GENERALIZED ENTEPRISE FUNCTION FRAMEWORK (GEFF) FOR AUGMENTED AND ACTIONABLE KNOWLEDGE MANAGEMENT

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***Abstract**: In the current paper the Generalized Enterprise Function Framework for managing augmented and actionable knowledge is presented. A novel approach for developing Knowledge Assets is suggested. The Framework contains enterprise functions that are enriched with Knowledge Assets and value creation is described. It supports rapid change, design generation and strategic business transformation through the development of reusable knowledge assets: Synthesis instead of Analysis.*

***Keywords**: enterprise architecture, enterprise function framework, knowledge management, knowledge assets, augmented knowledge, actionable knowledge.*

***ACM Classification Keywords**: H.m Miscellaneous*

Introduction

When studying Knowledge Management for organizations, terms and references towards hypertext organization, network technology, inference mechanisms but also towards strategic and cultural aspects like organizational learning [Argyris C. 1999; Huber G. 1991; Senge M, 1990], process oriented aspects on knowledge creation [Nonaka I. 1994; Nonaka I., Takeuchi H., 1995] and knowledge metrics[Kaplan R., Norton D. 1992; Kaplan R., Norton D. 2001], etc. come up. The most promising approach for applying knowledge management within organizations is that of Organizational Knowledge Creation. Within the concept of Knowledge on Organizational Knowledge Creation the knowledge management cycle concerning the creation and sharing is defined in four areas called Externalization (leading to Conceptual Knowledge), Combination (leading to Systematic Knowledge), Internalization (leading to Operational Knowledge) and Socialization (leading to Sympathetic Knowledge) leads to two dimensions of knowledge creation called Tacit, or Subjective Knowledge and Explicit, or Objective Knowledge. In this article we will focus on the Combination approach.

Combination is the process leading from Explicit Knowledge back to Explicit knowledge again. It is a process of systemizing concepts into a knowledge system with the goal to share the knowledge. This mode of knowledge conversion involves combining different bodies of explicit knowledge. Individuals exchange and combine knowledge through such media as documents, meetings, telephone conversations, or computerized communication networks. What we have seen over the years, however, is that knowledge seems to evaporate during time, because the organizational structure changes and employees get new jobs or leave and new employees enter the organization arena. Because knowledge is organized according to the organizational structure, the knowledge has to be converted according to this new structure. Next, employees then are not able to find the appropriate and applicable knowledge because of the mass of information that is moved or created in or by this knowledge replacement and conversion.

The volume of information explodes exponentially over the years and soon new knowledge workers to certain areas haven't the faintest idea where exactly to look for information. The use of Wikis for documenting knowledge has helped, but the problem is to keep the information up-to-date. Within a few years, months or even weeks, the information described in Wikis and other media or tools for document and information management is out-of-date. Even with new solutions like combinations of collaboration tools and document management

systems, the information overload is not solved.

What is needed is a more work-related, component-driven solution that supports knowledge management:

- When knowledge is stored work-related, the total "container of knowledge" for each knowledge worker will be substantially smaller, so the knowledge worker can perform a search in a more limited space
- When knowledge is component-driven and each component is distinguishable different to the knowledge worker, the access to the knowledge component becomes easier.

Hence, we need a structured knowledge management register that is easily accessible, maintainable, and delivers value for the knowledge workers and the organization at large. Large web portals, web sites and wikis are very accessible, but when searching for the right information one is often still lost in the sheer volume of information. So accessibility is not enough. Accessibility should intuitively lead to the necessary information.

Augmented and Actionable Knowledge

Within knowledge engineering data become facts, and facts become knowledge when first the context or knowledge management rules are described and second the total can be interpreted by an inference engine leading to conclusions. Likewise we can say that for humans information is about understanding the context of data. If information is to become knowledge humans have to understand how to use information. Business knowledge goes one step further. Business knowledge should be applicable within the organization. If knowledge is not applicable it is only knowledge, not business knowledge.

How do we make organizational information or knowledge applicable? Nowadays this is often performed by designing and developing Business Processes and automated Information Systems. To understand how they work we document these processes and information systems. Business Processes are formalized actions that are "chained together" in a formalized way. Decisions, or gateways as they are sometimes called, change the directions of these flows in Business Processes. These Business Processes and their flows can be managed by workflow and business process management systems. The formalized actions, when automated, can become information applications directing the user how to manage the information. In case of manual actions, these actions can also be formalized as mechanized actions with employees handling machines, for example in production processes. Fully manual actions, like accepting the daily post delivery, can be formalized by describing how to perform these actions.

