Knowledge Repositories and e-Knowledge Commerce

This white paper explains how new technology applications and practices will transform the processing and sharing of knowledge by every individual, team, and organization. These technologies will enable enterprises to deliver the right knowledge and intelligence, to the right person, at the right time, on the right device, in the right language, and in the right context. Such knowledge will be created once, reused many time, and delivered securely. These developments will increase the effectiveness of individuals, teams, and organizations. In the process they will also reduce costs through unification of knowledge domains serving enterprises, professions, trades, causes, governments, and other groups. We use the term ***e-knowledge commerce*** to characterize the transactions involving this new form of knowledge processing and sharing.

A powerful breed of new technology architectures and standards is currently supporting the development of knowledge repositories/registries. These will link and release knowledge resources across the entire constellation of knowledge domains that constitute the knowledge universe. Moreover, enterprise technology platforms are being developed with robust capacities to: 1) provide portalized access to knowledge resources, much like a utility; 2) hierarchically manage and manipulate standards-compliant content; 3) integrate knowledge, learning, collaboration, and performance; and 4) autonomically perform sophisticated back-office functions, including tracking and sharing revenues from e-knowledge commerce. These platforms and technologies are critical to the development of e-knowledge commerce and the knowledge domains that sustain it.

Using these tools and techniques, knowledge users will actively contribute to their knowledge domains and share in revenues generated from e-knowledge commerce. This will lead to the extensive mapping and participatory development of knowledge domains across the knowledge universe. Individual knowledge domains will be supported by interoperable e-knowledge repositories/utilities and linked by networks of registries enabling sharing across the universe of knowledge domains. These developments will provide great opportunities for professional societies, trade associations, and other enterprises that can serve as stewards of the networks, technology architectures, and communities of practice necessary to support knowledge domains.

From e-Commerce to e-Knowledge Commerce

Over the past decade, e-commerce has made it possible for online customers to locate, evaluate, and purchase products, services, and experiences. In the process, new forms of marketplaces, reverse auctions, and other forms of exchange have emerged. But e-commerce is very limited in dealing with knowledge-based products and experiences. Today's e-commerce tools access knowledge that is mostly frozen in time and in static chunks representing books, articles, manuals, and other explicit forms. When dynamic digitized knowledge repositories exist, they are typically limited, vertical slices of proprietary knowledge maintained by publishers and other holders of intellectual property. The digital marketplace ecology consists of a jumble of vertical, proprietary silos. In this world, most knowledge domains are significantly fragmented.

These tools and techniques of e-commerce do not adequately support the repurposing, refining, and sharing of knowledge that is needed by modern practitioners, learners, and researchers within and across all knowledge domains. Knowledge domains are the particular "bodies of knowledge" that exist in all professions, industries, and trades across the entire knowledge space. Users need access to all knowledge and learning resources in their knowledge domains, with the capacity to link different repositories, track and pay for intellectual property, and share. Moreover, modern users want to participate in the co-creation of knowledge resources, not just purchase a prepackaged bundle of other people's knowledge.

For these reasons, e-commerce is only one stage in the evolution of Web/Internet-based commerce for knowledge. Today, we are on the threshold of a new era. We call this coming time the ***age of e-knowledge commerce.***

e-Knowledge is the form that knowledge takes in a profoundly networked world. It is more than just a digitized collection of knowledge. E-Knowledge consists of shareable, standards-based knowledge objects including content, context, and insights on how to use, reuse, and repurpose them. It also includes links to communities of practice and repositories of tacit knowledge and tradecraft that can only be understood through conversations with knowledgeable practitioners, enabled through professional societies, trade associations, industry groups, non-governmental organizations, and other entities responsible for "bodies of knowledge." These conversations are best enabled and facilitated by authentic stewards of each particular knowledge domain.

E-Knowledge is transactable and the transactions based on the sharing of e- knowledge are called ***e-knowledge commerce.*** Many of these transactions are free, while others generate revenues that can be shared with knowledge producers and navigators.

The Leading Edge of Knowledge Domains and e-Knowledge Commerce

The leading edge of e-knowledge commerce and knowledge domains surfaces in many places. It can be viewed in the work of international standards bodies developing interoperability standards to support knowledge sharing. The Shareable Content Object Reference Model (SCORM) has been widely accepted as the basis for creating meta-tagged, shareable knowledge/learning objects. SCORM has been effective in providing interoperability of content and course materials across delivery platforms. But SCORM is silent on the issue of how content discovery and access are to be implemented across the multitude of registries.

