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# Developing a Capability Maturity Model for Enterprise Intelligence

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Abstract: Capability maturity models have become popular for outlining the key processes from which methodological flows are created. In this article, we define the topical framework of a capability maturity model for Enterprise Intelligence. Of special concern are the integration of systems engineering, process management, and data analytics to support robust knowledge management practices through the organization.

***Keywords:*** **Enterprise intelligence, Knowledge organization, Architectures.**

## 1. INTRODUCTION

### *1.1 Enterprise Intelligence.*

Knowledge comprises a vital type of resource for an organization. It is in how knowledge is leveraged that an organization achieves benefits from this resource. Organizations that are particularly adept at mining and nurturing their knowledge resources are known as *Knowledge Organizations* (Hjørland, 2008). These groups exhibit great agility in responding to business climate change.

The actions related to our knowledge are evidenced in entities known as 'intelligence'. The product of a sound organizational knowledge management program is *Enterprise Intelligence*.

Enterprise Intelligence is a popular phrase used throughout industry to describe the entities and resources of a broad-based knowledge management program (Waltz, 2003). While encompassing the data analytics usually accomplished through Business Intelligence systems, EI also concerned about the contextual meaning of data and the ability of an organization to marshal its data across organizational boundaries (Ross, Weil and Roberston, 2003). More succinctly: EI is a convergence of system, process, and data analytics for improving enterprise knowledge, architecture, and information management. Figure 1 demonstrates this convergence.

### *1.2 Enterprise Intelligence Approach.*

Most EI initiatives are "home grown" within the organization. Many organizations look to tool vendors to provide services in helping them pilot their EI effort. However, even with consistent use of tools and implementation profiles, EI initiatives seem to lack consistency. This is unfortunate, because two critical elements of a sound EI system are its ability to share knowledge across organizational boundaries and to garner new knowledge from external sources (Beire, 2003). The authors speculate that information assurance is at the heart of the matter. Organizations are so focused on protecting its lot of critical domain expertise for competitive advantage that they inadvertently close the door to new knowledge creation from outside influences and opportunities.

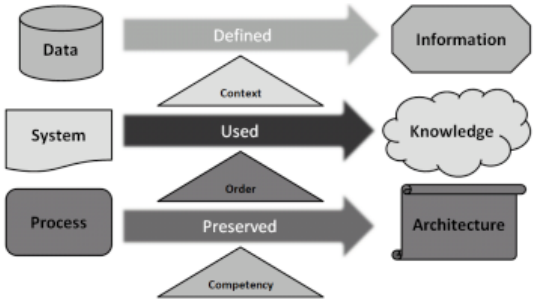


Figure 1. EI Improvement

There is an obvious need to develop a universal approach to EI. A standard capability maturity model (Humphrey, 1988 & 1989) that fosters the growth of EI practices in an organization is a logical place to start.

## 2. CAPABILITY MATURITY MODEL

### *2.1 Enterprise Intelligence Elements.*

Devising a capability maturity model requires a thorough understanding of the elements of the

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system in question. For an EI system, we first need to organize the elements by mapping constituent processes, constituent influences, constituent delivery methods, and related entity analytics. Each of these mapping should be shown at the level of entry into the organization. The levels are (from least to greatest): Individual, Workgroup, Domain, and Organization.

We start with the architecture constituent. Architecture management processes, architecture management influences, architecture abstraction, and information technology analytics are the attributes that form the mapping of the architecture constituent.

Architecture feeds knowledge. For the knowledge constituent; knowledge management processes, knowledge management influences, knowledge networking, and information technology analytics are the attributes of the elemental mapping.

The information constituent attributes for information management processes, information management influences, informatics, and information technology data analytics are also mapped.

Any system requires governance of its constituents. For an EI system, governance is usually accomplished through services provide by utilizing underlying information technology. Figure 2 illustrates this relationship.