We see that actions are related to two types of business knowledge. On the one side we see formalized knowledge of manual or automated actions concerning transforming materials and/or data, which we can call the data processing knowledge, and on the other side the explicit knowledge as a description of how these actions should be performed and managed, which we can call document processing knowledge. So we see that on the one hand we have knowledge completely contained within the formalized actions and on the other hand we have the knowledge contained in the description of how to perform and manage the action. To address things clearly, we will define the first knowledge, the knowledge of the action, as **Actionable Knowledge**, and the latter knowledge, the knowledge describing how to perform and manage the action as **Augmented Knowledge**.

Before this knowledge can be formalized in a declarative form and made explicit in descriptions and implicit in the formalized actions, this knowledge is more or less implicitly available in the heads of management and employees. Most of the applicable knowledge is implicit and will stay implicit as long as there is no necessity to use this applicable knowledge. But of course we can distill this applicable knowledge and make it explicit actionable and augmented knowledge. The possibility to describe this knowledge when no actions are at hand is suggested in the current paper.

Enterprise Functions and Knowledge Assets

An Enterprise Function is anything that an organization performs to fulfill its targets, without any concern about the organizational context. It describes only the "What". Hence, no references are made to "Who" performs the function "How" and with "Which" instruments, "When" and "Why", etc. The Enterprise Function is generally speaking defined as a combination of a verb and a noun (and several adjectives). For example an Enterprise Function can be defined as "Enter Customer Order". As the Enterprise Functions are described without their organizational context, through time these Enterprise Functions will hardly change. This is why, as we will later see, they form a Knowledge Asset.

We can describe all activities of the organization as Enterprise Functions. Actual as well as future activities, formally already defined activities as well as activities that are needed when new strategies and plans are to be rolled out. With this in mind we also solve the problem as to how to describe knowledge when no actions are at hand, yet. With them defined, we can describe both actionable information, as well as the augmented information concerning each Enterprise Function (Figure 1). When we add this information to the Enterprise Function we call it a Business Function. The knowledge is made intuitively accessible.

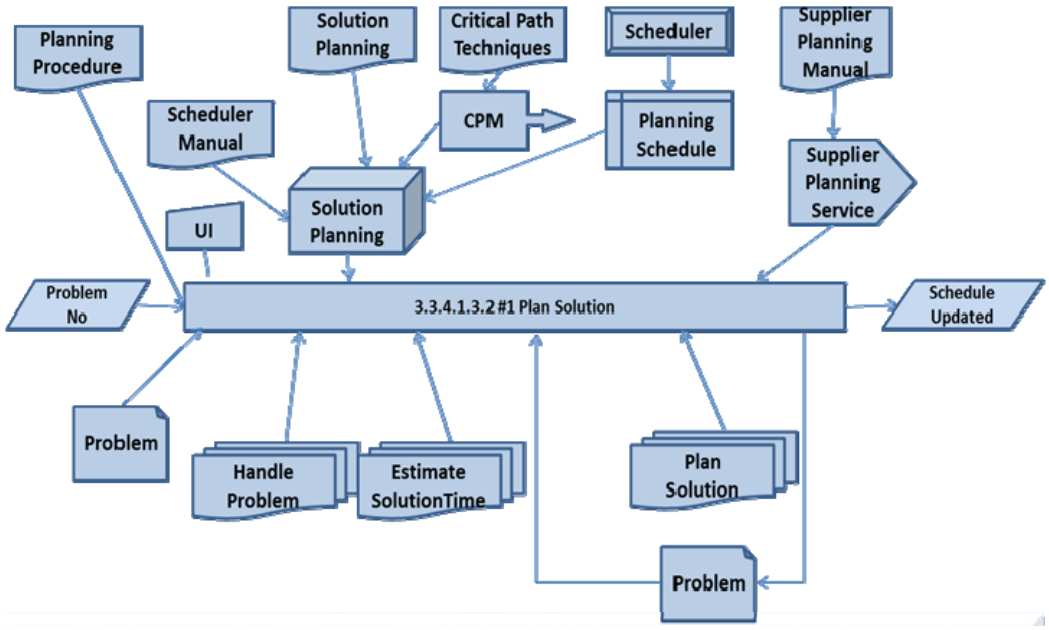

Figure 1: An example of the Enterprise Function (Plan Solution)