A new standards effort is underway: the Content Object Repository Discovery and Registration/Resolution Architecture (CORDRA). It is an open, standards-based model for how to design and implement software systems for the purpose of discovery, sharing, and reuse of knowledge content. CORDRA paves the way for establishing interoperable federations of learning content repositories.

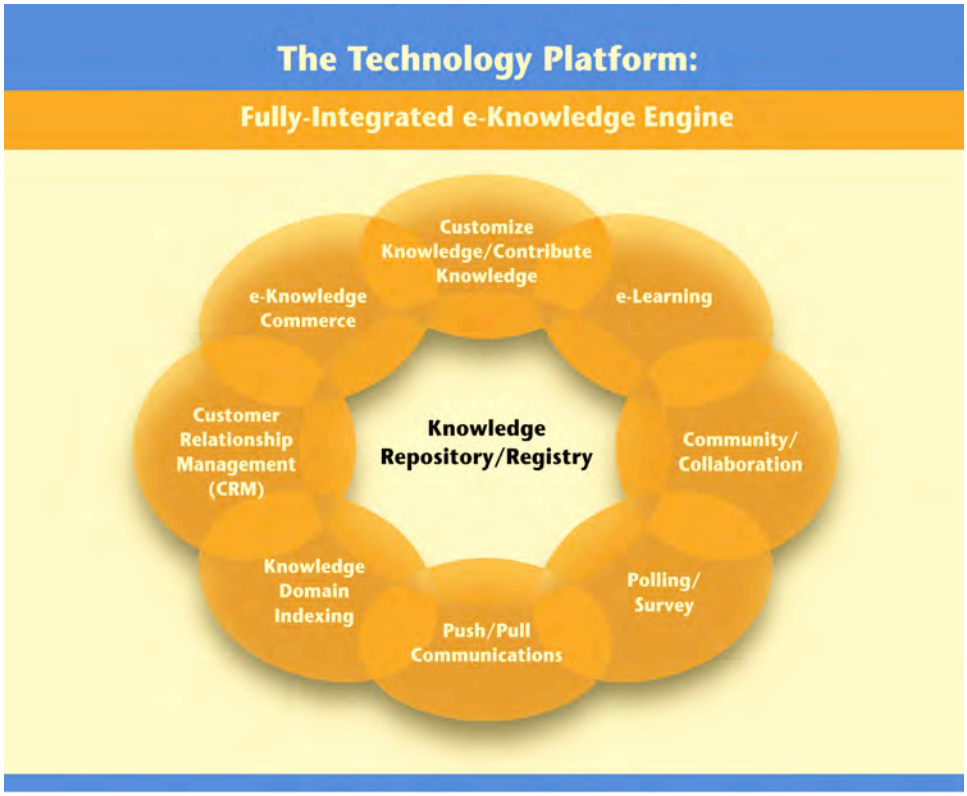
Four Levels of Capability for e-Knowledge Platforms. Achieving e-knowledge commerce requires more than standards, however. Enterprise technology platforms must surely be interoperable and standards-compliant, but they require a new set of capabilities to support the development of e-knowledge utilities. Four levels of capacity are being incorporated in leading-edge technology platforms such as SYNERGY ™ Knowledgeware.

1. Portalized Access to Knowledge Resources.. e-Knowledge portals provide authenticated and authorized access to knowledge-repository-based resources. These utilities are seamless, dependable, and reasonably priced; they rationalize the emergence of repository/registry-based marketplaces in particular knowledge domains.

2. Hierarchically Manage Standards-Compliant Content. Standards compliance creates vendor neutral, API-based, modular, interoperable, and scalable architectures. Hierarchical content management enables content elements to be understood and managed in hierarchies ranging from individual knowledge elements to enterprise-wide knowledge aggregations and processes. Individual courses, whole curricula, books, and other knowledge aggregations can be managed, repurposed, and combined as collections of individual knowledge objects. Automatic indexing and taxonomic generation are part of this capability

3. Fully Integrated, Interoperable e-Knowledge Engine. Figure 1 illustrates the modular, interoperable elements of the e-knowledge engine necessary to support e-knowledge commerce. These elements act seamlessly to support the development, maintenance, mapping, and indexing of knowledge domains.

Figure 1



Fully Integrated Back-Office Functions. Figure 2 depicts the modular, interoperable elements of the back office necessary to support e-knowledge commerce. These functions must be supported ***autonomically***, while e-knowledge commerce transactions are actively occurring.

