# Information management and knowledge integration for enterprise innovation

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**Keywords**

Information management, Information systems, Knowledge, Integration

**Abstract**

The key trends in emerging ICT integration choices for cost-effective, flexible knowledge integration, work-flow-embedded evaluation and eCRM-driven value innovation are examined. Enterprise knowledge integration initiatives can create socio-technical and cultural tensions as well as possible straitjacketing of business process architectures thus suppressing responsive business re-engineering and causing loss of competitive advantage for some companies. A framework, C-assure, is presented for optimising knowledge integration, impact analysis and evaluation to support innovation throughout the various interacting enterprise lifecycles.

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## Introduction

A business environment where the only certainty is 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 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 wake of the era of "rational exuberance" after 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 that this reliance exists, and notwithstanding geopolitical and 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 for sustainable success business models would need excellent information management and knowledge integration support. The annals of information systems (IS) case studies have shown us that what differentiates enterprise success from failure is business model resilience and this implies agile customer-centric value innovation. Those organisations that have survived both the technological and process integration fashions of the recent decade, have had ample chance to re-learn some old lessons about business practice realities. For instance:

- how to harness information and communication technologies (ICT) to become niche players in their market;
- how to assess the worth of their human and intellectual 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, whilst returning shareholder value.

The authors wish to gratefully acknowledge the support from the Network for IS Evaluation (NISE) Research Programme. NISE was established at Brunel University Department of Information Systems and Computing under a research grant from the UK Engineering and Physical Sciences Research Council (EPSRC) [GR/R08025/01].

Logistics Information Management
Volume 16 · Number 2 · 2003 · pp. 145-155

DOI 10.1108/09576050310467287

Logistics Information Management
Volume 16 · Number 2 · 2003 · 145-155

As has been the case since the mid-1980s successful and progressive organisations will distinguish themselves by how effectively they can leverage their ICT function to maximise their agility in the marketplace. 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. However, no single panacea exists for this. Rather, the wholesale realignment of business processes with resilient open ICT infrastructures is required. As such, the basis for ICT integration is in the rationalisation of function, process and technological components (Zachman, 1987). This approach to enterprise-wide computing architecture is well known and understood to be a good starting point for managing information and process flows. However, organisations have learnt to appreciate that flexibility of ICT including a deep harmonisation of core enterprise systems (e.g. 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, have been developing functionality that requires at least some of the core components to be present, as a skeleton on which to hang other enterprise computing resources.

For example, a recent trend has been to develop enterprise-wide portals that allow not only employees but also potential customers, clients and partners to access a company's business information, through Web technologies (e.g. Badii and Zhang, 2001). This has been shown to be an attempt to fix the consequences of ICT implementations that took place in the late 1990s, in the rush to deliver some integration through electronic resource planning (ERP) platforms, customer relationship management (CRM) and other electronic commerce (EC) applications deployed on an early-adopter basis.

## 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 a problematic choice of terminology unless "management" were to refer to a very narrow definition of the word. Similar concerns are shared by a number of leading IS researchers (e.g. Galliers and Newell, 2000). We envisage a data centred, context sensitive computing architecture, i.e. a 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); this is a process that may be facilitated by ICT to yield knowledge that may be more amenable to attempts at its own useful integration rather than its "management". Knowledge by nature is born of reflection and its subjectivity and emergent qualities arising from naturally occurring processes would mean that it is ill-posed to seek a generalised approach to "managing" it. Hence, if knowledge is not directly amenable to being managed, at least in some part, this poses the question of what is implied by knowledge integration?

Knowledge integration implies that timely insights can be made available to be drawn at the right juncture for sense making by the transactors, i.e. knowledge can be exchanged, shared, 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.

