The Influence of Enterprise Architecture and Process Hierarchies on Company Success

Geoff Cardwell

Abstract

Systems design is often overlooked as one of the most important aspects for ensuring that everyone in the organization understands how they can contribute to its success and thereby improve their own performance and job satisfaction. Simple system structures enable people to *SEE* how the systems work to achieve company goals. Suitable interrelating process diagrams make this easier.

The paper suggests that Enterprise Architecture can be structured in a simple set of process hierarchies so the IT function can implement the appropriate software packages in a way everyone can understand. It is apparent that many organizations are still not enjoying the benefits of proper Business Process Management (BPM). There is a major communications gap between the workforce and the people designing and implementing the company's business systems.

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1. Introduction

Enterprise Architecture (EA) has become a major focus area in medium and larger companies, as most, if not all, employees should know how their part in company processes influences the success of the organization. There is a clear need to go back to basics in terms of issues with present-day software complexities. A few reference examples will illustrate the types of IT problems encountered in larger companies. Many of these problems are of the same type encountered by the author 30 years ago (Cardwell, 1976).

The paper highlights the need to adopt a generalized EA framework and build simple system structures so that everyone in the organization will see where they fit in and how their activities contribute to its success. Peters and Waterman of *In Search of Excellence* fame found that "the underlying structural forms and systems in the excellent companies are elegantly simple."

2. Systems Design

Numerous articles have been written around the teachings of Peter Senge, as described in his book *The Fifth Discipline* (Senge, 1990). The five disciplines are Personal Mastery, Mental Models, Shared Vision, Team Learning, and Systems Thinking. The fifth one, Systems Thinking, is seen by Senge as the most important. Everyone in the organization needs to understand the systems in which they operate. He also developed the concept of Organizational Learning and stressed the importance of how the five disciplines should all contribute towards the goal of everyone working to promote the vision and strategies of the organization as the natural way of achieving employee happiness and company success.

Business systems are now seen as the area in which to focus substantial effort to achieve the desired result of customer and company success. The author believes that the "First Essential" for failure prevention in business systems is Simple System Structures (Cardwell, 2001). A number of recent articles and editorials in the IT field are stressing the need to simplify business systems, particularly where complex IT projects make it difficult to achieve success. A more appropriate acronym based on the common KISS principle would then be KITS – Keep Information Technology Simple! Processes can be complex, but their system structures should be simple so that everyone can understand the main input and output variables.

A report on Business Simplification (Capability Management, 2001) states in the Executive Summary, “As business becomes global, faster, with more options, it is becoming very complex. As we apply systems to business, we should ask if we are asking too much of IT, making it too complex to manage or deliver? As projects get complex, there can be so many variables that the project managers cannot keep track of all the *issues and decisions. The tendency of the project to go “off the rails” increases dramatically. The key is to try to keep each project or sub-project as simple and short as possible.” The overriding message to ensure a successful IT project is “Before you invest in systems — simplify your business.”

A recent article by the well known IT guru, Bruce Silver, (Silver, 2006) suggests that “business process management suites (BPMS) cover all the bases, but you can score big savings with business process analysis (BPA) and business activity monitoring (BAM) alone.” The article stresses that the most benefit from analytical modelling comes through getting everyone “on the same page.” “Although the potential savings from consolidating information and information systems can be huge, these efficiencies are impossible to achieve without a shared understanding of the processes that use those systems – their steps, resources, and management metrics – expressed in a common vocabulary and reference model. Use BAM to measure and aggregate information from running IT systems, displaying actual process results in a management dashboard and triggering alerts when KPIs deviate from target values.”

Silver observes that, while dedicated process analysis tools are extremely powerful, most process diagrams produced today are Microsoft Visio drawings. The Unified Modeling Language (UML) is widely used to develop software packages, and Visio has the capability to produce UML diagrams. One of the high-end tools available for software development is Rational Rose, which has a flower logo and uses the UML. There is close similarity between current data-daisy models and the author’s 1976 Database Relational Diagram for Eskom Undertakings in Figure 1 (Cardwell, 1976).

