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Integrating Information and Knowledge for Enterprise Innovation

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Abstract

It has widely been accepted that enterprise integration, can be a source of socio-technical and cultural problems within organisations wishing to provide a focussed end-to-end business service. This can cause possible "straitjacketing" of business process architectures, thus suppressing responsive business re-engineering and competitive advantage for some companies. Accordingly, the current typology and emergent forms of Enterprise Resource Planning (ERP) and Enterprise Application Integration (EAI) technologies are set in the context of understanding information and knowledge integration philosophies. As such, key influences and trends in emerging IS integration choices, for end-to-end, cost-effective and flexible knowledge integration, are examined. As touch points across and outside organisations proliferate, via work-flow and relationship management-driven value innovation, aspects of knowledge refinement and knowledge integration pose challenges to maximising the potential of innovation and sustainable success, within enterprises. This is in terms of the increasing propensity for data fragmentation and the lack of effective information management, in the light of information overload. Furthermore, the nature of IS mediation which is inherent within decision making and workflow-based business processes, provides the basis for evaluation of the effects of information and knowledge integration. Hence, the authors propose a conceptual, holistic evaluation framework which encompasses these ideas. It is thus argued that such trends, and their implications regarding enterprise IS integration to engender sustainable competitive advantage, require fundamental re-thinking.

Keywords: Information Management, Knowledge, EAI, Organisational learning

Introduction

A business environment where the only certainty is that of continual change, requires a relentless pursuit of new enterprise value propositions in order to deliver relationship-driven customer value propositions. Business models based upon the management of electronic or digital sell-side and buy-side channels, are no different from those of the traditional "old economy" business, in that they too must pass fundamental tests of agility and flexibility. In the light of the era of rational exuberance and the exponential growth of the internet in recent years, there is now a deeper understanding of the reliance upon core business drivers, which can lead to either economic growth or economic stagnation. Given this reliance exists, and notwithstanding macroeconomic volatilities, excellence in core business model implementation will continue to make a difference across business regimes. The emergence and pronounced impact of a fully globalised economy, means that there needs to be excellence in information management and end-to-end knowledge integration deployment also.

Those organisations that have survived both technological and process integration fashions of the recent decade, have had ample chance to re-learn some old lessons about modern business practice realities. For instance, how to harness information technology to become niche players in their market; how to assess the worth of their human capital; how to target and market more effectively to their customers; and most importantly of all, how to survive and maintain business continuity in unpredictable circumstances, all the while returning shareholder value. As has been the case since the mid 1980s successful and progressive organisations will distinguish themselves by how effectively they can leverage their IT/IS function.

Most of those organisations that survive industrial and economic shake-outs, survive because they are the best in their class, exhibiting the kind of resilience born of information management based on innovative practice logics inspired by customer value innovation. This, however, does not simply imply a need for singular process rationalisations and re-engineering initiatives. Rather, the wholesale realignment of business processes with resilient open IS infrastructures is required. By underpinning the organisation's computing model in such a way, through the various stages of an enterprises' lifecycle, many enterprises may need to return to the first principles of IS design. This is in the guise of understanding IS stakeholder requirements through an associated realisation of the underlying information and knowledge within the business.

As such, the basis for many MIS is in the rationalisation of function, process and technological components (Zachman, 1987). This approach to enterprise-wide technical architecture is well known and understood to be a good starting point for managing information and process flows. However, organisations have quickly learnt to appreciate that flexibility of this design as well as a deep harmonisation of core enterprise systems (closed-loop management reporting; purchasing, finance, procurement), is a necessity. Indeed many enterprise software solution vendors, such as SAP, Oracle and Siebel and more recently, Microsoft, are developing functionality that requires at least some of the core components to be present, as a skeleton by which to integrate other enterprise computing resources. For example, a recent trend has been to develop enterprise-wide portals that allow not only employees but also potentially customers, clients and partners to access a company's business information, through web technologies (e.g. Badii & Zhang, 2001 ; Zhang and Badii, 2000). This has been shown to be an attempt to fix the resulting consequences of IT/IS implementations that took place in the late 1990's, in the rush to deliver ERP, Customer Relationship Management (CRM) and many other early-adopter electronic commerce applications.