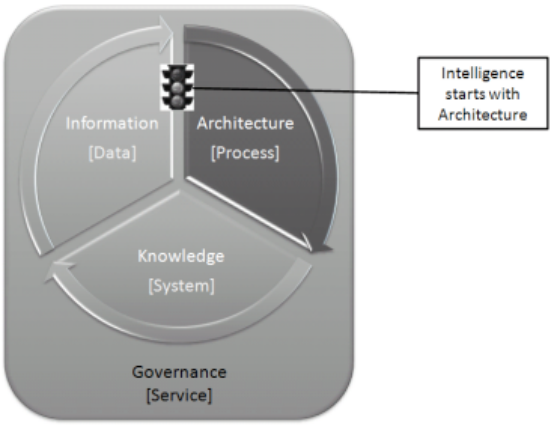


Figure 2. EI Constituents and the Governance Environment

*2.2 Enterprise Intelligence Ontology*.

The goal of an EI initiative is to move an organization from responsive decision support to agile decision-making. An association is drawn between the EI constituents and their governance environment and the enterprise acumen. Figure 2 is typical of the ontological approach most organizations seek in their EI endeavour. It illustrates that as the capability objectives of the organization expands from value offering to agility in its competitive practices, the nature of the intelligence that helps achieve those objectives changes. For example, highly specialized cooperative intelligence shared by many enterprise players (e.g., company employees, business partners, vendors, and even customers) is required to bring a new product, process, or service offerings to market and govern those offerings. This is in contrast to the broad-based collection of competitive intelligence used within (usually small) research teams that instigate business change.

*2.3 Formulating the Capability Maturity Model.*

Since its introduction in the early 1990s, the Software Engineering Institute's *Capability Maturity Model (CMM)*™ has been adopted as an industry-standard framework for both methodology development and process improvement. It has been reused for a variety of large-scale methodological practices, such as software engineering, human resources, systems engineering, and process modelling and analysis.

The CMM consists of five levels of maturity, leading from Level 1 where processes are mainly ad-hoc and focused on foundational improvement to Level 5 where a fully-capable, continuously improving environment based on sound methodological practices is institutionalized. At each level, certain key process areas are defined to provide the proper context for capability maturity.

In using the CMM as a basis for developing a method for EI, the first step is to map the levels to maturity of EI assets to the key process areas of EI. Figure 3 presents this mapping.

An important aspect of this model is its ability to address the essential level of business acumen. The key processes at each level provide uniform coverage of each value proposition of the Enterprise Acumen (displayed in Figure 2). Figure 4 provides a representation that conveys this coverage in a manner that is understandable by the stakeholders of EI processes.

