Establishing a research agenda for enterprise information management

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Abstract

Much is being made of the need for organisations to prepare for a 'new normal' in the wake of the Covid19 pandemic. This presumes that the 'normal' is well understood and that the 'new normal' will be a stable position. In reality it may take several years to achieve the 'new normal'. In the near term organisations will need to support a complex and constantly changing mix of office and remote working.

Because there has been so little research into how information has created, stored, discovered, used and shared (the information lifecycle) heretofore there is a substantial risk that changes introduced to ameliorate the impact of Covid19 may not have any substantial impact on improved information management and indeed could be counter-productive. Solutions to support a substantial work-at-home workforce may not be scalable and extensible if a more heterogenous framework of remote + office is found to be optimal.

This paper highlights how little is known about how information flows around organisations. It is based on both published research and on the insights and outcomes of over 100 information management consultancy projects.

Computational ethnography could become an important research methodology in tracking information flows but there are technical, compliance and ethical issues which need to be addressed by the global research community as a matter of urgency. Experience from research into personal information management and knowledge management should also be taken into account.

The paper proposes that every effort should be taken to facilitate exchanges of experience and expertise between academic research and practitioners who need to make business-critical decisions based on high-quality information.

Keywords,

Computational ethnography, enterprise search, ethnography, information management, information risk, information seeking, knowledge management, personal information management,

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1. Introduction

The scope and objectives of The New Future of Work Conference are set out as

"The new reality of distributed information work challenges and inspires us to revolutionize our work practices and technologies to support the sustainable and robust distribution of people, resources, and knowledge. There is an urgent need for the research community to come together to address the challenges to productivity, wellbeing, and society that people and organizations are facing.

The goal of this virtual symposium on The New Future of Work is to provide an open forum to explore where we have come from and to suggest where we should go. It is a venue to share timely and novel research on currently disrupted or evolving work practices, to reflect on how past findings shed light on the current situation, and to prepare for a world in which work may be done very differently."

In this paper I argue that there are no past findings that would enable light to be shone on the current situation. This paper highlights the complexity of managing information and suggests an approach to ensuring that information management processes are appropriate to the challenges that the business faces over the next few years. It is based on both published research and on the insights and outcomes of over 100 information management consultancy projects conducted over the last 20 years in Europe and North America.

In my opinion we are faced with evolving work practices without any benefit of hindsight. My recommendation is that a wide range of stakeholders need to be brought together to identify enterprise information management research objectives and discuss research methodologies.

2. A bridge too far

When we board an aircraft we are very aware of the jet engine pods but have absolutely no idea of how they work, other than air is sucked in, heated and creates the thrust to move the aircraft forward. In reality jet engine technology is at the leading edge of engineering and manufacturing technology and relies to a significant extent on corporate and personal expertise built up over many years. The complexity of a jet engine is often only revealed when it fails to work as intended. This is a very rare occurrence because throughout a flight, sensors are relaying information to experts at the engine manufacturer every 2.5 seconds. Key indicators are presented in the cockpit but the captain can be given advice on how to optimize engine performance and the data can be used in the design of new components. When the engine is serviced engineers have a very wide range of sophisticated tools to effect repairs and upgrades.

In the case for information in the enterprise we may have some sense of the volume that is being processed but have no sense of how well the information is being used or where a lack of information is causing serious problems.

In 2000 a Millennium Bridge, designed by Arup, was opened across the Thames. Within a few days it had to be closed because as pedestrians walked across it the bridge wobbled. It had to be closed down, rebuilt at a cost of £5M and reopened two years later. In a subsequent interview **[1]** the Chairman of Arup noted that since Arup had begun its investigation into why the bridge was

wobbling, it had discovered examples of the same effect throughout the world [2]. He also noted *"About 100,000 people crossed the Millennium Bridge when it opened on 10 June 2000, causing the sway. We were lucky nobody got hurt, That could have happened*."

These situations happen sufficiently often that it is even possible to build a typology of the underlying causes. [3]

3. Information as an asset.

There is little evidence that organisations treat information as a business asset, perhaps because it does not appear on the balance sheet.[4] Putting a value on information is impossible at a corporate and individual level and yet without information decisions will have to be made purely on gut instinct. [5] The ISO 27001 information security standard requires an organisation to establish a list of information assets but does not provide guidance on the depth of this list or how it should be created.