As such, a conceptual holistic IS integration strategy which provides an *in-situ* evaluation framework is proposed. This architecture for reflection of the cultural and organisational impacts of business process integration and innovation, should also provide insights into key success / failure characteristics arising from the technological changes thus introduced. The authors present a model of intra and inter-enterprise integration, for optimising information management and knowledge integration as a lifecycle process. Through the application of the C-Assure framework, innovation and evaluation of the various stages within the enterprise lifecycle can be supported. In doing so, a re-negotiability-centric design for architectural and organisational discourse and located accountability, provides a cost-effective basis for integrative lifecycle evaluation. In this context the key elements of the C-Assure architectural framework are described as mediating end-to-end knowledge integration and lifecycle decision flow-workflow embedded evaluation.

It is concluded that such integrative local and global evaluation and its implementation as a framework of tools including Holistic Heuristic evaluations constitute an essential component of an enterprise knowledge integration backbone architecture to aid organisational sense making, learning, innovation and thus sustainable success.

Data, Information and Knowledge

In recent years much has been written about "knowledge management". The title of this paper referring to knowledge integration as it does, indicates our mindset in viewing knowledge management as an inappropriate term, in its wider sense. This is a view shared by a number of leading IS researchers (such as Galliers & Newell, 2000). It is possible for an organisation to collect much potentially useful information about its customers and competitors, and, even about the business ecosystem that it operates in. This procedural codification and storage of knowledge can very loosely be described as knowledge management. However, it is the timely deployment of such knowledge should bring about business advantage. Poor information management aligned to a poorly thought-out and ineffectively executed business model which lacks this integration of knowledge support, could potentially cause a disbenefit as opposed to benefit of holding such information.

We envisage a data centred, context sensitive computing architecture i.e. context-aware business computing environment which implies relevant process related data processing i.e. information management. Putting data in context and interpreting it to get information and to do sense making through debate and dialogue yields information (Weick 1993); something that may be facilitated by information computing and technology (ICT), to yield knowledge that may be *integrated* rather than *managed*. Thus, knowledge, by nature, is born of reflection. The subjectivity and emergent qualities of naturally occurring processes within IS-based organisations, mean that a generalised approach to "managing" knowledge is in part, ill-conceived. Hence, if knowledge is not directly amenable to being managed in some part, this poses the question of what how can knowledge be integrated? Knowledge integration, is defined by the authors as managing information such that timely insight can be available at the right juncture for sense making. In other words, a contextual and effectual process for discriminating the where and when knowledge can be exchanged, evolved, refined and be made readily available at the point of need. This implies that knowledge integration must facilitate reflection and dialogue to allow personal and organisational learning and innovation.

Without effective information management to underpin knowledge integration, and therefore innovation, the enterprise could find itself spending more and more resources administering and guarding information silos rather than using them effectively.

An enterprise's response to information management challenges as a result of data generation and overload, is largely determined by the way it can organise the effective logistics of information management. This is the ability to have access to the right information, available for the right purpose, at the right time, place and space (Sharif, 2002). This amounts to the understanding sensitivities inherent in information systems pertaining to information ownership (via stakeholders); information scalability (within IT/IS lifecycles), contextuality (interpretation relative to interacting processes and data); and navigability (organising information for ease of access).

A framework is required for specifying information points of need and usage and relative information intensiveness of enterprise touch points so that adequate provision is made to service and integrate such points properly in order to avoid fragmentation of customer information. Moreover, we must distinguish between relative channel uptake, accessibility and intensity of information channels and their routine traffic and peak transaction load, as these differ from channel to channel as depicted in Figure 1 below.

This illustrates the information intensiveness and accessibility arising, ostensibly, from the main 'e' business models which have emerged in recent years i.e. B2B (business to business), B2C (business to consumer), C2C (consumer to consumer), P2P (peer to peer), mC (mobile e-Commerce). These new transaction channels have provided increased accessibility and usability of information in each of their respective areas of focus. Almost all of them have still to fulfil their full potential due to lack of integration i.e. due to fragmentation of information from various touch points, sub-optimal knowledge integration and thus inefficient customer value proposition and innovation. For example, studying e-CRM data intelligence from a multitude of information / knowledge touch points, has not yielded any deeper understanding of transaction semantics (Badii 2001a, Badii *et al.*, 2001). It is possible therefore that much so-called personalisation, particularly on websites, can be misinformed and thus result not so much in customer satisfaction as irritation and defection. There can be no full realisation of the innovative potential of either the data intelligence or the enterprise without knowledge integration and no knowledge integration without any-to-any linkability and many-to-many adaptability and dynamic representation of business information; just-in-context (Badii, 2001a).

