An Organic Approach to Systems-driven Information Management

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Abstract

Numerous attempts have been initiated over the past several years at the Department of Agriculture and Food, Western Australia (DAFWA) to create and implement an information management policy or framework which would facilitate the agency's growing need to properly support its information flow. Commissioned in 2007, a report into the agency's information management "state", described that state as "fragmented".

When confronted with the observation that an organisation's information is fragmented, it is natural to assume such a state is deficient, and therefore must be managed, or consolidated. It is far less natural to step back and consider that perhaps information fragmentation is normal and part of the way humans share information.

Proposed is an innovative approach to information management within large organisations which embraces a fragmented, or decentralised, model of information systems as a reflection of how information organically flows within a living system.

INTRODUCTION

When confronted with the observation that an organisation's information is "fragmented", it is natural to assume such a state is deficient, and therefore must be managed, or consolidated. New systems should be designed that will un-fragment the information, common vocabularies designed and then imposed onto the ailing system.

It is far less natural to step back and consider that perhaps information fragmentation is normal and part of the way humans share information. It is even harder to consider that the fragmented information system within any organisation is a natural reflection of the groups of humans within that organisation, and therefore a candid reflection of the organisation's culture and business practices.

The implication of considering whether the fragmented state of information and information systems within an organisation is natural, is profound. If it is true, it explains why so many information systems, imposed in the hope of consolidating organisational information, fail to meet organisational expectations. Apart from users having to learn new ways to interact with the system, requiring complex change-management strategies, the cure of consolidation has the potential of in fact impairing existing information flow – which, although fragmented, and often in spite of itself, actually works.

APPROACHES TO SYSTEMS INFORMATION MANAGEMENT RESEARCH

Information flow between people naturally clusters into pools of similar vocabularies. People who share common interests usually share common jargon or language (Haghirian, 2003), often sharing their information in ways that an "outsider" may not always understand (Buckley & Carter, 2002). It has been argued that the information exchange between users within a group of people meets the criteria of being an information system in that there is (1) people; (2) data /information; and (3) a mode of transmission or interaction (Pelozo, 2003). If this is true, then it is logical to assume that technology driven information systems come under the same natural laws which govern information exchange and knowledge transmission between people, excepting that the mode of transmission is specifically "technologies".

This assumption, however, has never really been made of technology information systems, nor has it been actively perused in much of the main stream information science research. On the contrary, a clear distinction was made early in the evolutionary research time-line of both “information management” and “knowledge management” (Dougherty, 1999) regarding the differences between knowledge transfer which occurs “naturally”, and that which occurs “formally” (Davenport & Prusak, 1998).

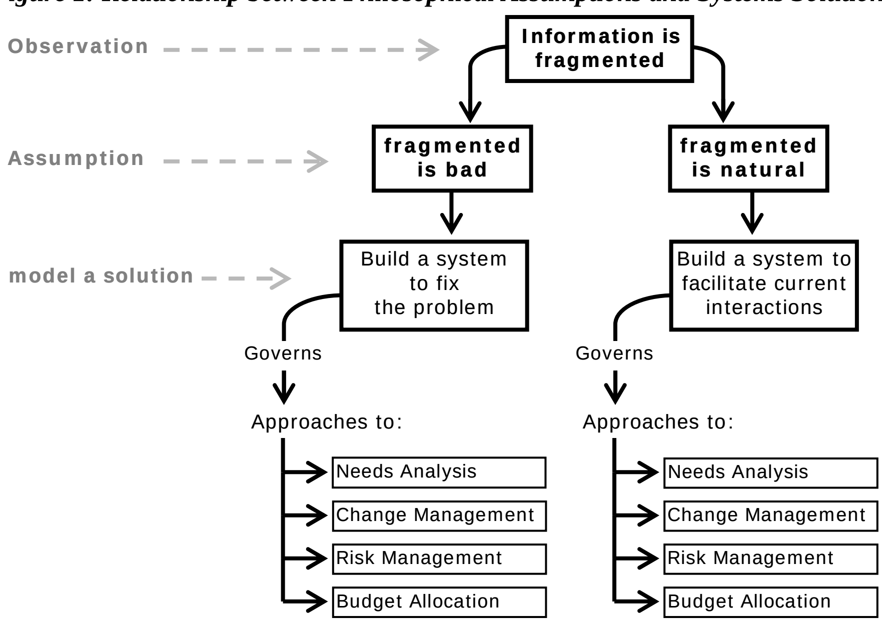
The result of this distinction, is a paradigm which frames organisational information systems within a formal mode of information exchange. This logically leads to the development of information systems that try to manage “formal” information transfer.

