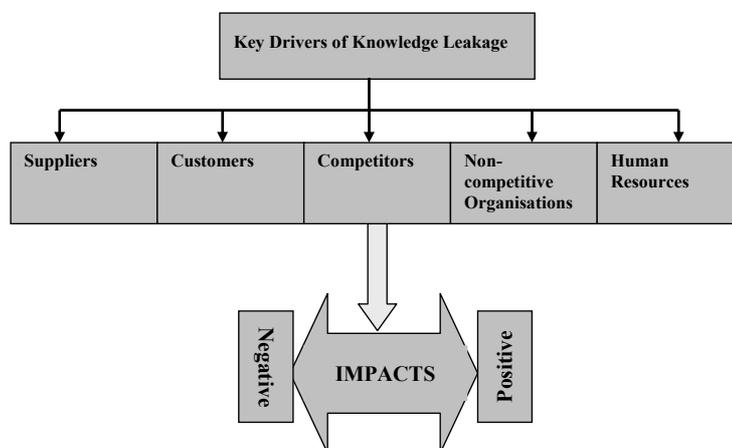
#### **Literature synthesis**

Four emergent issues appear to surface. First, the concept of knowledge has largely been used in the abstract and now requires greater specificity for practical clarity. Second, studies abound in terms of linking, albeit disputably, knowledge and organisational performance, with little reference to organisational productivity. Indeed, much reference to productivity has been based on a narrow, manufacturing perspective (see e.g. Lapré and Van Wassenhove, 2001), which is inadequately mechanistic. The third point, therefore, is that there is a need for greater holism in approaching the understanding of knowledge and its impacts on productivity. Fourthly, the interplay between people issues with knowledge and productivity remains relatively unexplored. Given these gaps, the current study attempts to holistically assess knowledge from the perspective of systemic leakage within and between organisations, defined as “the possibility of [...] knowledge that is critical to the organisation being lost or leaked – whether deliberately or unintentionally

(Annansingh, 2005)". The study also explores the productivity consequences, both positive and negative, of such leakages.

To begin developing the taxonomy of knowledge leakage and to address the gaps of holism, clarity and links with productivity, an analytical framework to illustrate specific knowledge flows was derived from the literature. According to the extensive literature, knowledge can be analysed through the dynamic interactions between the organisation and its suppliers, customers, competitors and non-competitive collaborations. Furthermore, knowledge is exchanged through human resources, both from an intra- and inter-organisational perspective.

Dyer and Nobeoka (2000), for instance, conducted multi-methods case study research in Toyota and examined how knowledge flows from Toyota to (and within) their *suppliers* improved business performance. In terms of knowledge interactions with customers, Gibbert *et al.* (2002) utilised case study research again to examine how over two dozen companies created value by learning from *customers*. McEvily and Chakravarthy (2002), on the other hand, through a survey of 416 firms (20% response rate) in the adhesives industry determined a series of organisational characteristics that gave rise to *competitor* imitation, which could potentially be detrimental to the source organisation. Still, knowledge flows in *non-competitive collaborations* have been written in a more positive light. Coughlan *et al.* (2002), for example reported on how effective learning takes place in industrial networks, while Rynes *et al.* (2001) focussed on university-practitioner forums as a means of transferring knowledge for business performance. Finally, where *HRM* is concerned, Dyer and Nobeoka (2000) also talked about exchanging human resources among suppliers to speed up the learning process. Figure 1 below illustrates the initial analytic framework resulting from the literature.



**Figure 1:** Analytic framework for exploratory study.

## EXPLORATORY INTERVIEWS AND EMERGENT FINDINGS

Eight organisations from the research team's existing contacts were approached either by telephone or in writing. It was decided that interviews should be conducted with senior managers who has an overview of the organisational processes. A total of 10 senior managers were consequently interviewed in the 8 organisations. The profile of the interviewees is depicted in Table 1 below. To reap the benefits of multi-disciplinary working, interviews were conducted using paired researchers from either different disciplines or different sectoral experience. Each interview lasted between 1 to 2 hours and the questions revolved around **the participant's view** of their

organisational knowledge, the associated knowledge flows and the effects on productivity. The interviews were recorded and transcribed verbatim.