The Enterprise Function is shown in the middle: Plan Solution. It is enriched in this figure with Augmented Knowledge (above the Enterprise Function) and Actionable Knowledge (below the Enterprise Function). The Augmented Knowledge is How the user can do the function (How the "Plan Solution" should be performed) with what (manuals like the "Planning Procedure", methods like "Solution Planning", techniques like "CPM" or critical path method, tools like the "Scheduler", models like the "Planning Schedule", and services like the "Supplier Planning Service"). The Actionable Knowledge describes How the information is processed with what (Business Objects like the "Problem", Business Rules like "Handle Problem", and the User Interaction (UI).

There are organizations that have defined many levels of Enterprise Functions by decomposing Enterprise Functions of a higher abstraction level into more elementary Enterprise Functions. Soon, a Framework in which all Enterprise Functions are structured logically is necessary. After studying several of such frameworks it became obvious that finding, and accessing Enterprise Functions within such frameworks is difficult and the lack of what is called "intuitive access" is obvious. With intuitive access finding the right elementary Enterprise

Function is easy because the structure of the framework is logical and the search path is clear. With a logical framework, the right Enterprise Function can be found by navigating in a very simple and obvious way through the framework. The applicability of such an Intuitive Enterprise Function Framework grows when it can be applied for any and all organizations: the Framework can be raised to a standard.

Of course, at the elementary level no organization is the same as the other, but on certain higher level they function in a comparable way. Also, with Enterprise Functions that are standardized by rules and regulations, like the different elementary Functions within Financial Administration, and those used by standardized ERP systems, elementary Functions are applicable for many organizations. What we have found using such frameworks, is that it is possible to define an Enterprise Function Framework, or EFF, applicable for all organizations. The Enterprise Functions within such a framework are very generalized. This is why we call it the **Generalized Enterprise Function Framework (GEFF)** because the functions mentioned within the framework need to be applicable for any type of organization.

Levels of Enterprise Function Frameworks

The GEFF forms the foundation for other, more specialized EFFs. In total we found that it was necessary to distinguish five levels of the Enterprise Function Framework to use it as an instrument for comparison of two types of organizations or even two organizations. The most obvious differences between these specialized Frameworks, are differences based on the industry or line of business (LoB): the EFF of organizations belonging to one LoB differentiate from the EFF of organizations belonging to another LoB. Therefore we defined not only the GEFF (level 1), but also many different LEFFs, or Line-of-Business Enterprise Function Frameworks (level 2).

Within a LoB we see many different types of organizations. When looking at the Financial sector or line of business we can distinguish Banks, Insurance Companies, Leasing Companies, Pension Funds, etc. These different types of organizations are completely different, although a large part of the enterprise functions will be the same. The EFF for this distinction we called the MEFF or Market area EFF (level 3). But when we compare organizations within each market area, we also see very different types of organizations. For example, banks can be wholesale or retail oriented and thus will use completely different enterprise functions where there areas of business distinguish from each other.

Next, when looking at differences between two retail banks we can see differences between these banks based on what functionalities they want to use within their operating model, based on their strategic choices, their proposition model – including which geographical area they want to operate –, their value creation model, and their way of managing the organization. But at this level (level 4) we are actually comparing specific organizations. This is why we call the EFF for this level the SEFF or specific EFF. In due time, departments within the organization can grow into different, more or less stand-alone business units that become cost and revenue responsible for doing their own business. Because of the differences within each business unit we found that an extra level of the EFF should be introduced: the BEFF or Business Unit EFF (level 5).

Because the highest EFF level as well as the lowest level we use the same structure, the EFF's Intuitive Accessibility is very high. In fact, with the EFF, comparing the functionality of one organization to the functionality of another organization can be made easily. Because of this, it is possible to reuse actionable and augmented knowledge from one organization by adapting these enterprise functions.

Maintainability

When Knowledge has to be maintained we often add or change the augmented information by either referencing new documents or by updating the original documents. But when the modus operandi really changes by

introducing a new organizational structure, new methods, techniques, and tools, for work, or by introducing new models or even external services, a more structured maintenance of the augmented information is necessary.