In the wake of Internet technologies an enormous wealth of data is being continuously generated at new enterprise touch points and communication channels, as well as externally, in the form of emails, Web sites, Web services, Web clients, mobile or otherwise – leading to information overload. The enterprise's response to such information management challenges is largely determined by the way it can organise the effective logistics of information management to have the right information available for the right purpose at the right time, place and space (Badii, 2000a; Badii and Sharif, 2002). For

Logistics Information Management
Volume 16 · Number 2 · 2003 · 145-155

this the actual logistics of information management must focus on maintaining context sensitivity, i.e. context-aware business computing. This is consistent with enterprise object modelling, component-based computing and new ICT e-sourcing regimes such as the application service/integration provider sector (ASP/AIP) that characterise the changing face of the enterprise software environment. Context-aware knowledge integration requires that the enterprise information management platform is standards-aware for at least XML-like semantic tagging, if not deeper transaction semantics (Badii, 2001). This implies an enterprise information representation, storage and access framework that can sensitively handle the aspects of:

- information ownership (by stakeholders);
- information scalability (within ICT lifecycles);
- contextuality (interpretation relative to interacting humans, processes and data); and
- navigability (ease of access).

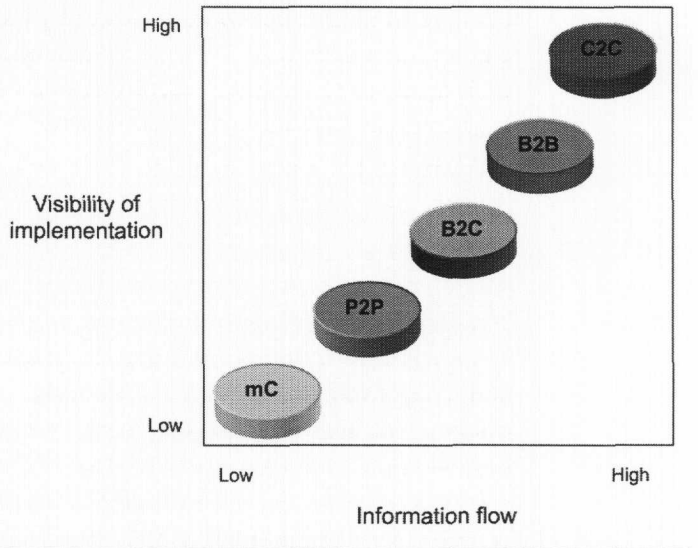
A framework is required to specify the points where need and use of information arises, and, where the relative information intensiveness of enterprise touch points lie so that adequate provision is made to service and integrate such points properly in order to avoid the fragmentation of customer information. 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.

This illustrates the information intensiveness and accessibility arising, ostensibly, from the main "e" business models which have emerged in recent years, that is:

- B2B (business to business);
- B2C (business to consumer);
- C2C (consumer to consumer);
- P2P (peer to peer); and
- 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. For example, studying

**Figure 1** Information requirements for Internet-based enterprise models




e-CRM data derived from a multitude of enterprise touch points, often fails to yield real insight for lack of a sufficiently deep representation of the situated semantics of the transactions (Badii, 2001; Badii *et al.*, 2000). It is possible therefore that much so-called personalisation, particularly on Web sites, can be mis-informed and thus result not so much in customer satisfaction as irritation and defection. There can be no full realisation of the potential contribution of data intelligence to enterprise innovation without knowledge integration and no knowledge integration without full linkability and adaptability and thus dynamic representation of business information – in context (Badii, 2001). The success of both wholly Internet brands such as Amazon.com, as well as "bricks-and-clicks" companies such as Barnes and Noble, is testimony to the fact that only agile customer-centric enterprises, underpinned by superior knowledge integration, have remained resilient irrespective of the channel of distribution.

However as touch points have proliferated, for many enterprises, industry resources have simply not been able to keep up with the challenges of properly integrating knowledge from each channel given the relative speed of introduction in order to sustain competitive advantage. The potentially huge volume of data which can be collected from a variety of touch points, within and outside ICT-based enterprises, implies a significant information management load in consistency checking, data cleaning, security, filtering, warehousing, pattern mining, pattern forecasting,

Logistics Information Management
Volume 16 · Number 2 · 2003 · 145-155

knowledge discovery and knowledge integration. This has made information management and thus knowledge integration a rather challenging goal. Coupled with the mounting demands for the integration of heterogeneous ICT systems and best-of-breed applications in the enterprise, there is a propensity for information and knowledge integration gaps to exist. Therefore 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 is yet to achieve the objectives of a fully automated commerce and supply chain logistics for the greater majority of enterprises. Traditional "old economy" information management and logistics, is expected to support "new economy" processes and ICT implementations in a perverse twist of supply and demand (Sharif, 2002). To effectively manage this information overload, ICT systems and services need to become context-aware and have decision-making capabilities. This can range from providing a search or cataloguing service through to services which are able to discern between media-variant, content-variant, context-invariant types of information (for example, a text document or a streaming video file which may relate to similar information or process).