If it were supposed for a moment, that this paradigm was incorrect, and that the very act of trying to “formalise” information transfer can result in impeding the process, then the implications are quite staggering. Moreover, if the prevailing notion that less formal, or “fragmented”, information requires organising into formal frameworks in order to be properly managed, were to be found wanting, then the whole way in which systems are built would need to be challenged.

The link between paradigm and solution

Figure 1 illustrates how philosophical assumptions (paradigms) drive the epistemological[1] frameworks which govern both the investigation and implemented solutions of phenomenon. In the context of this discussion (and figure 1) the phenomenon is “information fragmentation”, which was observed to be the state of organisational information management in a 2007 report (Frame, 2007) commissioned by DAFWA. Importantly, the assumption is not the observed state of “information fragmentation” although the author acknowledges that Frame’s (2007) use of the word “fragmented” implies a negative condition. The assumption comes after the observation, as an organisation determines whether fragmented information is a (1) bad; (2) good; or (3) natural state.

Figure 1: Relationship between Philosophical Assumptions and Systems Solutions



In the context of the presented observation of organisationally fragmented information (Frame, 2007) this paper proposes an alternative paradigm for the development of organisational information management systems and strategies. It considers the distinct possibility that fragmented information is the natural way in which humans exchange ideas and knowledge, and advocates that the resultant strategies and methodologies adopted in solution investigation and implementation are at odds with the current way systems are developed.

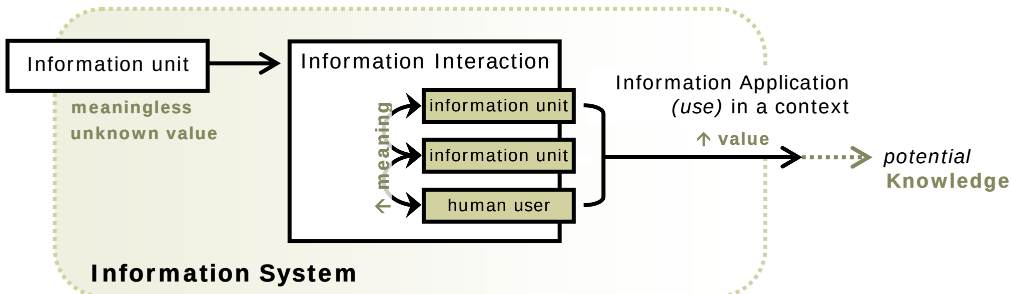
[1] Simply described epistemology refers to the assumptions one makes about one’s knowledge of reality (the paradigm) and how one obtains and/or understands that knowledge.

WHAT IS INFORMATION?

Information can be defined as a "unit" or "group of units" of data It is perceived as being its own existent, physical (or virtual) entity, possessing intrinsic – albeit unrealised or unknown – "value" to the context in which it exists. Importantly, information (or data) is also seen as a dynamic phenomenon, which can be joined with other existent information unit(s). It is the joining of information units, particularly in the context of human-information interaction, that information gains varying degrees of meaning and value (Ingwersen, 1992). In this context, information management is the facilitation of the joining of information units into meaningful sequences, which is seen to gain its greatest potential value when interacted with by human users.

