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THE ZACHMAN FRAMEWORK: ENABLING KNOWLEDGE MANAGEMENT IN THE GOVERNMENT INFORMATION FACTORY

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ABSTRACT

The fundamental issue in knowledge management is transitioning personalized tacit knowledge into stored and usable explicit knowledge. This problem is magnified in state, local, and federal governments, as balancing technologies with organizational knowledge retention have always been a challenge. Government information systems usually fail due to a lack of emphasis on the technology or the people using it, or perhaps a combination of both. The Zachman framework offers a unique way to observe the issue because it captures the holistic view of an information system. The perspectives and abstractions complement each other in dissecting an organization's information systems identity. These perspectives and abstractions add value to the government information factory because the serve as a guide to investigating problems between the people, processes, and technologies involved in new or established information systems. Typically, government information systems lack communication more so than the usual private sector information systems. This paper analyses existing literature and findings of the Zachman framework as a means to understand its success in corporate settings, and to understand why it seems to be a natural fit in government organizations.

Keywords: Zachman Framework, Knowledge Management, Data Warehousing, Government Information Factory

INTRODUCTION

The information age has introduced a requirement to have information available when it is needed. Organizational hurdles, such as information sharing shortcomings due to silos or poorly conceptualized architectures, have a tendency to prevent useful transfer of information and knowledge. The Zachman framework offers a thorough roadmap for organizations to pinpoint areas for improvement by comparing dimensions to perspectives. Regardless of whether older, well-known problems are in need of solving or new, lesser-known issues are of the essence, the Zachman framework is a very useful tool in today's information organization. A review of available literature proves that the Zachman framework has been used successfully over the last two decades, especially in government organizations. This literature review is consistent throughout this analysis. This paper analyses the unique nature of government information systems and how the Zachman framework can be used to simplify system issues and improve the value of information and customer satisfaction.

DIMENSIONS and RULES

The Zachman framework is an early scorecard, of sorts. Its dimensions are a combination of perspectives and abstractions that complement each other in dissecting an organization's footprint, no matter if it is a software product in the early phases of life, or it is a system that has been implemented and in use for many years. The intersection points, sometimes referred to as aspects, between the perspectives and abstractions provide an understanding to the organization of where they should start to fix the problem. If an organization uses the standard intersection points, it can customize those points over time to reflect the nuances of that organization, industry, or philosophy (2, 4, 6).

Perspectives

In the Zachman framework, the rows represent the perspectives of the organization. The first row is the Scope, or the Contextual or Planner's perspective. It describes the models and architectures from a high level that executives and other high-ranking officials consider when determining how their organization will interact with a product line,

vision, or mission. The second row is the Business Model, or the Conceptual or Owner's perspective. This perspective takes these products, services, visions, and missions from the Planner's perspective and assigns usage characteristics to them. The Owner's perspective gives a personality to what comes out of the Planner's perspective. The third row is the System model, or the Logical or Designer's perspective. This row makes sense out of these summary ideas from the Planner's perspective via designers and architects, deeming it technically possible or not. The fourth row is the Technology model, or the Physical or Builder's perspective, describes what these designers and architects determine the actual construction, fleshing out the constraints for the creation of the actual product or service. The fifth row is the Detailed Representation, or the Out-of-Context or the Sub-Contractor's perspective. This perspective focuses of the final contraction of that product or service, and the interoperability of its other sub-systems. The sixth and final row is the Functioning Enterprise. It's more of an actuality than a perspective, as it represents how that final product or service is deployed, and how it interacts with the organization. It is the desired state of using this framework (2, 4, 6).

Abstractions

In contrast to the perspectives of the organization, Rezaei and Shams (5) inform us that the dimensions, or columns describe, "…the types of abstractions that define each perspective" (p. 44). Interestingly enough, the Zachman framework started with only the first three abstractions in 1987. A revised version of the framework was released approximately six years later to introduce three more abstractions, as the framework began to have more opportunity for evaluating the human factor than what its original purpose was.

The first abstraction is Data, or the What, that looks at the very essence of that product or service. The second abstraction is Functional, or the How, which focuses on how the product or service functions. The third abstraction is Network, or the Where, in which the interaction of the product or service with others is analyzed. The fourth abstraction is People, or the Who, in which there is a focus on the people involved in the process and their usage of standard operating procedures, manuals, databases, etc. The fifth abstraction is Time, or the When, in which the focus is on scheduling and life cycle aspects. The sixth and final abstraction is Motivation, or the Why, which focuses on the policies and planning that guide that product or service (4, 5, 6).

Rules

To accompany the perspectives and dimensions, the Zachman framework requires that seven rules be followed to ensure effectiveness. These seven rules are dimension importance, dimension simplicity, dimension uniqueness, perspective uniqueness, cell uniqueness, dimension necessity, and logic recursiveness. Dimension importance enforces that each of the six dimensions has equal importance. Dimension simplicity assures that each of the six dimensions has a basic model. Dimension uniqueness assures that each of the six dimensions has a basic model. Perspective uniqueness enforces that each perspective represents a unique view. Cell uniqueness assures that each meta entity appears in only one cell. Dimension necessity assures that all six dimensions are fully needed to represent each perspective. Lastly, logic recursiveness enforces version recursiveness and decomposition recursiveness, which allows for an iterative flow for use and reuse (2, 4, 6).