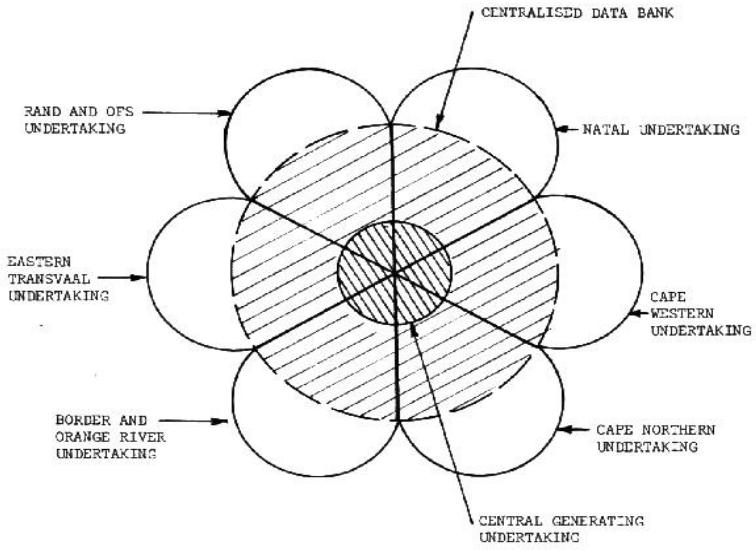


Figure 1. Conceptual Integration of Eskom Undertakings and Centralized Data

3. Enterprise Architecture (EA)

It is worth noting that in 1999 the Clinton Administration passed laws requiring all Federal Agencies to set up formal and understandable EAs so that information could be easily shared between them. For the same reason, efforts to coordinate the flow of information between functions in all organizations and among the people involved should be based on a proper EA.

Randolph C. Hite (Hite, 2004) of the US General Accounting Office describes an EA, in terms of an enterprise being any purposeful activity and architecture, as the structural description of an activity. "We can view enterprise architectures as systematically derived and captured structural descriptions – in useful models, diagrams and narrative – of the mode of operation for a given enterprise. As such, the architecture describes the enterprise's operations in both logical terms (such as interrelated business processes and business rules, information needs and flows, and work locations and users) and technical terms (such as hardware, software, data, communications, and security attributes and performance standards). Moreover, it provides these perspectives both for the enterprise's current (or "as-is") environment and for its targeted future (or "to-be") environment, as well as for the transition plan for moving from the "as-is" to the "to be" environment." From this general but accurate description it is easy to see that "the importance of EAs is a basic tenet of IT management, and their effective use is a recognized hallmark of successful public and private organizations. Managed properly, an EA can clarify and help optimize the interdependencies and relationships among an organization's business operations and the underlying IT infrastructure and applications that support these operations."

An early version of an EA is given in the Chief Information Officer's Report on Federal EAs (CIO, 1999) and includes the basic EA proposed by NIST (National Institute of Science and Technology) shown in the following Figure 2.