The data collected was coded collectively by the research team, who debated and discussed the issues until consensus was reached. Codes and sub-codes were created using the analytic framework shown in Figure 1 above; the coding process is not dissimilar to King’s (1998) template analysis. To add to the validation of findings, each interview was summarized and this summary was provided to the interviewee for comments. The transcripts, summary sheets and audio recording (where possible) was also accessible to each member of the research team through a web-based file sharing facility. As a result, knowledge was categorised into dynamic interactions between organisations and their suppliers, customers, competitors, non-competitive collaborators and human resources. The next section will tabulate some

**Table 1:** Profile of the interview participants in the exploratory phase.

Participant	Organisation	Size	Role	Organisation Type
A	1: Design	Small	Junior architect	Architectural design
B	2: Telecoms	Small	Chief executive officer	Infrastructure and service provider
C	3. Medical equipment	Small	Technical director	New product development
D	4. Design	Medium	Senior director	Architectural design
E	5. Bakers	Medium	Operational director	Food manufacturer
F	6. Metal products and design	Medium	Group manufacturing manager	Design and manufacturing
G			Research engineer	
H	7. Engineering design	Large	Associate director	Engineering design
J	8. Defence equipment	Large	Business development	New product development
K			Customer manager	

**Emergent findings**

Within the confines of this paper, Table 2 highlights some of the direct quotations from the interviewees. These gave rise to the subsequent analytic codings presented in Table 3.

**Table 2:** Categorising direct quotations from the exploratory interviews.

A selection of direct quotations from interviewees on knowledge leakage via...				
Suppliers	Customers	Competitors	Non-competitive Organisations	People
“We outsource our production information component of our work, usually on standardised sectors like healthcare, to India.” (Participant A)	“We have to have full traceability of every single item; from the supplier through to the baker, through to the distributor. We need to have full traceability, if anything goes wrong [...]” (Participant C)	“We would never pass a set of tooling outside the company. And if any tooling is scrapped, it is broken up and put in various skips and a tooling scrap register is filled in [...]” (Participant G)	“When I returned I was invited to the university to do some visiting lectures [...] got more interested in teaching and research [...] there is now an M.Sc. in XYZ design which has resulted from this collaboration.” (Participant D)	“Knowledge loss through maternity leave can be challenging, especially if the member of staff who is going on maternity holds a lot of critical knowledge about the project. This could throw back the schedules and progress of the project team. We are afterall a small setup.” (Participant A)

Table 2: (continued)

A selection of direct quotations from interviewees on knowledge leakage via...				
Suppliers	Customers	Competitors	Non-competitive Organisations	People
<p>“[...] a requirement set by your customer has top level specifications and top level system requirements which then percolate into system 2 level requirements, which then collects to sub level requirements and then so on and so forth, and then right at the end the poor garage owner or someone who does the widget gets a set of very, very specific specifications against which he designs his little widget, not knowing what’s happening at the other end, not knowing where it’s going to end, and there is a big likelihood of discontinuity and miscommunication in that link.” (Participant J)</p>	<p>“The most rudimentary level is to read a brief that the customer sends out to every competitor on the web say or on a letter and just respond to that brief. And that’s very hands of and it’s liable to be misinterpreted at some stages, or interpreted in your own way. It doesn’t dig into the psyche of what the customer really wants and it’s this language challenge. That’s at very top level. Then there’s the level of picking up a phone or meeting with a customer and walking through that requirement. And agreeing a second level interpretation. Further to that there are a number of meetings with the customer [...]” (Participant J)</p>	<p>“In fact there are so many instances where competitors sit together to agree standards, to agree ways forward. It’s in my best interest to have [my competitors] talking my language too. Because at the end of the day they will convince the [the major client in this sector] that what they are doing is right, therefore what I am doing is right.” (Participant J)</p>	<p>“Let us say, as it is very often the case we have training for surgeons, we have specialised equipments and we that on site. We set this up very often. The surgeons are very, very important. They make or break. If they do not like the product we go bankrupt. So they need to be nurtured and treated in an appropriate way, and this is very important for internal networking.” (Participant C)</p>	<p>“There are processes that most companies believe help in safe guarding this knowledge, from the mundane filing systems. It’s much easier now with digital filing, to the more advanced intelligent agent type of search engines where people’s thoughts and minutes can be mined. And then they can be used at a later stage by somebody else. There are also kinds of techniques that human factor specialists are trying to evolve in terms of how teams, collaborative teams could operate more efficiently in an optimum fashion and perhaps across different nations which is what most of our products tend to attract, different skills from different countries.” (Participant J)</p>
<p>“We sometimes capture knowledge at an institutional level, we are asked to provide cost information to Building Cost Information Service (BCIS) who publish information on buildings and they send us quite detailed forms which we fill in, which they can use to categorise the cost information and they can then produce statistical information based on that.” (Participant D)</p>	<p>“This risk with the customer is they are in transience, if the customer believes, in some cases wrongly, that what they want will solve their problem, and you’re trying very hard to show them a different perspective and they’re not wavering, not wishing to see a different perspective, then you have a problem. And how to mitigate that is perhaps to talk to a peer, perhaps to talk to a manager, or someone above that person. Or even to collude with your other competitors to change their perspective.” (Participant J)</p>	<p>“There is a certain amount of trust involved here, unfortunately money comes through the door and morality flies out of the window, and you know it’s human nature but with some people they may not have any agenda to steal, it is theft after al, theft and fraud if you’re doing it but the temptation can be quite strong, by some kind of competitors, industrial espionage for sure.” (Participant C)</p>	<p>“For example if we do a research project, we would have an IP and confidentiality agreement related to this project. [...] We work on the premise that the university of Brunel are not going to go to [our competitors] tomorrow, but what we do gain is that Brunel would actually write some software (so they own the software), but they give it to us under free license.” (Participant F)</p>	<p>“You are losing 35 years worth of experience, you gain that knowledge by making mistakes, sometimes you make all the mistakes you can ever make, and hopefully you’ve covered them up. So he’s made all these mistakes along the way and he had that time, and that’s what we’re losing [...] so to actually get someone in a position to replace him, you need someone with the same amount of experience and the same quality as an engineer.” (Participant F)</p>