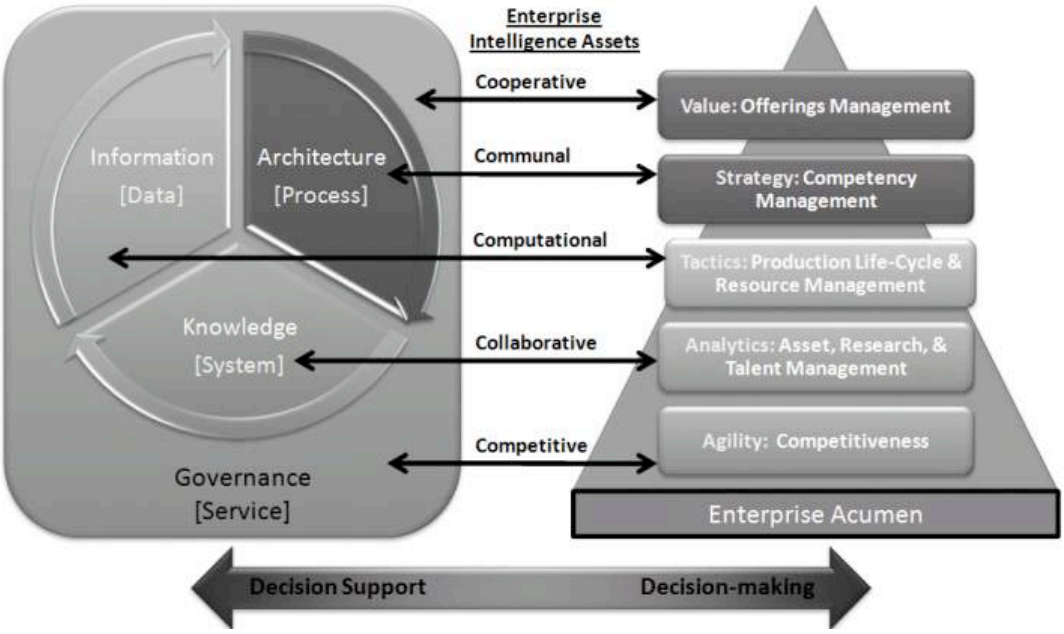


Figure 3. An Ontological Approach to EI

*2.4 Key Process Areas.*

Each key process area of the EI CMM contains a single essential goal. The main activities are listed to help the organization meet the goal. Each activity is assessed at a level of completeness. The levels of completeness are: 1 = Defined, 2 = Practices, 3 = Institutionalized, 4 = Repeating, 5 = Agile. For an activity to be classified as 'agile', it must be in a state of continuous improvement and governed by a change management process - which is planned at Level 1 under the Governance key process area.

The following summarize the goal and activities associated with each key process area (KPA) in the EI CMM.

2.4.1 Level 1 - Asset Leverage Key Process Areas

KPA: Assurance
Goal: World-class practices for information, knowledge, and architecture assurance. This includes the appropriate levels of security for the accessibility, management, and content of these assets.
Main Activities:

- Develop assurance standards that exceed those imposed through regulation.
- Integrate security measures in all process and system components.
- Determine allowable (if any) exception processes.
- Create role-based policies for information access and change management.
- Establish industry-approved repositories for intelligence assets.

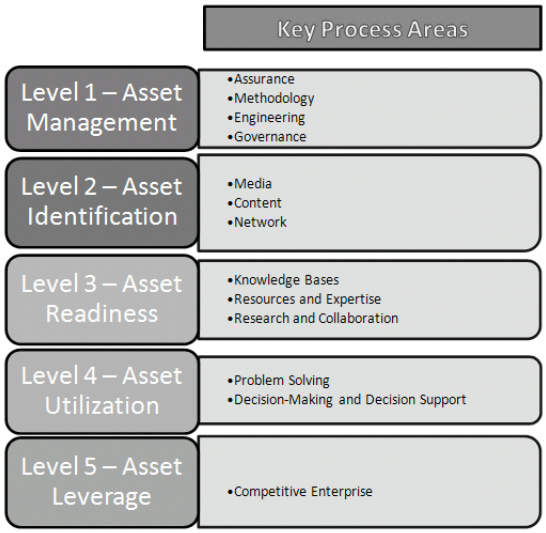


Figure 4. The EI Capability Maturity Model

KPA: Method
Goal: Industry-recognized practices for the life-cycle development/support of systems to create, preserve, analyze, manage, and distribute information, knowledge, and architecture assets. Note: This key process area is addressed in the *Integrated CMM (CMM-I)*™.
Main Activities:

- Implement an industry standard methodology that includes all elements of Information Technology support. This includes necessary additions for Enterprise Intelligence key process areas.