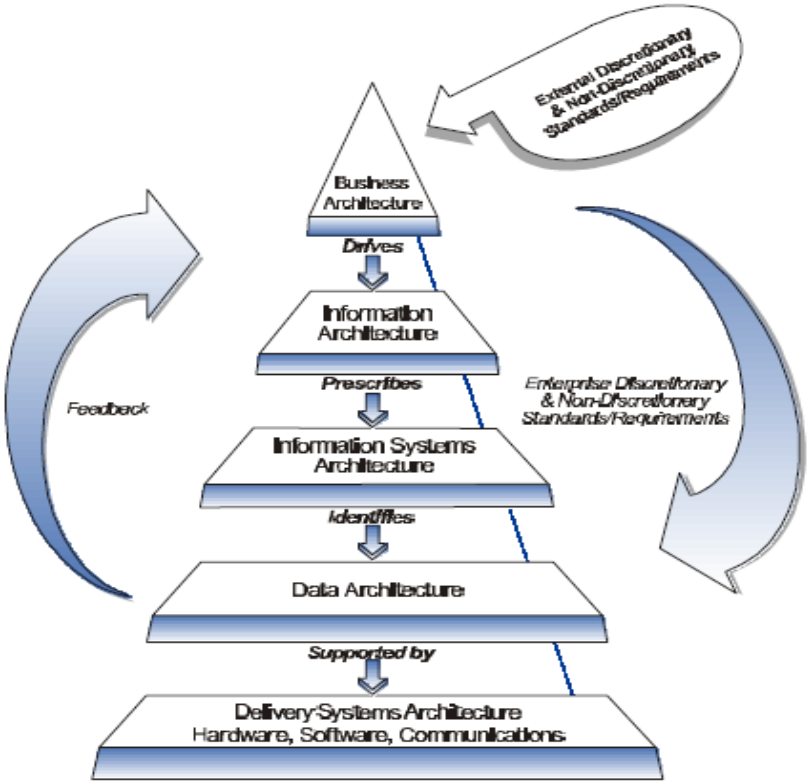


Figure 2. Example of early EA Structure developed by NIST in 1989 (CIO, 1999)

The various layers of a typical EA breakdown structure for most organizations could be described by the following hierarchy, which loosely aligns with the above NIST pyramid:

1. Overall purpose or mission and capability
2. Business unit functions and locations
3. System structures and relationships
4. Sub-systems and interoperability features
5. Business processes and process controls
6. Objects and interactions – structures

7. Components and materials – resources

Tony Brown (Brown, 2004) lists 6 advantages of implementing an EA in an organization:

1. Readily available documentation of the enterprise
2. Ability to unify and integrate business processes across the enterprise
3. Ability to unify and integrate data across the enterprise and to link with external partners
4. Increased agility by lowering the "complexity barrier"
5. Reduced solution delivery time and development costs by maximizing reuse of enterprise models
6. Ability to create and maintain a common vision of the future by both the business and IT communities driving continuous business/IT alignment

The above descriptions of an EA with its many advantages should not go unnoticed by senior management in all organizations, both large and small. Wherever IT systems play a significant role in the smooth running of an organization, a properly structured and maintained EA is essential.

Unfortunately, in the past, IT functions and departments have been guilty of installing complex software with unstructured EAs across the company that hardly anyone outside IT can understand. These were mainly for the benefit of the accounting function, where money talks, while the rest of the organization has had to accept the complexities and problems of the software systems forced on them. This has been expressed in a Butler Group report (Butler, 2004) through the following searching question:

"For how much longer can the IT tail wag the enterprise dog?"

"To remain competitive, organizations must urgently address the growing dislocation between the business requirements and IT deliverables. This issue is directly impacting the enterprise's ability to make quick, accurate decisions and is causing the slow implementation of the determined course of action. The gap between IT capability and business needs cannot be allowed to continue. Adoption of an end-to-end Enterprise Architecture approach will help to re-align IT developments with business objectives. To be effective, Enterprise Architecture must represent more than models for business, information, and organization. Butler Group recommends that the process encompass both services architecture and the deployment of a services platform. Only by embracing an end-to-end methodology and framework will organizations avoid analysis paralysis and separate islands of knowledge, maximising the undeniable benefits and cost savings available from the use of Enterprise Architecture."

A more recent development and extension to EA is Service Oriented Architecture (SOA). This describes an add-on type architecture that can interface with a number of legacy IT systems to provide one coordinated EA where the SOA is used to integrate existing software. There are obvious advantages to using SOA when suited to the organization's needs, but there can be problems integrating old systems. Sometimes it is easier to start from scratch with a new EA, rather than trying to merge completely different software systems into an organization-wide SOA.

4. Frameworks

The Zachman Framework for Information Systems Architecture was developed by John Zachman of IBM (Zachman, 1987). It is used to define and control the interfaces and integration of all components of a system. The model provides a formal structure to capture system specific information from the various perspectives of the overall system architecture.

The full Zachman Framework can be downloaded from www.zifa.com, while a simplified version of model is given in Figure 3 (Henning, 1996). "This illustrates a 30-cell Zachman model, tailored to support an information systems re-engineering application. In this customization of the model,

the system developers have an existing operational system in place. The model is applied to capture the security policy of the existing system to ensure the actual user requirements are understood prior to system re-development."