In addition, the integration systems and services would be expected to include seamless interfaces to device and system management components (e.g. operating system, network or a peer Internet group), which can filter and integrate information into other devices (e.g. 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 above processes can be powerfully aided by Internet-enabled and Internet-native technologies such as XML and its extensions for descriptive tagging and future deeper transaction semantics.

## Information and knowledge integration

The business computing environment in many enterprises today includes a variety of applications such as legacy, best-of-breed and packaged applications that have been developed often in response to the ICT manufacturers' marketing, and, sectoral competitive forces rather than as part of any proactive strategic planning for the digital transformation of the enterprise.

Therefore many enterprises today can suffer from a complex nest of incompatible ICT with fragmented and diverse ontologies, heterogeneous computing platforms, information repositories, formats and various programming models (e.g. Klasell and Dudgeon, 1998). However such enterprises are unlikely to find a sufficient remedy through deployment of ERP. ERP at its best is not expected to provide a one-stop solution to integration problems because ERP provides a suit of integrated applications rather than an infrastructure for all legacy and future systems integration (Brown, 1999). The full integration of the enterprise requires coordinated software application networks that can share data despite the technical difficulties (Klasell and Dudgeon, 1998). ERP requires complex, bespoke interfaces to be developed to bridge data and process gaps.

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-organisational supply chains. Thus the elements of integration that EAI provides are typically based around

Logistics Information Management
Volume 16 · Number 2 · 2003 · 145-155

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 (e.g. Badii, 1996; 2001; Themistocleous *et al.*, 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 four broad categories (Duke *et al.*, 1999; Grimson *et al.*, 2000; Hasselbring, 2000; Sprott, 2000; Themistocleous and Irani, 2000). These categories are application integration, system integration, value chain integration and enterprise application integration. Further breakdown 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 (i.e. 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 extend beyond 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 and processes automation layer; and
- *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 and process integration.

Value chain integration (VCI), and inter-organisational application integration (IAI) highlight particular instances of intra-inter-enterprise application integration scope approaches. Yang and Papzoglou (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:

> 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 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):

(1) enabling extended enterprises;
(2) enabling virtual enterprises; and
(3) 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 ICT infrastructure than can otherwise evolve within a company (Linthicum, 2000). According to Urlocker (2000) the main benefits of EAI are as follows:

- improving organisational performance and operational efficiency;
- providing an efficient centralised point of control;
- providing value added services;
- decreasing maintenance efforts;
- reducing the skill level required to integrate applications;
- allowing faster time-to-market; and
- increasing market share.

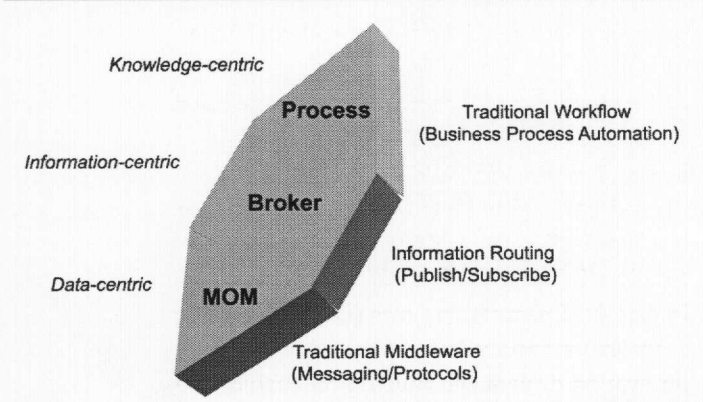
Figure 2 illustrates the components of enterprise application integration. The essence of e-business is integrated business and the facilitation of the sharing of