**Table 3:** Towards taxonomy through the initial development of analytic codes.

Knowledge leakage occurs via...				
Suppliers	Customers	Competitors	Non-competitive Organisations	People
through...				
standardised and repetitive products (P&N)	learning from customers in developing the brief/business propositions (P&N)	dealing with sensitive information (P&N)	collaborations with universities (P&N)	training courses (P&N)
intentionally not divulging critical knowledge (P)	customers leaking back knowledge to third parties (P&N)	accidentally publicising wrong information (P&N)	networks and forums (P&N)	employee involvement initiatives (P&N)
market intelligence (P&N)	market intelligence (P)	market intelligence (P&N)		recruitment from other companies (P&N)
outsourcing to other countries (P&N)	sample contracts and non-disclosure agreements (P&N)	competitor clustering (P&N)		multi-disciplinary team working (P)
sharing knowledge on a "need to know" basis (P&N)	customer relations management systems (P&N)	theft (N)		temporary/contingent workers (P&N)
the tendering/bidding process (P&N)	repeat business (P&N)	third parties (N)		temporary/unanticipated loss of staff (N)
partnerships/alliances / collaborations with suppliers (P&N)	having too many intermediaries between the customer and the organisation (N)			people leaving (N)
change of supplier/ supplier leaving (N)	not understanding each other (inability to communicate) as a result of cultural differences (P&N)			
public domain activities (e.g. supplier networks) (P&N)				
NB: "P" denotes "can have positive consequences on organisational productivity and competitiveness; whereas "N" denotes "can have negative consequences on organisational productivity and competitiveness" (as alluded to by the interviewees".				

## CONCLUSIONS AND RECOMMENDATIONS

In conclusion, this paper reports on a multi-disciplinary, multi-sectoral study into the impacts of knowledge on organisational productivity. The study is still very embryonic. A review of the relevant literature has been undertaken. This review suggests that the concept of knowledge remains abstract and requires greater specificity and holism in enabling industry to gain a clearer understanding of the concept of knowledge for better exploitation. Furthermore, the links between knowledge and organisational productivity, and the use of knowledge by human resources, remain relatively unexplored. This research seeks to plug the gaps by developing an understanding of the concept of knowledge leakage. Exploratory interviews have indicated that knowledge can be delineated through organisational interactions with suppliers, customers, competitors, non-competitive collaborations and human resources; some preliminary findings from this early taxonomy has been presented here.

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