All other assets in an organisation are tracked with great care and 'owned' directly or indirectly by a member of the Board of Directors. As a result, organisations will know exactly how many laptop computers it owns and the date they were acquired, and indeed how many cafeteria tables it possesses. It will have no details on the information it possesses other than data on server storage capacities.

Information auditing has been a discipline dating back several decades but there are no standards for the process, again unlike all other business assets. The lack of an information audit can give rise to problems in information management which can then increase information risk. [6]

There are very few published examples of organisational information asset collections. A notable exception is the Inter-American Development Bank [7] which lists 12 categories of information products that the Bank recognizes it needs to manage.

4. Information complexity

The reality is that in any organisation there are multiple sources of information, both internally generated and acquired from external sources. Nowhere is this more evident in research and development in science, technology and medicine (STM) where the combined revenues of STM publishers are of the order of $25B.

Because there is no incentive to audit information assets organisations are unaware of the complexity of the sources of information that are used every day. There is a tendency to refer to 'documents' as though all documents are identical. What is obvious from the Inter-American Development Bank audit [7] is that each of the 12 categories has a very different information life-cycle, and within each element of the life-cycle there are invariably multiple inter-related workflows to provide a quality check on each item.

5. Information quality

Not only is information not regarded as an asset but there are none of the quality metrics that might be associated with other assets. Most organisations will have set out quality standards for products and processes, especially where they need to comply with external compliance regimes. ISO Standard ISO9001:2015 **[8]** for quality management systems requires organisations to maintain documented information to the extent necessary to support the operation of processes and retain documented information to the extent necessary to have confidence that the processes are being carried out as planned.

However, the standard only considers the quality management processes and provides no assessment metrics for neither the quality nor the availability of information, As an example, the quality manual for Sanofi, one of the world's largest pharmaceutical companies, makes no reference to information quality. [**9**]

ISO 8000-61:2016 is an international standard for data quality [**10**] but there is no equivalent standard for information quality. In 2012/2013 UK Research and Innovation funded a research project with the title of 'Understanding Information Quality Standards and Their Challenges' seemingly oblivious that there were no information quality standards. **[11]** One valuable result from the project was a book on the philosophy of information quality [**12**] and there is an Association of Computing Machinery (ACM) journal on data and information quality. **[13]**

6. Information access rights

A feature of enterprise working is that the extent to which employees can access information is quite strictly controlled. It is not uncommon for an employee to have only partial access to an information source, for example a personnel database. They may be able to validate the existence of another employee and their location but especially in Europe access to personal information under GDPR is very tightly managed, especially in Germany and Austria.

Access is often role-based, so that all sales managers can see certain details about customers but not (for example) who in the customer has responsibility for authorising payments. In many professional services firms there are very strict access controls to avoid conflicts of interest between the firm and clients.

Moving ahead from the current lock down situation there are going to be substantial challenges opening up information to employees taking on new roles and therefore needing access to information resources they may not know existed. The secondary question is how far back this access should be authorised. Managing the changes in security trimming is likely to be a major challenge.

7. The languages of information

To add to this complexity organisations are working in multiple languages, though it is only over the last few years that the implications of this plethora of languages and cultures has been subject

to detailed assessment. In the case of one German-owned multinational company employees are able to search through 100 million documents. [**14**] However although 75% of these documents are in English only 25% of employees have English as their primary language. Constructing queries and scanning result snippets in a second or maybe even third language presents substantial problems in locating relevant information.

It is often overlooked that the skills of understanding spoken language, reading it, writing it and speaking it are distinct skills. These are set out in the Common European Framework of Reference for Languages. [**15**] Much is made of developments in machine translation (MT) but this technology does not address all aspects of cross-lingual use. Over the last few years there has been a substantial amount of research into HQ-local subsidiary management issues related to language use and challenges but the focus has been on communication and culture and not in aspects related to the management of information. [**16**]

8. Information risk

There is a fiduciary duty on the Directors of a company to manage the business on behalf of shareholders and stakeholders so that the impact of any risks is minimized. There is usually a regulatory requirement to set out potential risks in the Annual Report and indicate how these risks will be managed. This is especially obvious in the case of the annual US Securities and Exchange Commission SEC10K filing for publicly quoted companies in the USA which have to set out risks in considerable detail in Section 1A at the beginning of the filing. [**17**] An examination of these risks invariably shows that that many are likely to arise as the result of not having adequate information.