Logistics Information Management
Volume 16 · Number 2 · 2003 · 145-155

non-sensitive resources for mutual benefit, i.e. overcoming generic market barriers through standards seeking and re-intermediation services, e.g. trusted third party and global arbitration services. The increasing influence of virtual marketplaces beyond re-intermediation to include new ways of IS e-sourcing and integrating is seen as leading to new intermediaries. Thus the emerging integration technologies will need to accommodate the various modalities of vertical and horizontal exchange commerce to support supply chain management and e-CRM-driven innovation within different business-to-business (B2B) eco-systems.

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 exert 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 observed by previous case study research by a number of researchers in the field (e.g. Themistocleous and Irani, 2000). From a security viewpoint, although information sharing on goods or services flowing across the supply chain may be necessary, it could lead to risks of inadvertent. exchange of competition-sensitive data amongst potential industry rivals.

**Figure 2** Components of enterprise application integration




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) to support networked economy business models based on relationship management for mutual benefit (RMMB), (Badii and Rolfe, 1996), and return-on-relationships (RoR) investment and evaluation strategies (Badii, 2000b). The trend towards such value networks underpinned by RMMB means that future e-business architectures will be expected to cope with mobile and pervasive computing with end-to-end e-content management, knowledge integration and mass-personalisation systems and Web services to serve virtual communities (Badii, 2000a, b). Furthermore the parallel development of electronic 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 BSIRM-driven value innovation, i.e. to support new series of partnership-based business models and new series of market advantages into the future, e.g. as inspired by new Web-enabled CRM-centric and net-economy oriented 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 to support the networked

Logistics Information Management
Volume 16 · Number 2 · 2003 · 145-155

economy for collaborative and mobile commerce (Badii, 2001).

## Situated evaluation and knowledge integration

The imperatives for full ICT integration include continuous IS evaluation integration at various levels of abstraction. These are outlined below in the context of the need for end-to-end knowledge, decision flow and workflow integration and evaluation without causing organisational and decision maker cognitive overload and structural rigidities across time, place and space (Badii, 2000b). Thus end-to-end ICT-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 personal and collaborative effectiveness. This is underpinned by a re-negotiability-centric information systems architecture, C-assure, encompassing a framework of requirements/evaluations representation, tools and methods described briefly here with fuller description provided in references. C-assure stands for "Cultural Accommodation with Sensitised Systems for Usability Relationships Evaluation" (Badii, 2000a, b). C-assure integration supports innovation and change management intra-inter-enterprise, i.e. within businesses as well as across virtual trade exchanges and networked enterprises. As such C-assure supports the goal-oriented stakeholder-centred and thus resilient business eco-systems practising relationship management for mutual benefit (RMMB), within the overall return-on-relationship (RoR) approach to knowledge integration and ICT evaluation (Badii, 2000a, b).

C-assure is a theoretically grounded and practically tested framework of models, tools and techniques for knowledge integration and integrative ICT evaluation to facilitate re-negotiability, holistic *in-situ* evaluation and located accountability. The ethos motivating C-assure, has been to harness established psychosocial and psycho-physiologically-grounded patterns-of-relating, i.e. personal and social memories *modus operandi*, and theories of actability, pleasure, pain and preference. The above theoretical framework is used in stakeholders' preferences elicitation and processing to support behaviour and relationships modelling thus exposing deeper customer values and usability knowledge (Badii, 2000a, b).