Only flexible enterprise value propositions which respond to an equivalent customer value proposition, is resilient irrespective of the channel of distribution (witness the success of both wholly internet brands such as Amazon.com, as well as "bricks and clicks" companies such as Barnes and Noble). But for many enterprises, this integration between knowledge value propositions is yet to be realised. This is because as touch points have proliferated, enterprise and industry resources have simply not been able to keep up with the challenges of properly integrating knowledge from the each channel given the relative speed of introduction in order to sustain competitive advantage. Coupled with the mounting demands for the integration of heterogeneous IT/IS systems and best of breed applications within the enterprise, there is a propensity for a information and knowledge integration gap to exist.

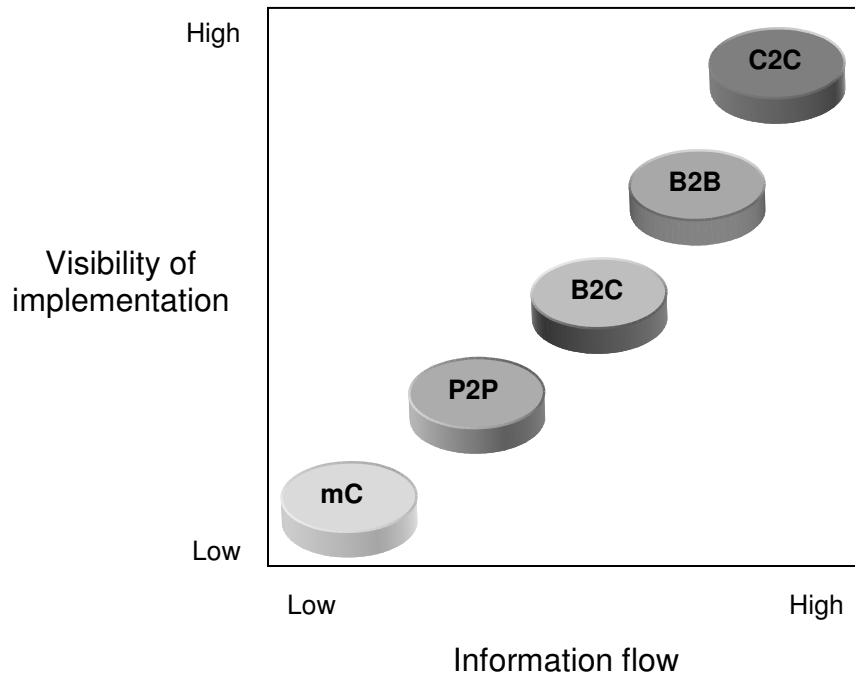


Figure 1. Information requirements for internet-based enterprise models

This potential volume of data which can be collected from a variety of touch points, within and outside of an IS-based enterprise, implies a significant information management load in consistency checking, data cleaning, security, filtering, warehousing, pattern mining, pattern forecasting, knowledge discovery and knowledge integration. This has made information management and thus knowledge integration a rather demanding function. Thus the information overload, attendant with the Internet economy models as they largely operate today, appears to be detracting from, rather than contributing towards, the goal of harnessing useful business data intelligence.

It is perhaps for the above reasons, that the Internet has still not achieved the objectives of automated commerce and supply chain logistics in its fullest sense. Traditional "old economy" information management and logistics, is supporting "new economy" processes and IT/IS implementations in a perverse twist of supply and demand. To effectively manage this information overload, IS systems and services which are context-aware in this light, need to have decision-making capabilities. This can be as simple as providing search / cataloguing of information; through to services which are able to discern between media-variant, content-variant, context-invariant types having similar contextual information in them (for example, a text document or a streaming video file which may relate to similar information); and in addition, device and system management components of an information system (operating system, network or a peer internet group), which can filter and integrate information into other devices (personal digital assistants, mobile phones). Any context-aware knowledge integration framework, must enable identifiable information management needs, to be captured and differentiated through distinct user experiences (such as via goal and scenario modelling).