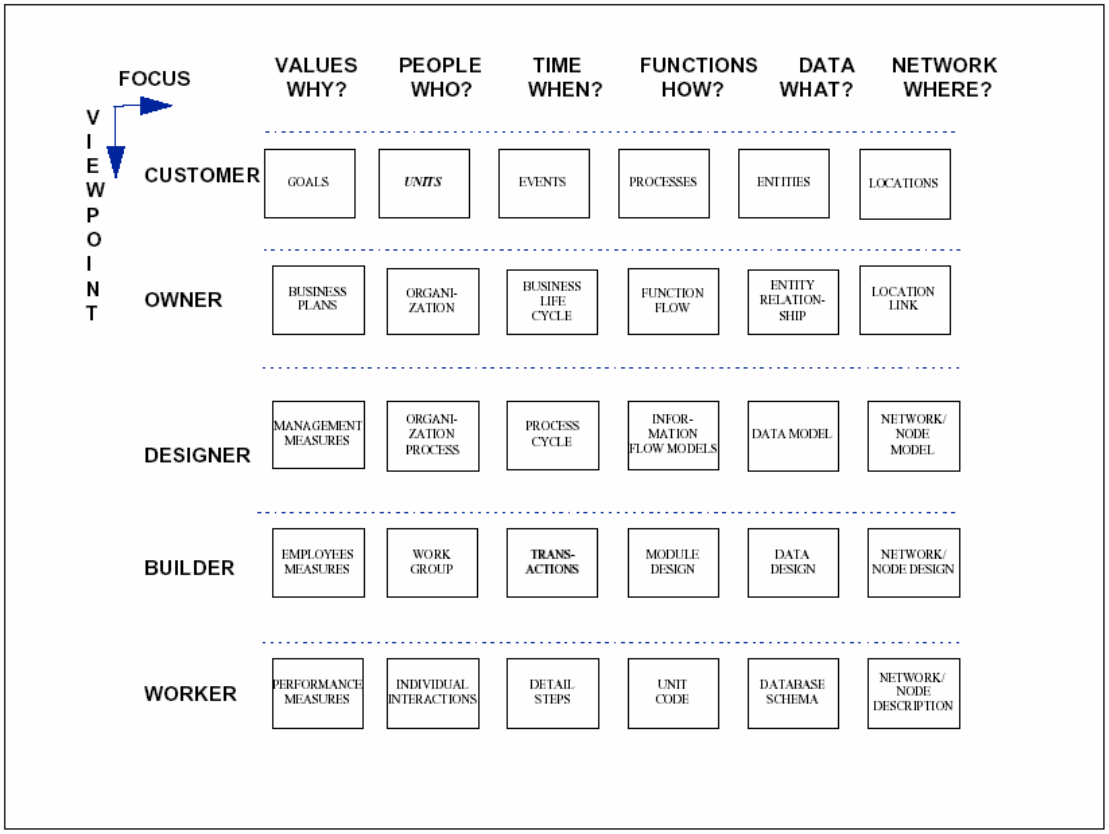


Figure 3. Basic Zachman Framework reference diagram (Henning, 1996)

Henning goes on to explain that "the Zachman framework has two very distinctive features that make it ideal for information modeling. The framework may be applied at any level of abstraction in the system development process, from a global enterprise, to a system, subsystem, or major module level. The framework also gives the modeler latitude in that any data representation technique can be used to model the inner workings of each cell."

It seems logical that EA and BPM structures should be based on customized versions of the Zachman Framework. The Zachman 6 x 6 matrix can be used as a general guide where a company may only use a part of the matrix, such as one or two rows and/or columns or even just a few cells. Several recent authoritative references confirm that a standard approach to BPM using a common workflow structure and coding system can be achieved. Business process modeling is being standardized through the Object Management Group (OMG) but is not yet fully operational. Model Driven Architecture (MDA) is an established methodology for showing how software is developed.

Considerable effort is going into developing international standards for EA and software modeling, and a short summary of the standards produced by ISO TC 184/SC5 and other IT groups, such as IFIP and IFAC (International Federation for Information Processing and International Federation of Automatic Control), is included, as follows:

ISO 14258 – 2003, Concepts and rules for Enterprise Models (Industrial Automation)
ISO 15704 – 2000, Enterprise reference architectures and methodologies (replacing ISO 14258)
ISO 19439 – 2006, Enterprise integration, framework for enterprise modeling
ISO 19440 – FDIS, Enterprise integration, constructs for enterprise modeling