The practice of corporate risk management is well understood from a compliance perspective but from an information management perspective the focus tends to be on compliance with ISO 27001 [**18**] for information security management. This sets out the requirements for an information security management system (ISMS). An ISMS enables an organisation to manage the security of assets such as financial information, intellectual property, employee details or information entrusted by third parties. It should be noted that there are no references in the standard to information quality or specifically to information risk.

9. Information seeking and searching

Although many search vendors and consultants claim that knowledge workers spend 2.5 hours a day looking for information. There is no basis for this assumption which was based on an estimate dating from 1999. [**19**] It emphasizes how little is known about the processes of seeking and searching in the enterprise. The challenge in the workplace is not only about finding information but also managing the flood of information being pushed to the employee by corporate applications such as ERP and CRM applications, intranets, emails and social media.

Case and Given [**20**] assess the outcomes of over 1500 research papers on various aspects of information behaviour and information seeking and present 12 different models of information seeking behaviour. The very fact that there are these different models is an indication of the complexity of information behaviours.

Although there has been intensive research into how people search the World Wide Web and web sites there are only a handful of research papers on how search is used in the enterprise. A very broad query for [search] in the ACM Digital Library returns 207,000 results. When that is narrowed to ["enterprise search"] there are only 337 results, with just 28 in the last two years. The ACM Digital Library only includes ACM journals and proceedings but this imbalance in research activity is indicative of the situation. The 2018 SWIRL conference [**21**] on future directions in information retrieval, sponsored by Microsoft, had no participants from the enterprise search community and the issues around internal search were not on the agenda.

Another contribution was made in 2012 by Borlund [**22**] and her colleagues in which they looked at the information seeking approaches of engineers. The study used a work-task journal approach in which the engineers recorded their tasks during the working day. The most important outcome of this research was

"Out of the work task journal data, it seems that for profession-oriented work tasks of engineers' work duty (i.e., identifying a suitable solution to given requirements or designing a new application) the expectations to the search engine differ from work tasks that were of administrative nature (i.e., time or travel management). The qualitative content analysis of work-task journal study material pointed on the following work task scenarios: (1) ordinary and (2) unordinary administrative tasks; everyday professional tasks as (3) high-quality tasks, (4) "just-to-get-done" tasks and (5) regular teamwork; and unordinary professional tasks as (6) unique tasks and (7) inventive teamwork."

This differentiation in tasks is very important because it shows that using a generic 'knowledge worker' description is almost certainly misleading. A valuable epistemic view of how organisations acquire knowledge and seek information has been proposed by Wei Choo. [**23**]

Recent research, in particular the development of the Complex Searcher Model [**24**] and work on professional search [**25**] suggests that the search process is largely one of information foraging and this has implications for ranking models and user interface design.

It is therefore not surprising that over the last five years surveys by IntraTeam [**26**], AIIM [**27**], Findwise [**28**] and NetJMC [**29**] all indicate that around 25-30% of employees are dissatisfied with their performance and are finding the process of information discovery to be very challenging. This is not just a 'technology' issue. There are also concerns about information quality and about the lack of training on enterprise search applications. [**30**]

10. Information value

The value of information is a function of how much use is made of it in achieving corporate objectives. From 1997 - 2000, the IMD Business School, Lausanne, working with Accenture, undertook a project entitled "Navigating Business Success". This Study examined for the first time the perspectives of senior managers on the effective use of information, people and IT capabilities in improving business performance. The study involved 1200 managers and over 200 senior management teams from 103 companies.

The outcomes of the research were published in a number of books, notably Competing with Information **[31],** Information Orientation **[32],** and Making the Invisible Visible **[33].** The research showed conclusively that information can add value to the organisation, minimize risks, reduce costs and stimulate innovation. There has been no research programme with this scope and depth since the IMD project.

In the context of innovation US President Lyndon Johnson, addressing the Annual Conference of the International Federation of Documentation in 1974, remarked that the spirit of innovation is lit by inspiration, fuelled by information and sustained by hope and hard work. At the present time our global economy and society are going to be very dependent on innovative solutions to challenging problems, and high-quality information is essential to this process.

In 2015 PWC and Iron Mountain released a report entitled 'Seizing the information advantage: How organisations can unlock value and insight from the information they hold.' [**34**]

The findings of a global survey of 1650 businesses were

"Just 4% fall into the 'information elite' category. The information elite have well-established information governance insight bodies, strong value realisation cultures and allow secure access to those with the necessary skills. This minority of businesses are attaining a range of commercial and operational benefits as a direct result of their strong focus on information value."