The Enterprise challenge : Information and knowledge integration

In the context of approaching the best auspices of information and knowledge management, the business computing environment in most enterprises today includes a hybrid mix of information technology (IT) as well as information system (IS) components. Whereas the former prescribes the usage of technology-based resources, the latter more broadly defines a range of IT-enabled business processes which involve human interaction (Willcocks, 1994). This disparate mix of enterprise software which range from legacy, through to best of breed and packaged applications, have tended to have been developed more often than not in a reactive manner to external competitive forces, as opposed to in a proactive planned fashion. Therefore many enterprises today can suffer from a complex set of incompatible information systems with fragmented and diverse ontologies, information repositories, formats, heterogeneous computing platforms, and various programming models (e.g. Klasell and Dudgeon, 1998). In particular, with the trend for the deployment of enterprise and other resource planning systems, there has been significant scope for the failure to integrate an organisation's core processes, by as much as 30% (Seeley, 1999). This is not, at its best, expected to provide a one stop solution to the integration problem because ERP systems tend to provide a suit of integrated applications, rather than specific a enterprise infrastructure for all legacy and future systems integration (Brown, 1999). For full integration, the enterprise requires coordinated software application networks that can share data to overcome such technical difficulties (Klasell and Dudgeon, 1998).

Once such approach to stem this problem, is via Enterprise Application Integration (EAI) technologies. Enterprise Application Integration (EAI) promises integration functionality extending beyond the earlier enterprise bridging technologies such as Middleware Technologies, Message Services, Standards and Protocols. Linthicum (2000) defines Enterprise Application Integration as the "unrestricted sharing of information between two or more enterprise applications. Thus, EAI is more than simply a middleware, workflow, or data transformation approach; rather, it is a technical solution set that attempts to address each of these aspects of enterprise automation. According to Ring and Ward-Dutton (1999), Enterprise Application Integration "combines the technologies and processes that enable customer built and/or packaged business applications to exchange business-level information in formats and contexts that each understand".

The aim of EAI is to serve the efficiency and effectiveness of individual business processes within intra-inter-organizational supply chains. Thus the elements of integration that EAI provides are typically based around messaging, brokering and process-based integration between enterprise applications. Additionally, intra-inter-enterprise and hybrid application integration approaches, may be required at all levels of an enterprise in order to cover the spectrum of business processes and practice logics, in terms of data, objects and processes ((Badii 95-2001; Badii *et al*, 95-2001 ; Themistocleous, Irani, Sharif 2000). There is considerable confusion around the definition of various types and levels of application integration, although several authors have attempted to evaluate and classify the terminology into the following broad categories: (Duke *et al*, 1999; Grimson *et al*, 2000; Hasselbring, 2000; Sprott, 2000; Themistocleous, Irani & Sharif, 2000). These are Application Integration, System Integration, Value Chain Integration and Enterprise Application Integration. Further decomposition of these definitions, lead to two distinct categories which need to be differentiated:

- *Application Integration*: suggests that EAI is a technology that solves only a part of the application integration problem (package-to-package integration).
- *Enterprise Application Integration*: describes general issues of integration area as well as providing solutions to integration problems. EAI software combines EAI tools with existing software solutions. Case studies support this category of definition as they indicate that EAI products do not solve only package-to-package integrations.

Enterprise Application Integration or Application Integration approaches can be another set of terms that could be confusing. This area can be further devolved into Technical Integration Approaches, and, Application Integration Scope Approaches as follows:

- *Technical Integration Approaches*: describes in technical terms the main layers of integration: Transport layer, Translating and Formatting layer, Processes Automation layer.
- *Application Integration Scope Approaches*: describes the scope of the application integration, divided into Data Integration, Component Integration, Package-to-Package integration, Customer Applications Integration, e-Business Integration, Process Integration.

Particular instances of intra-inter-enterprise Application Integration Scope Approaches are highlighted by Value Chain integration (VCI), and Inter-organisational Application Integration (IAI). Yang and Papazogluou (2000) defined a new category of integration called Value Chain Integration (VCI) that incorporates applications of the same value chain across companies. In particular they stated that "Value Chain Integration means that an enterprise's business system can no longer be confined to internal processes, programs, and data repositories, rather they must incorporate with other such systems that support links in the supply chain". Inter-organisational Application Integration (IAI) can be defined as the technology that supports (B2B). Here the integration focuses on external processes. Three scenarios are distinguished for e-Business application integration (Helm, 2000): (a) enabling extended enterprises, (b) enabling virtual enterprises and (c) e-commerce Application Integration. Virtual Enterprises Application Integration refers to inter-organisational applications that are characterised by the highest degree of dependency i.e. if one partner fails to execute a process in this category of e-Business applications then all the partners will fail (Themistocleous and Irani, 2000).