Figure 2 illustrates how an information unit begins as a "meaningless" entity, in that its meaning is unknown until it is interacted with. Although meaningless, this unit of information or data is thought to have value, although – if the entity remains inactive – what its value is remains unknown. It is in the process of information interaction, facilitated by an information system, that information units are able to gain degrees of meaning. If that meaning becomes clear to users and is applied to various contexts, the value of the information can also become known, leading to a potential growth in user knowledge.

Figure 2: Information, information interaction, meaning and knowledge



Information versus Knowledge?

In this type of model, knowledge does not exist within the actual information system, but in the application of the information within the system (Bates, 2005). This is an important distinction, in that it recognises meaning and value are at their highest when interacting with, and being applied by, human users.

Information Flow: *Information Ecosystems*

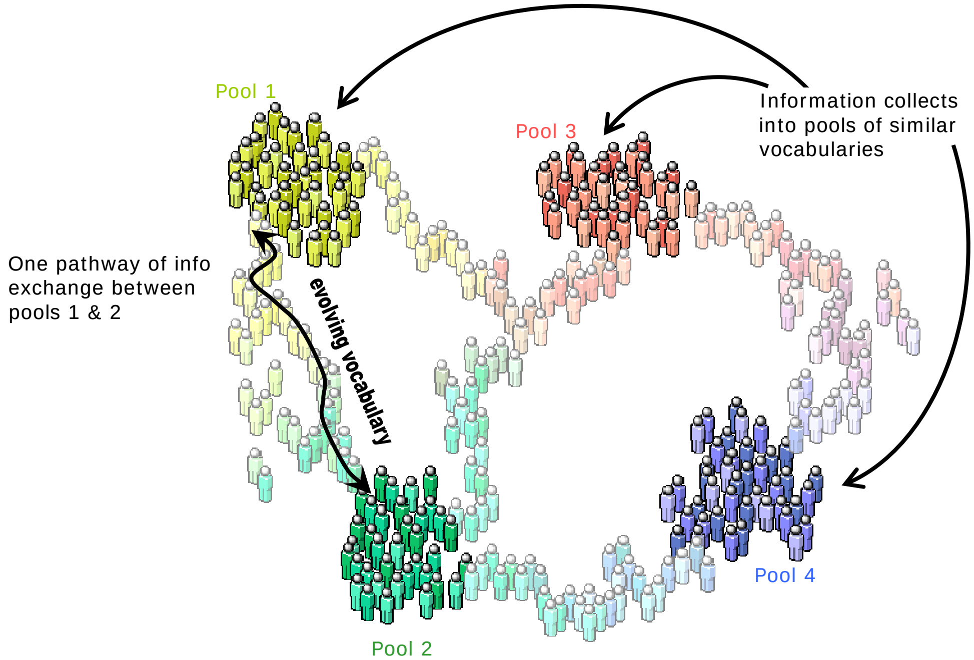
Marrow (2000) describes an ecological system as one in which the living organisms of the system exist in "a web, or network, of interactions with other organisms" (p16). This use of terminology has resulted in the obvious comparisons, at least metaphorically, between natural systems and information systems (DeAngelis & Gross, 1992; Tateson, 1998).

An important construct of any defined ecosystem is its self-sustaining nature. This is sometimes referred to in *Complex Systems*[2] research as the ability of a system to self-organise. Importantly, ecosystems are also seen as being primarily governed by stochastic, or random, events. In this context, the ability to self-organise is an important characteristic in the homeostatic process of maintaining a system's internal stability.

The basic assumption of an information ecosystem approach to understanding organisational information is that information exchange, in mimicking information exchange in non-technical information systems, first clusters into pools of similar information. Users (or exchangers) of information identify with specific pools, with some users fitting more neatly into a cluster than other users. The users on the peripheries of specific pools then provide pathways for information exchange between these pools of information through an evolving vocabulary. The process is illustrated schematically in figure 3.

[2] Complex Systems and Complex Systems Theory are relatively new interdisciplinary fields of theoretical study investigating the dynamic relationships betweens the parts that make up a system.