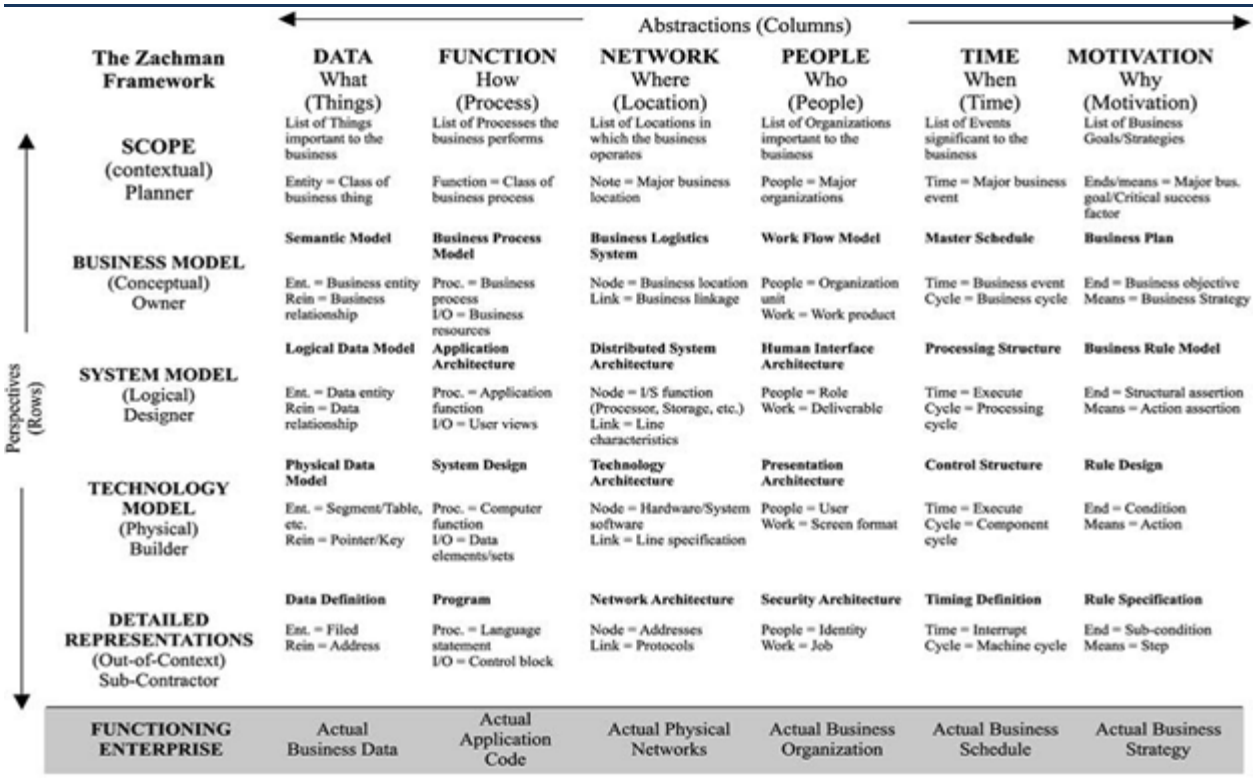

Figure 1: The Zachman Framework (3)

KNOWLEDGE MANAGEMENT APPLICATION

Issues

Organizations in the information age struggle with the creation and retention of knowledge management. The biggest hurdle appears to be translating and transforming tacit knowledge into explicit knowledge. Tacit knowledge is knowledge that is invisible, stored, and interpreted differently by different people. Getting this type of knowledge on paper is difficult enough, and deciphering into a storable and useful media for future usage is another challenge entirely. Explicit knowledge, on the other hand, is that ideal and desired state in which tacit knowledge becomes useful for future endeavors in the form of a textbook, standard operating procedure, intellectual property, or a database (3).

Knowledge and Information Architectures

It is important for an organization to understand its knowledge flows. They are the most critical ingredient for success, and understanding how to turn tacit knowledge into explicit knowledge can easily be an organization's biggest strength. The most important parts of the critical success factors in a knowledge management system are its culture, knowledge architecture, information technology infrastructure, and support services. If an organization has emphasized the importance of a strong culture, mapped their knowledge flows effectively, invested in the right technologies, and they support these activities effectively, they can expect to reap the rewards of an effective knowledge management system (3, 4).