EAI integrates applications at a functional level, not just at the user interface or data level. In addition EAI adds value by placing business logic in the applications network and creating a more dynamic IT infrastructure than can otherwise evolve within a company (Linthicum, 1999). According to Urlocker (Urlocker, 2000) the main benefits of EAI are as follows: (a) improving organisational performance and operational efficiency, (b) providing an efficient centralised point of control, (c) providing value added services, (d) decreasing maintenance efforts, (e) reducing the skill level required to integrate applications, (f) allowing faster time to market and (g) increasing market share.

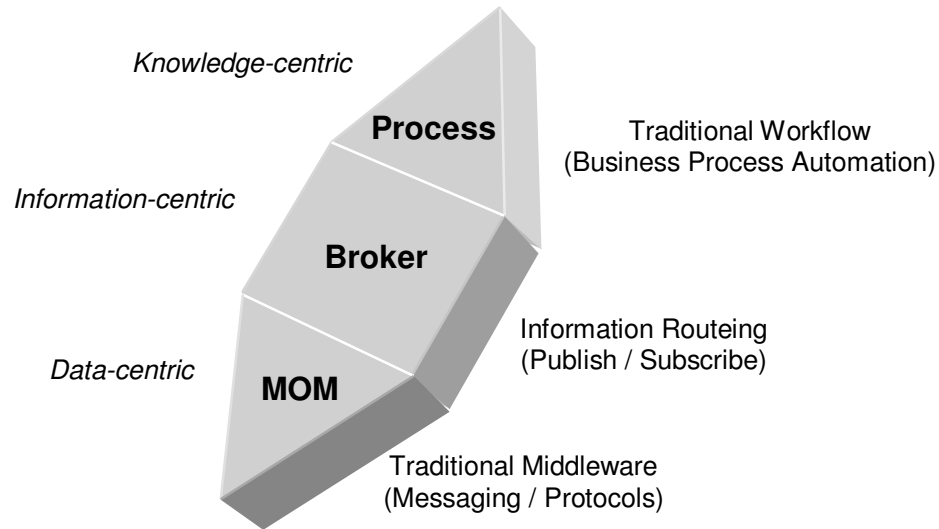


Figure 2. Components of Enterprise Application Integration

Thus, the essence of e-business in this light, is towards integrated business and the facilitation of the sharing of non-sensitive resources for mutual benefit i.e. to overcome generic market barriers such as standards seeking and making and re-intermediation services e.g. Trusted Third Party and Global Arbitration Services. The authors share the view, widely held amongst IS researchers and business re-engineering professionals, that the adoption of ERP systems within organisations, has tended to have exerted a harmonising influence over sectoral practice logics amongst competing companies (Davenport, 1998). This has caused some companies to lose some of the competitive advantage rooted in their previously distinct business logics. The human resources impact, particularly the threat, if not the actual certainty, of re-deployments and redundancies must also be kept in mind as these can lead to passive or active resistance to change manifesting as sabotage of the ERP projects as has been mentioned by several authors (such as Motsios, 1999).

Although information sharing on goods or services flowing across the supply chain may be necessary, it can potentially lead to risks of inadvertent exchange of competition-sensitive data amongst potential industry rivals. Here the application of prudent information relationship management regimes will be necessary and these could be dynamically updated and monitored by a framework such as Boundary Sensitised Information Relationship Management, BSIRM (Badii and Rolfe, 1995-1996). Hence, the future e-Business architectures will be expected to cope with mobile and pervasive computing with end-to-end eContent Management, Knowledge Integration and Mass-Personalisation to serve virtual communities (Badii, 2000-2001 ; Badii et al 200-2001). The parallel development of e-commerce (EC) and EAI opens the possibility for companies to distinguish themselves by the innovative ways in which they harness integrated EC-EAI in continuous relationship-driven value innovation i.e. to support new series of business models and new series of market advantages into the future (as is found in CRM business models).