The report goes on to state

"*We have identified a large 'misguided majority' – three in four businesses (76%) that are either constrained by legacy, culture, regulatory data issues or simply lack any understanding of the potential value held by their information. They have little comprehension of the commercial benefits to be gained and have therefore not made the investment required to obtain the information advantage."*

11. The 'new normal' vs the old normal

As a result of the Covid19 virus every business has to start to plan from Base Zero. Corporate risk registers will have to be totally reworked, highlighting situations where a lack of dependable information and knowledge is putting the company at risk. Any failure to find information, knowledge and expertise could put the company at immediate risk in this challenging period.

A paper published in July 2020 [**35**] presents the findings of a bibliometric study of COVID-19 literature in the business and management domain published between March and June 2020 to identify current areas of research. A co-word analysis contains a node for information retrieval but there are no other direct references to the management of information.

Going forward the internal structure of all organisations is going to change over the period from now to perhaps the end of 2021. It will certainly be mixed-mode, and comprise

- Working from home for part or all of the working week
- Working in an office on a part time basis and with socially-distanced colleagues

- Working with employees on site in manufacturing and other specialised locations
- Working remotely on client and customer sites as permitted

In all four modes employees will also be taking on new roles and responsibilities and perhaps working on tasks and topics that they are unfamiliar with whilst not being able to take advantage of on-site training and mentoring.

Other factors that need to be taken into account include the extent of the digital literacy of employees taking on new digitally-complex tasks, the well-being of employees [**36**] who will be working under considerable stress for at least the next 12-18 months, and the need to ensure that digital systems are compliant not only with WIA accessibility standards [**37**] but also for employees with dyslexia [**38**] (probably 1 in 10 of employees) who will find it especially difficult to transition to new applications and user interfaces.

The challenge that we face in supporting the new normal is that we have very little information on what the old normal was in terms of the information eco-system and enterprise information management. A small-scale survey undertaken by Microsoft of its employees and published in July 2020 [**39**] notes that

"As organizations across the globe shift back to the office, measuring patterns of work against a baseline and keeping an eye on how people adapt will be essential — especially if new waves of disruption bring new unknowns"

At present there is no baseline and very little expertise and experience on 'keeping an eye on how people adapt'.

12. Evolving research methodologies

The issues raised in this paper indicate the complexity of the information eco-system in any organisation. This level of complexity is increases when systems and governance may be developed to meet the apparent workflows and not the true workflows. It is important to differentiate between 'fitness to specification' and 'fitness to purpose'. There is a considerable amount of evidence that employees are adept at finding ways around processes that are not fit for purpose, to the extent that it is possible to define a typology of these workarounds as bypassing, substituting and complementing **[40] [41].**

Over the last decade there have been some important developments into information eco-systems research. For example there has been the recognition of the value of focusing on tasks [**42**] and the need to use a wide range of different research techniques to map the way that information flows and is consumed in organisations [**43**]. However the *Journal of Enterprise Information Management* **[44]** has not published any research papers on corporate enterprise information management in the last five years, an indication of the lack of research in this sector.

Over the last decade the concept of a Digital Business Ecosystem (DBE) has emerged as a collaborative environment made up of different entities that co-create value through information and communication technologies. Information management (and knowledge management) are

just elements of a DBE but the research issues are similar in gaining a good understanding of business processes and how they are supported by technology and information. In a survey of research into digital business ecosystems (DBE) [**45**] the authors noted that while ecosystem research in the broad management field is increasing, DBE studies, on the other hand, are dwindling. The authors could only identify 303 papers, of which only 101 were selected for analysis. The authors also note that their review is the first ever review of research on DBEs.

An important contribution made by the authors is to identify the barriers to undertaking research into DBEs and these also apply to enterprise information management research. One of the most challenging is the concern of the organisation over the disclosure of confidential information at the research stage and also at the time when the research is published.

For many years ethnographic research has been an important methodology in understanding cultural and communications issues within organisations.