Figure 2

The Leading Edge of Repositories/e-Knowledge Utilities. Several repositories/registries demonstrate the application of these new technologies.

The U.S. Department of Defense (DoD) has developed the Advanced Distributed Learning – Registry (ADL-R) that will make available to authorized users all of the technical training and learning materials in all parts of DoD. The addition of the back-office tools necessary for e-knowledge commerce is the next stage of development. ADL-R and other CORDRA-compliant registries will serve as a model for repositories/registries across the federal government and in other settings such as the sharing of e-learning resources among consortia of universities such as the Southern Regional Education Board (SREB).

The Educational Research Service (ERS) is developing an e-knowledge portal that will be a utility on "what works in evidence-based practice" for the knowledge domain serving K-12 education. This e-knowledge portal is SCORM/CORDRA-compliant and is supported by all four levels of technology necessary to support e-knowledge commerce. It will serve as a model for similar efforts serving the knowledge domains whose stewards are professional societies, trade associations, federations, and other non-profit organizations.

The Future of Knowledge Domains and E-Knowledge Commerce

Figure 3 traces the evolution and emergence of e-knowledge commerce. We are still in the early stages of this development, and the thought leaders have been major knowledge universe-wide navigators such as Google, Yahoo, and Microsoft. But emerging e-knowledge commerce innovators such as ADL and ERS are harbingers of the next wave of developments. While the knowledge universe-wide navigators will continue to be important, the future will belong to the constellation of players that are the best mappers/navigators/facilitators/indexers/stewards of individual knowledge domains.

The real action in e-knowledge commerce will occur in individual knowledge domains under the stewardship of a champion organization that can shepherd the evolving repository/community of practice and be trusted as a guardian of the values of the knowledge domain.

Knowledge universe-wide navigators such as Google will provide universal access to the content of all public access knowledge domains. This will be acceptable for users wanting general knowledge. In knowledge domains where no natural steward emerges or where the efforts are inadequate, Google-based communities of practice may function tolerably well. But the preferred solution for most knowledge domains will be a knowledge repository/community of practice shepherded by a professional society, trade association, scientific discipline, civic organization, cause or philanthropy, governmental agency, or non-governmental organization (NGO).

Think of the capacity of the knowledge utilities serving such knowledge domains. Users could achieve portalized access to the resources of the knowledge domain, some for free and others for a fee. They could customize and personalize their knowledge products, services, and experiences and contribute to the body of knowledge. Much of the deepest knowledge and learning experiences would be gained through conversations and collaborations with experts, thought leaders, and practitioners in the field. Or through conversations with intelligent agents that had recently tapped the latest knowledge from these sages and were making that intelligence available broadly. Such offerings make today's e-commerce offerings of books, monographs, and articles seem stale and ponderous, indeed.

Such knowledge portals could serve as the "face book" of knowledge domains, portraying the interests, values, contributions, and latest knowledge nuggets from key figures in the knowledge domain, while protecting the limited personal bandwidth of each individual. Some face book entries might capture the collaboration of teams, working groups, and long-standing professional collaborations, as well as those of individuals. The most successful stewards of knowledge domains will be those who discover out how to create and sustain vibrant, dynamic, self-regulating, and adaptive communities of practice to support knowledge domains and e-knowledge commerce.