EC-EAI implies a close coupling of Enterprise Applications with front and back-office e-Business Solutions, Customer Relationship Management (CRM) including Call-Centre Fulfilment Services and Supply Chain Management (SCM) applications to improve not just the enterprise's own

processes but also those of the entire value network external to it; i.e. inter-enterprise integration of business processes such as to enable relationship-building capabilities. This must also include application integration (AI) or rather Application to Application (A2A) integration. This assumes that the rather monolithic browser-server architecture of today will eventually have to give way to a micro-kernel architecture of distributed objects repositories to be deployed under programmable remote control. Such a web of services will constitute a multi-layer "plug-and-play" open architecture serving as a cost-effective re-usable and re-configurable backbone system for collaborative and mobile commerce.

Lifecycle end-to-end Evaluation and Knowledge Integration Architecture

The imperatives for full IS integration then, should not only include concepts of information integration in terms of integration across data, information and processes, but also a manner by which to evaluate such conformance across the various levels of abstraction within an enterprises' IS. The components of such an evaluative framework are now outlined below, in the context of the need for end-to-end knowledge, decision and workflow-based integration and evaluation. This approach supposes the negation, of organisational and decision maker cognitive overload and structural rigidities across time, place and space as previously published (Badii, 2001a). End-to-end IS-mediated knowledge integration and evaluation are essential in order to protect and promote the enterprise success by leveraging the available opportunities for deploying a balanced mix of business models. What is needed is a convergence of technology best practice and information content in a distributed environment of personal, autonomous agents and community computing to support cooperative, virtual and physical environments. This is underpinned by the re-negotiability-centric information systems architectures such as C-Assure (Cultural Accommodation with Sensitised Systems for Usability Relationships Evaluation (Badii 1999b, Badii 2000a-e).

C-Assure integration supports innovation and change management intra-inter-enterprise i.e. within businesses as well as within virtual trade exchanges and networked enterprises. These will constitute operating platforms for resilient business eco-systems practicing Relationship Management for Mutual Benefit (RMMB, Badii & Rolfe 1996, Badii 1995-2001) within the overall Return-on-Relationship (ROR) approach to knowledge integration and IS evaluation Badii (1997-2000). This approach is a theoretically grounded and practically tested framework of models, tools and techniques for knowledge integration and integrative IS evaluation to facilitate re-negotiability, holistic in-situ evaluation and located accountability. The ethos motivating C-Assure, has been to harness established psycho-social and psycho-physiologically-grounded patterns-of-relating, personal and social memories, and theories of actability, pleasure, pain and preference. This is aided by exploiting such theories in order to elicit and continuously refine models of stakeholder preferences thus exposing deeper customer values and usability knowledge (Badii, 2001a). Accordingly C-Assure supports, both data-driven and model-based analysis of user/customer value judgements and decision making throughout various interacting lifecycles. This is so as to build, test and thus maintain models of user (dis)-satisfaction, innovation and cultural development and loyalty trajectories and elasticities.

The C-Assure meta-methodological framework comprises an enquiry and knowledge co-generation methodology, a knowledge integration architecture, a set of tools, for example on-line workflow-embedded consultation tools for in situ evaluation i.e. local evaluation as well as global evaluation tools and models. For example, this includes the Pop-Eval Family (Badii and Murphy, 1999 ; Badii 2000c), the MMREA (Hounat and Badii 1996), Workflow Integration and Impact Analysis (Zhang,

Badii and Hounat 1997 ; Badii *et al*, 1995-2002 ; Eva & Badii 1998). These are integrated within the C-Assure framework to facilitate e-CRM-driven innovation of mass-personalised systems and services with high need-fit usability. It is in support of the need for the so-called change management, actually co-generative enquiry and knowledge creation facilitation in C-Assure, that knowledge integration must allow for a reflexive layer to allow organisational learning to occur as shown in depicted in Figure 3 below (and as noted in Badii and Sharif, 2002):