Figure 3: Natural/Organic Information Systems of Information Exchange



In reality, the process is far more complex than a few individual pathways between information pools, as illustrated in figure 3. Multiple pathways, some more efficient than others, are seen to facilitate the process of information exchange. But, like a game of Chinese Whispers, some pathways can cause breakdown or changes in the message not originally intended. New pathways evolve, or information takes on new associations and meanings when these breaks occur. In digital ecosystems (Fiorina, 2006) thinking, this is the *dynamic* of an information ecosystem, and represents a whole new way of looking at the component parts of an information system (Gustavsson & Fredriksson, 2003; Herrera *et al.*, 2005).

DISCUSSION: A PARADIGM FOR SYSTEMS INFORMATION MANAGEMENT

Proposed is an innovative approach to information management within large organisations which embraces a "fragmented", or decentralised, model of information systems as a reflection of how information organically flows. Information "units" (figure 2) are seen to organically pool into groups of similar information units. Here, these information units interact with one-another, which makes the information "meaningful" to the users who interact with them. Users on the peripheries of these information fools provide pathways, albeit at times inefficiently, between the fragmented pools, leading to organisational wide (and even inter-organisational) information flow.

The challenge for a new generation of systems designer is to find ways to cut channels within and between these natural pathways (or streams) of information exchange. In so doing, information flow can be increased, and information exchange becomes more efficient.

An important point of this type of systems design approach is that it sees the implementation of one shared vocabulary as potentially obstructing the natural information flow mechanisms that have evolved over periods of time within an organisation. This is completely at odds with conventional IS wisdom, which has advocated organisation-wide implementations of everything from Standard Operating Environments (SOE) to standardised metadata and "meaningful" email subject lines.

Not an entirely new concept

The concept of information ecosystems is not a new one although it has taken a long time to become an established paradigm within the field of information systems. Flores (1999) wrote of future technologies as "complex, dynamic and heterogeneous infrastructures", describing each part of the system (people, organisation, software and information) "infohabitants" (p17). This may be, in part, because the authors' extolling the virtue of embracing information systems as complex self-sustaining ecosystems, did so while still advocating the need to overtly "manage" them. Eymann *et al.*, (2000) acknowledge that in a complex system the natural tendency of the infohabitants will be to lean towards their own protocols, be they organisational, cultural, departmental, social or informatic, and Kephart *et al.*, (1998) warn this tendency for infohabitants to pursue their own "individual optimality" threatens the overall stability of the network.

The basic underlying assumption of this view is still that "fragmented is bad" (see figure 1). So while the rhetoric of complex and organic systems was at least being discussed in IS literature, its application, at least as self-sustaining entities, was philosophically flawed.

Applying *Complex Systems Theory* to Information Systems

In simple terms, a system is a collection of organised parts. The parts, or entities, of a system can be; (1) objects, – the planets of a solar system; (2) concepts, – a metric measurement system; (3) functions, – an economic system; (4) controlling mechanisms, – a belief system; or (5) processes, – homeostasis. Importantly, systems are seen to operate at multiple levels of "connectedness", in that the parts of a system are not just the pieces of the whole, but they are the way those pieces relate and inter-relate to each other.

System theory, and more recently, complex systems theory is the theoretical study of the dynamic relationships betweens the parts that make up a system.

Information Systems as Living Systems

Living Systems Theory (LST), developed by Miller (1978) is a theoretical framework designed to investigate the ecology of complex systems. A living system is conceptualised as such for the reason that, amongst other characteristics, it is able to maintain its *living* state through being open and self-organising in the context of stochastic events (Kay, 2000). Importantly, of the eight system levels said to make up any living system, Miller named level one as "cells", thereby making a fundamental distinction between "living" and "non-living" systems, with the essential component of cells – and therefore living systems – being organic molecules such as DNA, RNA and protein (Parent, 1996). This distinction supported the view of some writers that a "computer system" is therefore *not* a living system.