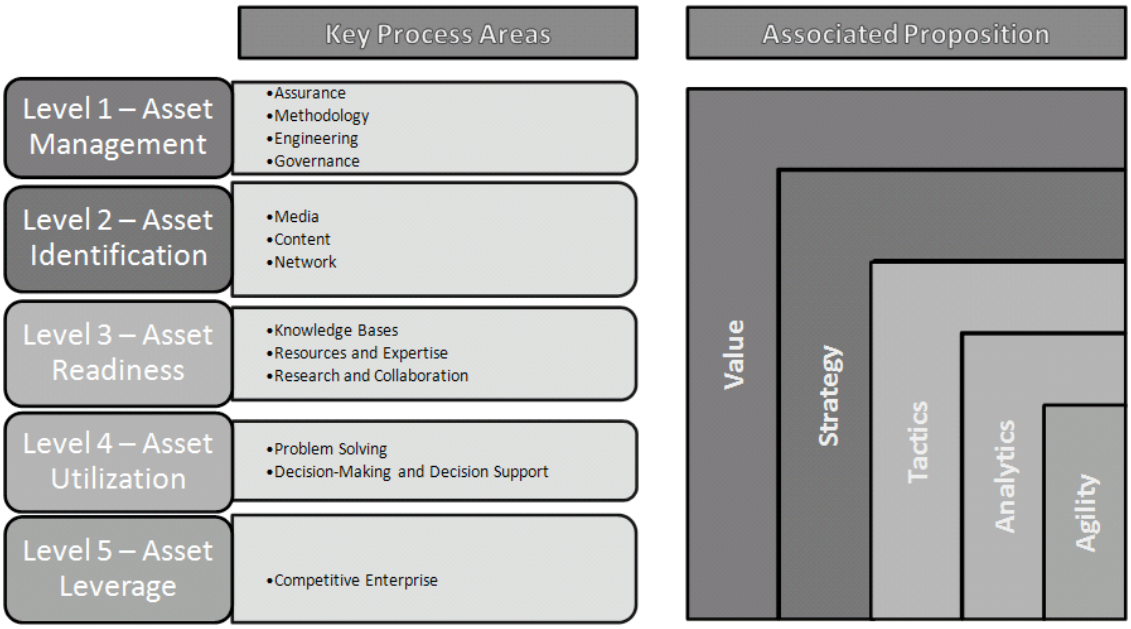


Figure 5. EI Capability Maturity Influence on the Value Propositions of the Enterprise Acumen

- Tie methodological practices to Enterprise (Strategy) Planning.
- Institute an associated best practices repository.

KPA: Engineering
Goal: Enterprise-wide practices for information, knowledge, and architecture engineering. This includes infrastructure support for system design and build activities associated with these assets.
Main Activities:

- Complete all appropriate in-house improvement framework key processes to institutionalize Enterprise Engineering practices.
- Organize and control a standard set of tools and techniques for Enterprise Engineering.
- Establish an information sharing network.
- Devise methods for standard information architectures (SOA).

KPA: Governance
Goal: Enterprise-wide practices for information, knowledge, and architecture governance. This includes architecture support for system support activities associated with these assets.
Main Activities:

- Oversee all change management tasks associated with the various key process areas for Enterprise Intelligence.
- Define processes to leverage resources within the enterprise knowledge base and from external agencies for enterprise decision support.
- Establish communication methods to simplify the access of information related to the key process areas for Enterprise Intelligence.

2.4.2 Level 2 – Asset Utilization Key Process Areas

KPA: Media
Goal: Multiple electronic media capability in all production practices and authoritative documents.
Main Activities:

- Establish standards, practices, and tools for various media types.
- Engineer media-based content in aircraft design and build record.
- Utilize multi-media content for all corporate communications and learning products.
- Determine on-line media (access and production) allowable.
- Create standard for media delivery methods.
- Support media exchange for future Engineer Everywhere, *Construct Anywhere* practices.

KPA: Content
Goal: Manage the content that comprises enterprise documents, websites, databases, knowledge bases, and other sources of data, process knowledge, system knowledge, and service knowledge.
Main Activities:

- Determine content classifications.
- Establish change control over all content.
- Establish a suite of tools and methods for content management, access, and engineering.
- Develop content-oriented environmental controls (desktop, browsers, portals, mash-ups, control panels, blackboards, etc.).

- Create content dictionary to reflect schema of repositories (possibly for global searches).
- Establish content search methods (multi-source, internal/external).
- Create role-based and/or content-based delivery mechanisms.

KPA: Network
Goal: Manage network growth/technical change.
Main Activities:

- Develop a plan for network technology changes.
- Determine the (near-)optimal use of internal versus external network resources.
- Collaborate with other key process areas to determine load forecasts and prepare for increased demands.
- Smartly position services and systems within the enterprise.
- Model network flow of information to gain insight on critical events, potential bottlenecks, and smart network resource utilization.
- Determine viable alternatives for harvesting computing power.
- Monitor network use and respond to unusually high demands.

### 2.4.3 Level 3 – Asset Readiness Key Process Areas

KPA: Knowledge Bases
Goal: Enterprise Intelligence is garnered through a set of sources. These bases of knowledge can be approved and controlled by the corporation for internally developed knowledge, or they can be gotten through discovery for external knowledge.
Main Activities:

- Identify standardized internal knowledge bases,
- Identify popular on-line knowledge bases.
- Identify bases of knowledge to aid in competitive practices.
- Create knowledge acquisition mechanisms.
- Govern knowledge mining processes.
- Associate acceptable risk management practices and objectives.