Figure 3

The Emergence of e-Knowledge Commerce

Categories	e-Commerce Age (1997–2006)	e-Knowledge Commerce Age (2006 – onward)
Thought Leaders	• Amazon • e-Bay • B2B exchanges	***Today*** – Google, Yahoo, Microsoft ***Today*** – Advanced Distributed Learning (ADL), Educational Research Service (ERS) ***Future*** – Best mappers/navigators/enablers/stewards of knowledge domains
Use of Knowledge Repositories	Publisher Websites (trade presses, associations, university presses, and others) contain online versions of books, monographs, and articles.	Knowledge repositories contain meta-tagged knowledge objects. Books, monographs, articles, case studies are broken down (chunked) into component knowledge objects, which are tagged and managed hierarchically. Widespread use and linkage of repositories depend on standards
Technology Architecture	e-Commerce and CRM technology bolts onto existing, association membership data base architecture. Collaboration/ learning tools are also bolted on.	e-Knowledge-based architecture that can turn all the knowledge in the enterprise into meta-tagged knowledge objects and integrate seamlessly with communities of practice, learning, and knowledge-building activities. Enables hierarchical content management. Interoperable, SCORM and CORDRA-compliant. Back-office enables autonomic allocation of intellectual property rights and revenue shares.
Importance of Standards	Most e-commerce-focused repositories are not interoperable.	Shareable Content Object Reference Model (SCORM) standards are critical for creating shareable knowledge objects. Content Object Repository Discovery and Registration/ Resolution Architecture (CORDRA) standards create the basis for creating repositories and registries among which knowledge can be shared. Future knowledge domains require networks of standards-compliant registries and repositories.
Nature of Transactions	Customers order books, monographs, articles that contain prepackaged collections of knowledge objects.	Customers can order any combination of knowledge objects. They can also add their own knowledge content and co-create a knowledge collection which can be packaged electronically or in print. Knowledge communities and e-learning opportunities are an integral part of e-knowledge commerce solutions. Community members are contributors, reviewers, customers, all at the same time. E-Knowledge commerce enables these participants to be financial rewarded for their contributions.
Customization and Personalization	CRM tools enable publishers to track customer history and personalize messages. But the customer does not participate in the creation of the product.	Customers can personalize and co-create knowledge products. A product is not considered authentic unless it has been co-created and/or is peer-to-peer based. Healthy knowledge domains depend on active participation by contributors from the community of practice.
Leading-edge Examples	• Amazon • Websites of major publishers • Websites/portals of major associations	***Today*** – ADL Registry/Repository – enables discovery and access of all training/ learning content in U.S. Department of Defense. ***Today*** – ERS e-knowledge portal – knowledge utility for K-12 marketplace. ***Future*** – Interconnecting registries link resources in industries and knowledge domains.
Impact on Knowledge Domains	Knowledge is imprisoned in particular contexts. Knowledge is fragmented by intellectual property ownership.	Knowledge can be repurposed into different contexts, and combined and shared in new ways. Knowledge is in a continuous state of flux. Reusable knowledge and intelligence. e-Knowledge Commerce enables the unification of knowledge domains and the creation of vibrant knowledge marketplaces.
The Future of Knowledge Domains	e-Commerce is too inflexible to be a major factor in the future of e-knowledge.	• Organizations like Google will provide universal access to all knowledge domains. This will be acceptable for general users and in knowledge domains where no champion rises within the domain to create an e-knowledge utility. • Associations and other definers/defenders of particular bodies of knowledge can beat Google if they focus on providing the technology, community, and know-how to map, navigate, and enable knowledge domains supported by communities of practice and perpetual learning and knowledge sharing. • Think of association knowledge portals as the "facebook" of knowledge domains, portraying the key players and inviting participation in the knowledge domain. Revenues from e-knowledge commerce can be shared with participants, depending on their contribution.

Resources

The top resource in the field of e-knowledge commerce is the manifesto for the Knowledge Age.

Donald M. Norris, Jon Mason, and Paul Lefrere. *Transforming e-Knowledge: A Revolution in Knowledge Sharing.* Ann Arbor: Society for College and University Planning, 2003.
www.scup.org/eknowledge

Other important resources include:

Daniel Rehak, Philip Dodds, Laurence Lannom. "A Model and Infrastructure for Federating Learning Content Repositories." WWW 2005, May 10-14, 2005, Chiba, Japan.

Donald M. Norris, "Experiencing Knowledge." *SCUP Webcast*, November 2004.

Donald M. Norris, "Mapping the Knowledge Ecology of the Urban Land Institute, 2004, case study can be found at "http://www.scup.org/eknowledge/case_studies_f.html.

Donald M. Norris, Jon Mason, Paul Lefrere, "e-Knowledge Comes to Campus," League for Innovation, *Strategic Leadership Abstract*, 2004.

Donald M. Norris, Jon Mason, Robby Robson, Paul Lefrere, and Geoff Collier, "Share and Share Alike: The e-Knowledge Transformation Comes to Campus," *EDUCAUSE Review*. September/October, 2003.

Donald M. Norris, Jon Mason, Robby Robson, Paul Lefrere, and Geoff Collier, "A Revolution in Knowledge Sharing," *EDUCAUSE Review*, September/October 2003, pgs. 14-26.

Jon Mason, Donald Norris, Paul Lefrere, "An Expeditionary Approach to e-Knowledge" 2003.

Donald M. Norris, "Changing How We Experience Knowledge," *Association Trends*, Donald M. Norris, 2002.

Donald M. Norris, "Are you e-Knowledgeable Enough?" *Association Trends*, February 28, 2003.