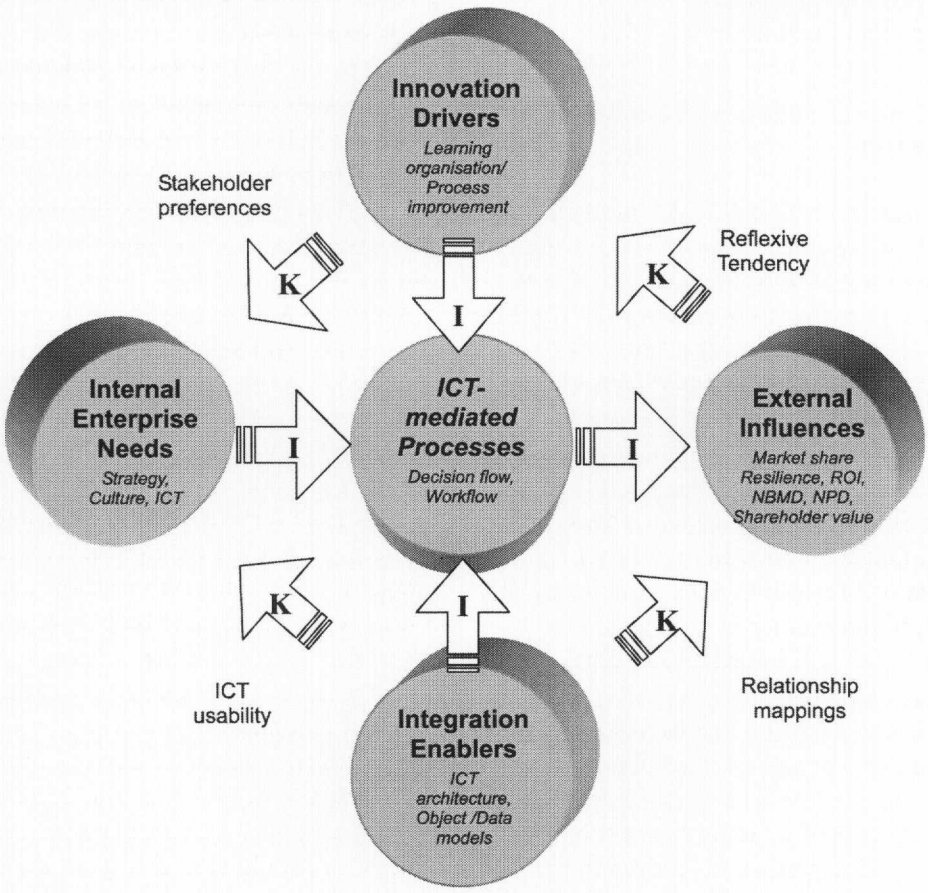
Accordingly C-assure supports, both data-driven and model-based analysis of user/customer value judgements and decision making throughout various interacting lifecycles. This is so as to build, test and thus maintain models of user (dis)-satisfaction, innovation, their cultural development trajectories and their loyalty elasticities (Badii, 2000a, b).

The C-assure methodological framework comprises an enquiry and knowledge co-generation methodology, a knowledge integration architecture and a set of requirements elicitation and impacts tracking tools. For example on-line workflow-embedded consultation tools for *in-situ* usability knowledge elicitation, workflow-embedded ICT evaluation and users' preferences tracking, i.e. local evaluation. This includes:

- the pop-eval family (Badii, 2000a, b);
- the multimedia requirements engineering assistant (MMREA) (Hounat and Badii, 1996);
- workflow integration and document management systems (WF-DMS); and
- integration, impact analysis, and, holistic heuristic evaluations (Badii and Zhang, 2001).

These are included 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 referred to as co-generative enquiry and knowledge creation facilitation in C-assure, that knowledge integration must include a reflexive layer to allow organisational learning to occur at various levels as indicated in Figure 3 (adopted from Badii and Sharif, 2000). This shows the integrative information flows (I) and knowledge flows (K) respectively in terms of both innovation drivers and integration enablers (i.e. organisational learning and EAI interfaces).

**Figure 3** An integrated enterprise information management and knowledge integration framework




The evaluation of such enterprise information and knowledge integration structure should therefore be inherent in ICT-mediated processes, which provide input to the internal value chain and the sectoral value networks.