KPA: Resources and Expertise
Goal: Identify, support, grow/nurture, evaluate, and obsolesce the resources that deliver, transform, and distribute critical domain data, process, system, and service intelligence.
Main Activities:

- Establish Talent Management practice.
- Establish Communities of Practice to network Subject Matter Experts (SMEs). Utilize Social Networking techniques for these communications.
- Create intranet preferences.
- Promote a corporate culture of learning.
- Promote wise and value-added information sharing among scarce resources.
- Implement a role succession program to grow SMEs and provides individual breadth of knowledge.
- Maintain depth of knowledge for all resources through advanced training.
- Tactically plan for continuous resource improvement and obsolescence.
- SMEs to provide oversight to various enterprise knowledge bases.

KPA: Research and Collaboration
Goal: Knowledge used for Enterprise Intelligence efforts is gained through internal research or in collaboration with partnering agencies.
Main Activities:

- A strategic plan for research and development directions is established.
- A process for defining, funding, and gaining other approvals for research and development projects is established.
- All information stemming from finding and lessons learned in conducting research and development projects is archived and available (as appropriate) to the organization.
- Channels for collaboration with industry, academic, and government research partners are established and supported.
- Proprietary information is secured.
- Patentable, copyright, or other vital intelligence is appropriately guarded and protected.
- Knowledge gained from external agencies that result in improved competencies or product offerings is made visible to the originating organizations.
- Communities of Practice and other SME forums are utilized to ensure quality technical oversight for all research and development projects.
- Consultants who generate product and process-oriented knowledge share that knowledge.

### 2.4.4 Level 4 - Asset Utilization Key Process Areas

KPA: Problem Solving
Goal: Knowledge is leveraged to provide directed and/or real-time problem solving.
Main Activities:

- Establish a team that is dedicated to the task of problem solving using analytical methods (called “analytics”) to process knowledge and data from processes and systems.
- Model all knowledge sources to understand the nature of the knowledge used for problem solving. Keep statistics about the relevancy of this knowledge.
- Create lessons learned for problem solving efforts and events.
- Create a stream of knowledge from external to internal knowledge bases.

- Develop a statistical basis for all risk management tasks in association with problem solving efforts.
- Document all analytics.

KPA: Decision-Making and Decision Support
Goal: Knowledge is leveraged to provide directed and/or real-time decisions.
Main Activities:

- All normal decision-making processes are documented and understood (through models).
- Exceptional decision-making processes are documented and subject to review/oversight.
- All teams involved in decision support activities document their processes and the actors/consumers of their services.
- Assets used for decision support are archived and made available to resources serving appropriate decision-making roles.
- Tools and methods for decision-making are customized and deployed based on the role of the decision-maker (e.g., RSS feeds, status and control panels, callboards, gadgets and gauges).
- Analytics are in place to reduce the decision-making life-cycle.
- Analytics are in place to automate repetitive decision-making.

### 2.4.5 Level 5 - Asset Leverage Key Process Areas

KPA: Competitive Enterprise
Goal: The organization's base of offerings and all associate activities are determined from insights gained through the timely acquisition and development of intelligence.
Main Activities:

- Establish a system for Competitive Intelligence activities in the organization.
- Provide hybrid methods for intelligent search and acquisition of information from both internal and external knowledge sources.
- Link product offerings, product attributes, product improvements, core competency management, and research and development strategy to competitive intelligence findings.
- Archive all knowledge and lessons learned from competitive intelligence activities.
- Tie Marketing and Offerings activities to statistically relevant analyses.

## 3. CONCLUSION

This paper presented the basis of a capability maturity model for an Enterprise Intelligence system. The model includes a structuring of the key process areas that must begin to be addressed at each level of capability maturity. Many organizations will likely have elements of many of the key processes already in place. In fact, the key processes presented at Level 1 of the model will almost certainly exist in close to their entirety in organizations with their own internal Information Technology business unit. Still, most organizations will at best have a foundational set of business practices that are tied to Enterprise Intelligence. For those organizations, the capability maturity model presented in this paper could serve as a framework for identifying areas of improvement; providing a context for gap analysis and process control. The Enterprise Intelligence Capability Maturity Model is useful for linking the architectural requirements of the enterprise to process definition and improvement activities specific to knowledge management objectives.

Throughout most of the model, a considerable amount of attention needs to be made to modeling aspects of the enterprise (Whitman and Huff, 1997). This is a continuous effort, but it behooves an organization to develop major baselines for their enterprise process models in order to plan the analogous activities in the capability maturity model (Whitman and Huffman, 2009).

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