Other relevant sources of information on EA standardization efforts include CIMOSA (Computer Integrated Manufacturing Open Systems Architecture), GERA (Generic Enterprise Reference Architecture), and GERAM (Generalized Enterprise Reference Architectures and Methodologies), which is described in ISO 15704, 2000. Also, the TOGAF (The Open Group Architecture Framework) group has recently issued TOGAF Version 8.1 Enterprise Edition, which describes how a framework can be developed. CAEE (Computer Aided Enterprise Engineering) provides another tool for developing an EA structure. It is not the intention to further elaborate on these documents and standardization efforts except to note that most are aimed at IT and software experts so that those people involved in the processes themselves are unlikely to understand the purpose and relevance of the documents to their own functional areas.

A current focus among IT groups is on achieving interoperability between the IT systems of companies in the same industry and then later, on a much broader scale, across all industries. The costs associated with lack of interoperability between customer and supplier systems are a major driver for "lean" companies to improve efficiencies for competing in the global marketplace. There is a recognized need for standardization of methods and application processes and to share data and knowledge between the IT areas and the process management people.

The European Commission established the ATHENA Project (Advanced Technologies for interoperability of Heterogeneous Enterprise Networks and their Applications) a few years ago, and it has the ambitious Vision Statement: "By 2010, enterprises will be able to seamlessly interoperate with others." The ATHENA Project "aims to make a major contribution to interoperability by identifying and meeting a set of inter-related business, scientific and technical, and strategic objectives" (www.athena-ip.org). As above, ATHENA is mainly focused on getting agreement among IT experts and software people. It is hoped that once agreement is reached and the final documents are issued, a simple process-user friendly version will be available to show how the various systems interrelate so that the overall EA structure can be easily understand.

5. Process Hierarchy Diagrams

An earlier version of a process hierarchy model, known as ARIS (Architecture of Integrated Information Systems) developed by Prof Scheer in Germany (Scheer, 1992 & 2002), has been incorporated into the SAP-R3 proprietary software packages. The ARIS House diagrams include ISO 9001 requirements, and link into many of the TQM based concepts and tools for optimizing business processes and implementing software systems. The SAP systems and tools are relatively complex high-end applications and hence they are expensive.

A more recent authoritative reference is the BPTrends EA Pyramid Model (Harmon, 2004) shown in Figure 4. The article elaborates on a typical EA structure and describes the relationships between human interaction and process performance.