Current application of LST within information science disciplines however, has theorised that while a "computer", complete with circuit boards, binary code, microprocessor and physical memory chips contain no DNA type molecules that would constitute it as a "living" object, computer systems, and particularly information systems, once interacted with by their human component, do contain the building-blocks of life, and are indeed, a living system.

As a living system therefore, an information system would inherit the properties of all living systems, particularly those which enable them to be considered complex interactive systems, with the ability to self-organise in the context of unplanned interactions. The metaphoric constructs, called 'sub-systems' (Miller, 1978; Miller & Miller, 1992; 1995), of a classified living system provide a robust framework by which to investigate a system's structure, processes, and their interrelations (Bailey, 1994). Associated living system characteristics such as information input, feedback patterns, system stress, and the like can be investigated using a paradigm not fully explored within information systems research.

New Avenues of Exploration

Historically, systems theory (Bertalanffy, 1950) emerged in the middle of 20th Century. Although divergent in discipline application, the core idea of systems theory was the importance placed on the contextual relationships between the entities in any given system (Hammond, 2003). The concept of the interconnectedness of system entities was quickly embraced by emergent fields such as software engineering and became the driving paradigm underpinning the design of most modern software systems (Jackson, 2000).

An identified problem however, is that where the Social Sciences have continued to push and mould systems-driven theories, developing new complex areas of discourse, such as systemics (François, 1999); systems psychology (Olds, 1992); cognitive and family systems theories (Cooper, 2004); and novel applications of LST (Bailey, 1994; 2001; 2005); information technology driven disciplines have lagged behind, still utilising the archaic models employed to develop the first computer languages. To this extent, the conceptual space inhabited by so called "back-end" computing has remained largely unchanged for half a century, buoyed by the illusion of progress simply because the physical (hard) technologies keep developing.

The problem of the lack of an evolving paradigm in computer and information science disciplines is manifest especially in the more "human-centred" fields of study, which typically adopt "borrowed" social science concepts and theories to be used in the *deductive analysis* of human ICT behaviours. Human behaviour, though, is extremely complex, and requires a more diverse set of applied theories and methodological approaches than is currently typically manifest in information systems research (Choudrie & Dwivedi, 2005; Bagozzi, 2007).

Implications

The implications of developing a complex and living systems framework with which to investigate (1) information systems behaviour; and (2) human computer interaction; is profound. Ultimately, it has the capacity to synthesise the very way information science researchers consider their discipline, and the scientific enquiry of it. The "information system" becomes a decentralised entity, where notions of *chaos theory* (Lorenz, 1963; Francois, 1997), self-organisation (Collinge, 1999), emergence (Minati *et al.*, 2001) and nonlinear dynamics (Harter, 2003; Kozma & Tunstel, 2005) provide a unique and novel way to investigate system behaviours, human cognitive behaviours, and human-computer system engagement.

Importantly, in the context of the current discussion, a new living system paradigm provides an investigative framework where "fragmented information" is not necessarily perceived as a "bad" characteristic in an information system.

CONCLUSION & FUTURE RESEARCH

The beginning of this paper presented a commonly observed phenomena in most large organisational information system implementations. Faced with the perceived challenge of somehow pulling together a diverse, decentralised and distributed system of multiple software, interface, and user vocabularies, DAFWA must consider its options in relation to how the organisation perceives its current informatic and information management state.

Described in Frame's commissioned report (2007) as "fragmented", DAFWA's road to systems integration, including how the organisation applies common business analytical strategies such as business process and needs analysis, risk assessment, current and future state gap analysis, and project management of implementation solutions is paved with the philosophical assumptions associated with how the organisation perceives the concept of "system".

The current paper presents a new information systems theory, gaining a degree of respectability within the computer and information science disciplines, which – if true – implies that many of the scientific assumptions, in regards to how systems work, made previously are not necessarily correct (Loosemore, 2007). The implications of this are two fold: Firstly, it begins in part to explain why so many imposed information system implementations fail to meet organisational expectations. Secondly, and more importantly, it provides for an organisation a whole new paradigm with which to consider solution implementation.

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