Historically ethnographic research has focused on organisational culture and communications [**46**] and not on information management. The notable exception has been a review of the IMF. [**47**] There is now increasing interest in the application of ethnography to understanding business processes. [**48**] Computational ethnography is an emerging family of methods for conducting human–computer interaction (HCI) studies in healthcare. Computational ethnography often leverages automated and less obtrusive means for collecting *in situ* data that reflect end users' true, unaltered behaviors of interacting with a software system or a device in naturalistic settings [**49**] [**50**] For example it been used to capture in great detail the use of office applications during the course of the working day. [**51**] [**52**] [**53**]

Two recent examples that illustrate the role that computational ethnography can play are a study on how clinical staff use electronic health records [**54**] and how documents circulate within enterprise collaboration platforms. [**55**]

It is also important to take into account research that has been undertaken into personal information management and knowledge management. Much of the research into personal information management has focused on the education sector. However studies on file management [**56**] [**57**] raise issues at a personal level that could have significant impacts on organisational information management. Research into knowledge management is also important to take notice of because although it is often highly narrative it usually takes a broad view of organisational culture, communications and information sharing. [**58**] There is a significant interest in measuring KM contributions to the organisation [**59**] which could be models for the impact of information on the organisation.

13. The bigger picture

In this paper I have presented the complexity of information management in a single enterprise. When there are multiple companies working on mega-projects such as the HS2 rail link in the UK then effective information management is even more vital and more challenging [**60**]. The Nasa Mars Rover crashed into the surface of the planet because of an information quality management

issue. Some of the documentation (from the EU) was in metric units and other documents (from the USA) were in imperial units. No one noticed. [**61**]

14. Back to the jet engine

To quote from Making the Invisible Visible **[33]** dating from 2001

"While managers have worked on learning how to manage technology and information they have not yet developed a full understanding of how people's behaviours affect information use within their companies. "

There is now no point in trying to measure the past. Good practice built up over many years will almost certainly have little relevance in a mixed-mode working environment.

To return to the jet engine metaphor, there is an urgent need for

- Sensors – what would be the best research methodologies
- Toolkits – information managers need survey techniques and good practice guidance
- Benchmarks – how do managers know that information is being managed effectively
- Performance indicators – what should be reported up the line to senior managers and the Board

The European Commission has funded the Dossier project **[62]** to research a range of aspects of how users comprehend, formulate, and access information in professional environments. The research is going to be undertaken as a set of PhD projects and so the outcomes will not be available until perhaps 2024.

Sensors

All the evidence suggests that a mixed methods approach will be best, with computational ethnography potentially playing a very important role for in situ research. At present there are many different approaches to both ethnographic research and presentation, and it seems that computational techniques are becoming well established in the health care sector. There is probably a need to move ethnography more towards information processes than its current focus on culture and communications.

Toolkits

The techniques developed as sensors then need to be packaged into toolkits that information managers can use to identify user requirements and to ensure that what is delivered is fit for purpose, not just fit to specification. An important outcome of the development of toolkits is to ensure that specification and purpose are aligned as closely as possible.

Benchmarks

The current focus on productivity gain is not a constructive one. It puts an emphasis on quantity at the expense of quality. Vendors promise that new features will enhance productivity but are never willing to offer even an indication of the productivity increase. It could be that current work on

Time Well Spent [**19**] could offer an alternative. There could be a role for a standard along the lines of ISO30401 for knowledge management processes. Benchmarks for sectors could also be of value.

Performance indicators

If information is an asset then senior managers will need to be reassured that corporate information assets, both internal and external, are being well used and having an impact on business performance. It might be possible to develop information risk methodologies. These exist at present but are grounded in corporate risk management rather than information management.

The sequence for development has to start from sensors/research techniques, which are then optimised as toolkits for information managers. As they apply them benchmarks will evolve within the organisation and from these variants can be derived that provide trend information on performance which has a value to senior managers.

The first step would be to bring together the various research communities, which could be accomplished virtually as speed is of the essence and in addition the expertise is worldwide. There is much to do and little time to do it.

I would like to propose that a SWIRL-type forum **[21]** is set up with the minimum of delay to begin to address the issues and opportunities I have set out in this paper. These might be set up on a regional basis, or perhaps on a sector basis. Information Schools around the world could act as coordinators as they themselves will have an interest in expanding their research and teaching in information management.

15. Third time lucky?

The important role of information in a digital economy was first presented by Tom Peters in 1992 in his book Liberation Management **[63].** Ten years later the competitive advantage that companies could gain was shown with considerable clarity in the work of Don Marchand and his colleagues at IMD Lausanne. Since then nothing significant has happened to enhance the way that organisations manage information. Certainly there has been an immense investment in IT, but with the emphasis on the T, not the I.

If we globally are going to emerge with stronger economic and social performance in the next decade the effective use of information is going to play a crucial role.

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