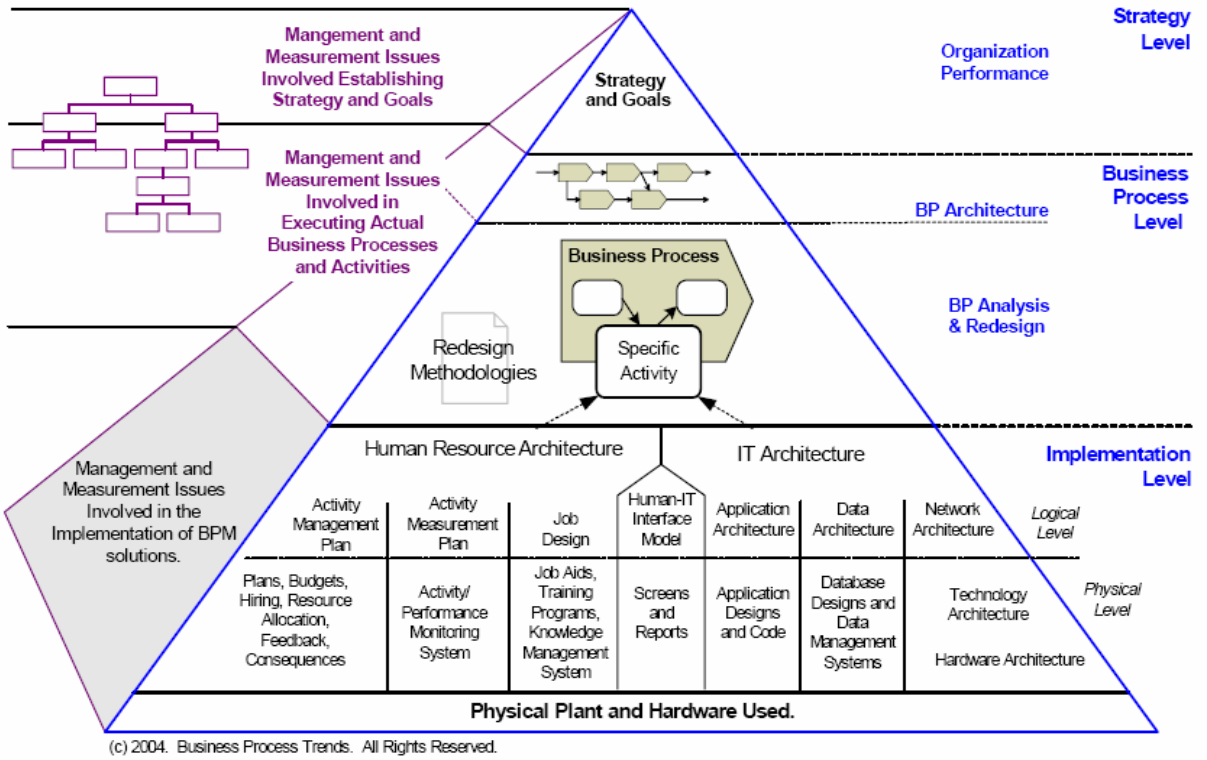


Figure 4. The Business Process Trends Enterprise Architecture Pyramid (Harmon, 2004)

The author's simple process diagram hierarchy shown in Figure 5 uses business processes found in most organizations and fits the structure of the Zachman Framework. It provides a business system structure based loosely on 2 columns of the Zachman Framework.

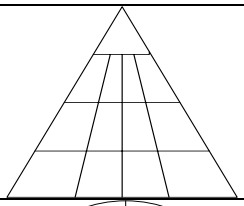
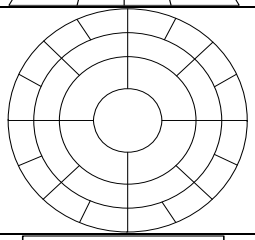
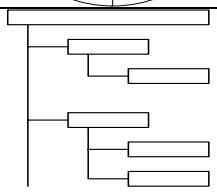
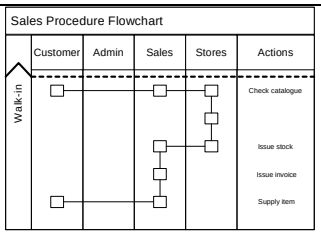
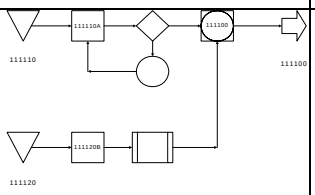
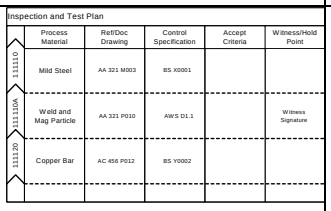
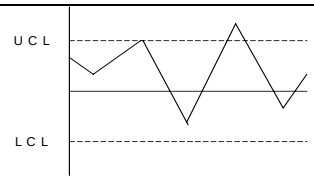
PURPOSE or ROLE	PROCESS or FUNCTION (HOW)	PROJECTS, GOODS or SERVICES (PGS) (WHAT)	DOCUMENT HIERARCHY (LEVELS)	DIAGRAMS, CHARTS & SCHEDULES (EXAMPLES)	NOTES UML and Related Diagrams
BUSINESS MISSION (CUSTOMER)	Mission Statement, Strategic Plan	PGS Objectives and Constraints	Organization Cone and Document Pyramid, Layout/Overview Diagrams and Photos		Top Process Dgm
BUSINESS SCOPE (OWNER)	Functions the Business Performs, Functional Policies	PGS Disciplines and Sectors/Entities, PGS Plans	Function Circles & Hierarchy Sectors, Physical Structure Diagrams		UML Use Case Dgm
BUSINESS MODEL (ARCHITECT)	Function and Process Decomposition	PGS Work Breakdown Structures and Relationships, Classification Levels	Structure Breakdown & Decomposition, Classification Codes		(UML Class Dgm)
SYSTEM MODEL (DESIGNER)	Data and Information Flows between Processes	PGS Work Package Resources, Operations	System Flow Diagrams, Cross-Functional Flow Diagrams, System Procedures		UML Sequence Dgm
TECHNOLOGY MODEL (BUILDER)	Process Specifications	PGS Specifications, Special Processes	Process Flow Charts, Special Processes & Qualifications, Schedules and Work Instructions		Data Flow Dgm, UML Activity Dgm
TECHNOLOGY DEFINITION (TEAM LEADER)	Program Code and Control Blocks	PGS Databases, Parameters and Costs Budget vs. Actual	Inspection & Test Plans, Process Parameter Schedules, KPIs, KIVs & KOVs, CPM & Gantt Charts		(UML Static Structure Dgm)
TECHNOLOGY APPLICATION (OPERATOR/ USER)	Application Programs	PGS Delivery Support and Site Services	Process Control Charts, UCL, LCL & Feedback Data, Real Time Controls & Reports		(UML Deploy-ment Dgm) Source Code