Effective information architectures are the result of having successful knowledge architectures. To some, this could be a chicken and the egg type of argument, as the two of them work in such a unique tandem. The characteristics of information architectures are usually comprised of databases, websites, software, intranets, extranets, online communities, and communities of practice. Essentially, the information architecture takes well-managed knowledge architecture to the next level. The information architecture allows these communities of practice the ability to create their own identities and culture. The biggest challenge for corporate leaders is allowing these communities of practice to exist, while also keeping them in lock step with the overall knowledge culture (3, 4),

THE GOVERNMENT INFORMATION FACTORY

Background

In the evolution of corporate infrastructures, application systems that performed detailed transactions paved the way for data warehouses. Data warehouses opened the door for operational data stores, data marts, and data mining. Eventually, the Corporate Information Factory became commonplace by incorporating the data warehousing techniques of the past, such as aforementioned operational data stores, data marts, and data mining. The Government Information Factory evolved out of the Corporate Information Factory, as state, local, or federal governments all seem to have independent, yet unique needs that the Corporate Information Factory does not address (1).

The Government Information Factory became even more import and after the acts of terrorism on September 11th, 2001. Broken information systems from within the government became even more apparent due to the inefficiencies of information flows. New security measures, integrating data amounts government agencies, and a new emphasis on information sharing all legitimized the Government Information Factory in the new millennium (1).

Incorporating the Zachman Framework

The Zachman framework and the Government Information Factory form a great union when paired. As Inmon (1) states, "The Zachman framework and the Government Information Factory work in tandem with each other – in an extremely complimentary fashion – to produce the architecture and the plan for modernizing government systems, and a path for moving forward into the future (p. 6)".

The components of the Government Information Factory include operational applications, transaction processing systems, data warehouses, data mining, web environments, interfacing with other government agencies, archiving of data, preventative and predictive securities, and decision support systems applications. Together, the Zachman framework and Government Information Factory create the needs for the architecture. Thus, the modernization of legacy systems and the enabling of information sharing initiatives become more achievable than with other architectures. Furthermore, the Zachman framework works with the Government Information Factory because together they identify the needs of the system, such as the scope definition, enterprise model identification, dependent and independent technologies, and the functioning systems of the architecture (1, 6).

For the sake of an example, a fictitious government entity will be used as an implementation ground for the Zachman framework. Let us assume that this is a new Department of Defense (DoD) agency, formed to achieve a purpose that current government agencies do not address. This agency was formed to be a centralized administration of unmanned aerial vehicles (UAV), as the development and sustainment of UAVs is spread out amongst the DoD. This new agency has all of the elements needed to stand alone, yet they do have external customers and overseers. These elements include leadership, research and development (R&D), operations, policy, finance, and procurement. Like any new or old government organization, they have problems communicating, achieving goals, and deploying quality internal and external products.

With an established vision and mission, this organization can first make use of the Zachman framework by using the perspectives to align with the vision and mission. The vision and mission feed the scope and business model, as the contextual and conceptual perspectives will be honed. From there, the product or service is defined, as well as the receiving customer base. That product or service takes shape through the system model and the technology model, as the designer and builder perspectives add the technical and expert details to what the customer will receive. Finally, the detailed representations are carried forth for contractor and subcontractor relationships. These days, the out-of-context perspective of the detailed representations is of more importance than ever given the high level of reliance that U.S. Government organizations have on industry. For this fictitious government organization, these detailed representations would likely be are statements of work (SOW), key performance parameters (KPP), or other contractual specifications that would be part of a request for proposal (RFP) in order to carry out the development of a product or the labor to perform a service.

In this example, the abstractions serve as a reality check once the product or service has been contractually awarded. However, they are also quality checks to measure how well this agency is meeting its expectations to their external customers and overseers at the DoD level, as well as Congress. Asking the abstractions of what, how, where, who, when, and why will guide this young organization in controlling quality and delivering quality products and services. However, what if there is a problem? The Zachman framework will assist them in finding the problem. For example, let's say that there is an issue in which a UAV has crashed, and the problem appears to be human error. Using the Zachman framework from Figure 1, the People abstraction would lead us to believe that there is a human interface problem. That would also lead us to believe that there is connected issue with the system model and the designer perspective. Therefore, in order to fix the problem, this government agency would need to go back to the system model and re-examine how people interface with the UAV software before it has been developed and deployed.

CONCLUSIONS

The Zachman framework is unique because it captures the holistic view of an information system. It was the first system architecture to account for the human factor, which is a credit to its success. In accounting for the human factor, it properly blends people with the operations. It is a versatile tool to use, because applies to current systems just as much as it applies to new and future systems.

The Zachman framework is used by system architects much like a chemical engineer would use the periodic chart of the elements. The dimensions, both perspectives and abstractions, form the appropriate grid for cross pollination between differing views of what the system should be and functional realities of what the system will need to do. All six abstractions are needed to represent the perspectives effectively. When applied correctly, these dimensions form the desired state of system usability.

The fundamental issue in knowledge management is transitioning personalized tacit knowledge into stored and usable explicit knowledge. This problem is magnified in state, local, and federal governments as balancing technologies with organizational knowledge have always been a challenge. Furthermore, government information systems usually fail due to a lack of emphasis on the technology or the people using it, or perhaps a combination of both. The Zachman framework has been used in government organizations with success, and it is finding its way to newer government agencies. Its application to government systems is ideal, because it specifies that both the technology and the human interaction are equally important. This focus accounts for two of the biggest information systems problems found in government information architectures, which are outdated technologies and a lack of human interaction. These problems promote organizational silos and barriers to effective information sharing.

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