The C-assure effects-affects matrix (Badii, 2000a, b) provides the analysis base for this framework using a matrix of both spoken and unspoken, but nonetheless measurable, benefits, dis-benefits, side-effects and affects in the enterprise environment. This analysis base is enriched by the C-assure representation of context including the affordances-resonances knowledge for each agent. This represents the ends-means aspect of the analysis within a stakeholder-centred and goal-oriented focus. This is for the local and holistic evaluation of the situated impact of relevant systems involving all the agents implicated at various levels. This is shown in the diagram as the feedback between external competitive influences and internal, enterprise requirements, based upon information (I) and knowledge (K) flows and 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. Thus the design for located accountability implicit in C-assure ensures decision flow-workflow integrated RMMB-based evaluation of information systems. This therefore implies both *ex-ante* and *ex-post* evaluation of investments at the point of decision-making and throughout systems lifecycles 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 in progressively mature markets with increasingly shorter product/service shelf lives and thus faster innovation cycles for both new business model development (NBMD), and, new product/service development (NPD).

The C-assure analysis base provides a representation for both the deep usability knowledge as well as the pre-compiled form, i.e. the heuristically refined usability knowledge, it supports both deep and extensive evaluation of large multi-agency systems such as e-government systems as well as cost-effective holistic heuristic evaluations

Logistics Information Management
Volume 16 · Number 2 · 2003 · 145-155

of Web-enabled systems and services for rapid competitive advantage in fast changing markets (Badii and Zhang, 2001).

## Conclusion

As enterprise touch points proliferate, their ready availability and use by customers can lead to a data flood that can outstrip a firms' ability to integrate new information from new ICT applications. The resulting fragmented collection of customer data can lead to inconsistencies in relationship understanding and management, lack of customer-centric value proposition and thus loss of business advantage and markets. It is argued that the above trend and its implications regarding enterprise integration for maximum resilience and advantage need fundamental re-thinking. Accordingly, in this paper, the current typology and emergent forms of enterprise resource planning (ERP) and enterprise application integration (EAI) technologies have been set in the context of understanding the knowledge integration objectives to serve innovation and relationship management.

These new technologies will require, and will need to leverage, such enterprise ICT infrastructure as e-stores, bio-metric identification, wireless connectivity and personal information management. This can only be realised when information can be usefully derived from 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. This would 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 context-aware computing (Badii, 2000a, b).

The advent of component based business computing and its new ways of e-sourcing and ICT maintenance has led to a new enterprise software service environment whereby plug-and-play technology is available from application service providers (ASPs), application integration providers (AIPs) and e-business solution providers (EBSPs) through a range of increasingly Web-services oriented sources.

This offers attractive and flexible routes to the provision and maintenance management of end-user systems and services to enable rapid deployment of e-business models. 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 infrastructure.

However technology integration must not be allowed to cause a 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 enterprise. Accordingly integrated decision flow-workflow embedded holistic evaluation must be part of the enterprise application integration infrastructure. Thus the impact of all change management and innovation on processes, systems, structures and above all human resources and organisational culture should 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 managed 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, 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.

A re-negotiability-centric design for architectural and organisational discourse and located accountability provides a

Logistics Information Management
Volume 16 · Number 2 · 2003 · 145-155

cost-effective framework for integrative lifecycle evaluation. In this context the key contributions of the C-assure framework (Badii, 2000a) were described as mediating end-to-end knowledge integration and holistic decision flow-workflow embedded evaluation. C-assure supports both data-driven and model-based analysis of user/customer value judgements and decision making throughout various interacting lifecycles. Thus it can facilitate both deeper and extensive evaluation of large multi-agency systems such as e-government systems as well as cost-effective holistic heuristic evaluations of Web-enabled systems and services for rapid competitive advantage in fast changing markets (Badii and Zhang, 2001).

It is concluded that such integrative evaluation and its implementation, as a framework of tools and techniques constitutes an essential component of a knowledge integration architecture to aid organisational sense making, learning, innovation and thus sustainable success. To support this, the C-assure framework encompasses the integration of information and knowledge flows, and, EAI within a holistic ontological view of knowledge integration. This provides a sufficiently rich but still manageable representation of dynamic usability knowledge to support holistic evaluation, preferences tracking and impacts analysis. It is thus proposed that further research into best practice routinisation of decision flow-workflow embedded holistic evaluations and their impact on the networked economy, merits serious and systematic study and should constitute a key plank of an agility research strategy for technology management.

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