Figure 5. Business Systems Framework – Process Diagram Hierarchy and UML References

The model shows a hierarchy of diagrams, charts, and schedules that people will understand. It also suggests which part of the UML could apply. The relevance of the UML will need further research and development. If the system diagrams in Figure 5 could be further developed to link to BPA modeling tools, then this would provide the Screens and Reports bridging mechanism between the human side and system side of the BP Trends EA Pyramid of Figure 4. The benefits gained from applying the simple system structure approach to the company EA will be substantial.

6. Recent Business Examples

The author has had personal experience in large companies in the service and energy industries where EAs have not been properly defined and most people are not sure how the systems and processes relate to each other. Due to the commercial sensitivities involved, details are not available for publication. However it is reasonable to say that many of the issues and problems described here have been encountered by the author in most companies over the past 38 years.

The following examples are cases described in recent IT publications where there are mismatches between what the business processes require and what the IT function has provided. It seems that the common problem is a communications gap between IT experts designing the software systems or installing proprietary software packages and the people working in the business processes.

One example (Sinur, 2006) describes the credibility gap between large software vendors and their clients and mentions that some BPM tools are too complicated and lack support.
"SAP, Oracle, IBM, and other large software vendors are racing to address gaps in their business process management (BPM) portfolios as more businesses are examining processes as part of service oriented architecture (SOA) projects. Still, SAP's BPM workflow tools are too complicated, have too few rules management features, and lack human-to-human task support, according to Jim Sinur, Vice President and distinguished analyst at Stamford, Conn.-based Gartner Research Inc."

Another example (DM Review, 2006) highlights the communications gap between IT and business people on software requirements thus: "New survey results released from Borland Software Corporation, a global leader in software delivery optimization, suggest that while IT organizations understand the importance of effective requirements management, perception differs from reality when it comes to how they go about gathering, defining, and managing requirements. Experience has shown us that gaining a clear definition of requirements is very difficult for organizations because of the communications gap between business and IT."

Rashid Khan (Khan, 2006) refers to people issues as presenting the major problems in IT applications. These usually involve the people operating in long established processes with the acceptance, or otherwise, of new IT systems and techniques. He goes on to say:
"There is an anomaly in the BPM industry today. On the one hand are two factors that strongly suggest that BPM is a viable technology which should be widely adopted. First, there are numerous documented BPM cases demonstrating high ROI. Second, BPM vendors and analysts…talk about…mature industries. On the other hand, my own observations of Global 2000 companies around the world, which are corroborated by analyst reports, indicate that the penetration of BPM is in the 2-5% range. This suggests that BPM is in its early stages.

"Why is BPM not more widely adopted when the technology is supposedly mature and the ROI is strong and well-documented? BPM makes so much sense that every company and organization should be a customer! I am convinced that the answer lies in the complex nature of human beings who play the central role in business processes. BPM changes the way people work. People work in highly complex ways that differ from person to person, and these individual work patterns cannot be easily modeled or captured by software."

7. Conclusion

It seems that the above communications gap is wider than we think. As Bruce Silver pointed out "the most benefit from BPA is getting everyone on the same page." Perhaps that page is Figure 5, or a more robust version in software terms. The challenge is to develop a suitable equivalent "page" so that we can all "get onto it," while keeping the First Essential in mind – KITS, please!

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