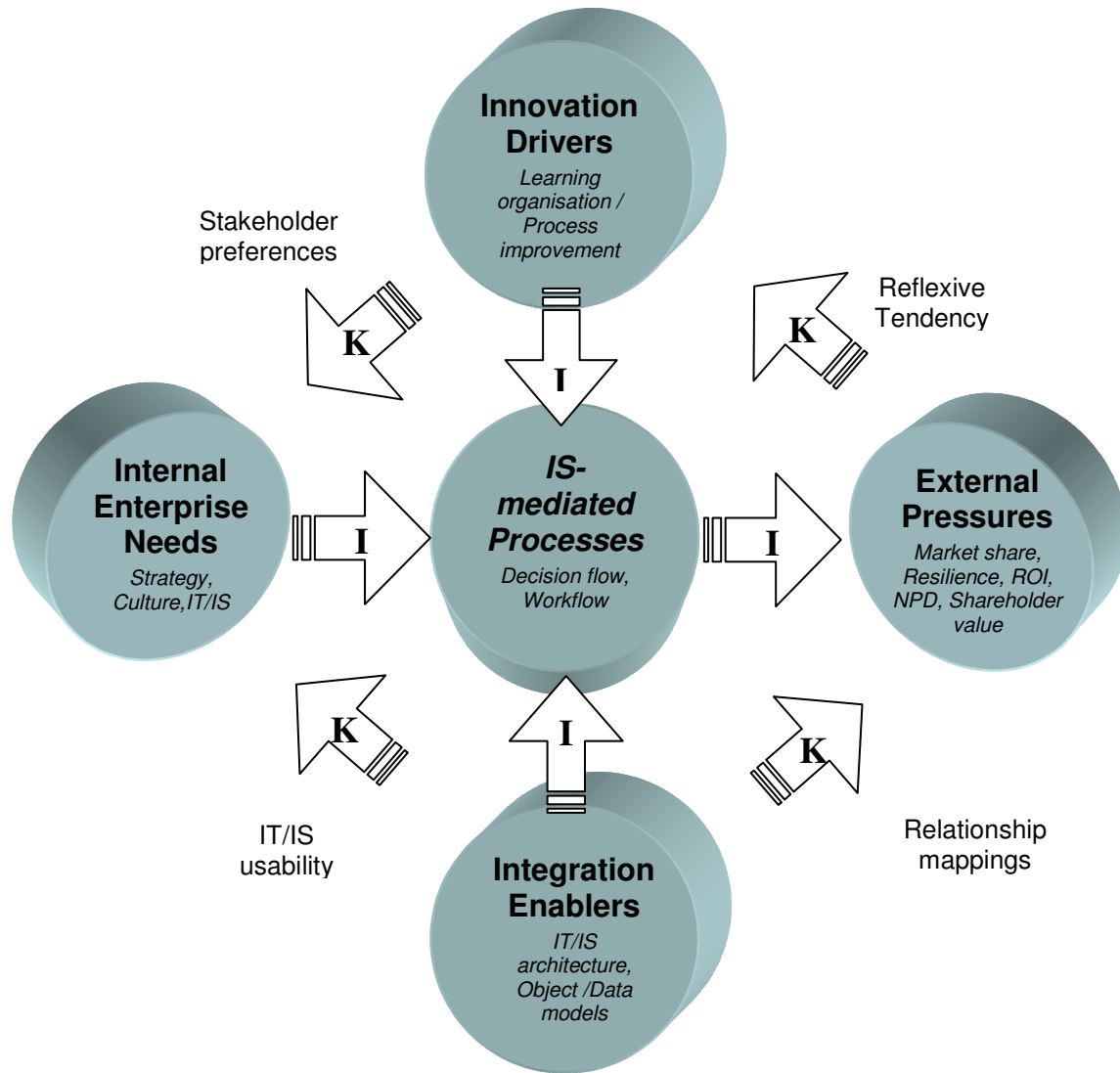


Figure 3. An integrated Enterprise Information Integration and Knowledge framework

The C-Assure Effects-Affects matrix (Badii 2000a,c), provides the backdrop to this framework where a matrix of both spoken and unspoken, but nonetheless measurable benefits, dis-benefits, side-effects and affects are associated within the enterprise environment. This is specified by a representation of *context* including the *Affordances-Resonances* knowledge for each agent. This supports the evaluation of the impact of relevant changes involving actants, processes and situated contexts as experienced by all stakeholders. This is shown in the diagram as the feedback between external competitive pressures and internal, enterprise requirements, based upon information (I) and knowledge (K) dependencies. Essentially this multi-model metric involves the evaluation of all effects, side-effects and affects in terms of their RMMB-based value or saliency rating as experienced by all persons, processes, partners interacting within each located accountability context.

The design for located accountability implicit in C-Assure thus also implies decision flow-workflow integrated RMMB-based evaluation of Information Systems throughout their lifecycle. This implies both ex-ante and ex-post evaluation of investments at the point of decision-making and throughout systems lifecycle from inception to obsolescence. Both time-to-evaluation and cost of evaluation for tactical systems have to be minimised given the rapid pace of innovation. Thus as C-Assure accommodates representations for both the deep usability knowledge as well as the pre-compiled form, it supports both deep and extensive evaluation of large multi-agency systems such as e-Government systems as well as cost-effective, and fast, but Holistic Heuristic evaluations of web-enabled systems for rapid competitive advantage in fast changing markets (Badii & Zhang 2001, Badii & Smith 2002).

The resulting framework shown above, complements these aspects which are inherent in the C-Assure framework by also including the integrative qualities which are dependent upon the deployment and dissemination of both information and knowledge (shown as the letters I and K respectively). This is in terms of both innovation drivers and integration enablers (for example, organisation learning and EAI interfaces). The evaluation of this enterprise information and knowledge integration structure, is therefore inherent in IS-mediated processes which provide input to each of these components.

Conclusion

The pace of availability of enterprise touch points and their usage by customers has outstripped the firms' ability to integrate new information from new IS applications. The resulting fragmented collection of customer data can lead to inconsistencies in relationship understanding and management, poor customer centric value proposition and thus loss of business advantage and markets.

Technologies that will clearly require and will need to leverage such enterprise IS infrastructure as e-stores, bio-metric identification (security), and wireless connectivity (sales force automation, and personal information management), can only be realised when information can be clearly derived from their core enterprise systems and through their touch points. Enterprise technologies and concepts such as ERP, business intelligence and supply-chain management can then be exploited to yield sustainable business advantage. A departure from the rather monolithic browser-server architecture of today is needed to allow migration towards a micro-kernel architecture of distributed objects, repositories and web of services to be deployed under programmable remote control in an environment of pervasive and context-aware computing. These emerging e-business environments

allow virtual user communities to become active participants in the enterprise value chain to the extent of becoming part of its service and support infrastructures.

Technology integration must not mean straitjacketing of the e-business value innovation and supportive business process architectures. Flexibility and agility of the infrastructure must remain the primary goal of the modern enterprise. Accordingly integrated decision flow-workflow embedded holistic evaluation must be part of the Enterprise Application Integration infrastructure so that the impact of all change management and innovation on processes, systems, structures and above all human resources , organisational culture and patterns-of-relating can be fully and cost-effectively monitored.

The enterprise should seek to exploit the synergy between Object Enterprise modelling and re-design and thus component-based context-aware business computing, heterogeneous technologies, data and content convergence management. This will also include new business object sourcing regimes such as new best-of-breed component outsourcing and smart e-sourcing through a management mix of relationships with ASPs, AIPs and with competitors in the sector, e.g. via B2Bs as middleware and Trusted Third Party services providers, through value network partners as well as by in-house development of sensitive and critical components. These approaches would require industry standards for deeper transaction semantics such as extended XML-like and semantic web technologies. Increasing customer empowerment and the need for social inclusion and re-negotiability, indeed located accountability, of everything poses significant IS integration challenges that have to be met. These challenges include the need for mass-personalisation services and global access to everything, always (Badii 2001-2002).

In this context, the significance of the re-negotiability-centric design of C-Assure (Badii '95-2002) was examined. C-Assure supports both data-driven and model-based analysis of user/customer value judgements and decision making throughout various interacting lifecycles. The C-Assure representation space for holistic heuristic usability-actability knowledge can facilitate both deeper and extensive evaluation of large multi-agency systems such as e-Government systems as well as cost-effective and fast but Holistic Heuristic evaluations of web-enabled systems for rapid competitive advantage in fast changing markets (Badii & Zhang 2001, Badii & Smith 2002).

It is concluded that such integrative local and global evaluation and its implementation as a framework of tools and techniques constitutes an essential component of an enterprise knowledge integration backbone architecture to aid organisational sense making, learning, innovation and thus sustainable success. Through the presentation of a holistic, conceptual framework that brought aspects of information, EAI and the C-Assure model together, a generic ontological view of knowledge integration was presented. It is thus proposed that further research into best practices of decision flow-workflow embedded holistic evaluations and their impact on the knowledge-based networked economy, where the balance of internal enterprise requirements and external competitive forces need to be met, merits serious and systematic study and should constitute a key plank of a research strategy for technology management.

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