When we want to maintain the augmented knowledge of an Enterprise Function we need to know what components build up to the Enterprise Function. We have found that the following components are necessary to maintain:

- Documents
- Models
- Methods
- Techniques
- Tools
- 3rd Party (Business) Services

Of course, all types of media data like audio or video files, photos etc. are applicable. We share them under the document components. Even models could be classified as document components, but as they are more related method, techniques and tools, we gave them a special category.

Maintaining actionable information is different. For an Enterprise Function to become actionable we either need them to be described as software applications with specification based on a programming language (PL), or as a Function with specification based on a business rule language (BRL) and business rule engine to execute the BRL. As Business Rules can be described in Natural Language, like a more formalized and structured English, or any other language, we use Business Rules to define Actionable Knowledge. We found that the following components are relevant to address maintainability of Actionable Knowledge:

- Business Rules
  there are several types of Business Rules like constraints, or data rules, and function rules
- Business Objects
  as Business Rules need to act on Facts or data variables, we need structured sets of data, or business objects, to describe the variables
- User Interaction
  often, users interact with Business Functions, adding more data or changing the data, to the Business Function; the User Interaction plays an important role in the maintainability of a Business Function

Value Creation

Information and knowledge are not always valuable to all organizations. Organizations delivering stored products from warehouses to consumers have not the least interest in information and knowledge concerning rocket science, for example. So information and knowledge in organizations should be of value. But how can we decide whether information and knowledge really have value to the organization? The above mentioned example is obvious, but in many cases the grey area between valuable and non-valuable information and knowledge is very large. Here time also plays its role: what seems invaluable at this moment can be very valuable in due time. But is it therefore necessary to store and maintain all potential valuable information and knowledge?

We have seen that applicable knowledge has two sides, Actionable Knowledge, describing how to make knowledge actionable in data processing, and Augmented Knowledge, describing how to make knowledge actionable in document processing and more conventional ways of working. It seems obvious that the creation of value towards these two types also differs.

Value and Actionable Knowledge

As Actionable Knowledge uses a formal, declarative, language to describe the data transformation, it is ideal to

use within data processing and within the automated parts of business processes. The value creation within business processes, although not complete, is often described within methods like value chain analysis and the creation of value described by Porter [Porter, M.E. 1985], BPR, Lean, Six Sigma, etc. Within Business Processes it is easier to describe and define the creation of value than within Enterprise or Business Functions. However, this is still possible. When looking at all dimensions and vectors of creation of value (costs, revenues, risks, waste, etc.) it is also possible to specify at least a part of the value creation. As an example, we might look at the Enterprise Function "Accept Mortgage" of a mortgage bank. On the one side the loan delivers revenues to the bank, but on the other side there is the risk of back payments. Within one Function the creation of positive value (revenue) and negative value (risk) can be described with the declarative language in terms of business rules. So the creation value for the organization is covered.

The value of Actionable Knowledge for knowledge worker is a general one. Through the use of formal language of a (very) high level, the knowledge worker can understand the Business Function more easily than when he or she has to delve into computer code. Computer code is not only harder to understand through its complexity, strange syntax and semantics, but also through the volume of the code necessary to execute a function.

Another value of the Actionable Knowledge is that Business Functions described with Business Rules and with the support of a Business Rule Engine can really become actionable. The approach is called Direct Model Execution or DME. With it the Business Functions and Business Processes can be executed as if they were software applications or automated information systems. The advantages and benefits, and thus the value, are obvious:

- After design and specification the Business Functions and Processes can be directly tested focused on their functionality resulting in
    - higher quality,
    - less failures in systems delivery
- The systems delivery phase (Technical Specification, Build, Testing) will be shortened resulting in
    - a faster delivery track and
    - less costs
- The maintainability of the Business Rules is far more easy than the maintainability of programming code

Value and Augmented Knowledge

Augmented Knowledge describes how the Business Function should be performed from the view of document or non-data processing. It describes the "know-how" as well as the "know-what", and the "know-why". Even the "know-who" can be described[1]. The Augmented Knowledge is described in terms of documents describing the Business Function as a whole as well as the application and use of methods, techniques, tools, models, services, etc. to deliver the results of the Business Function.

Of course, what is applicable for business rules within the area of data processing is also applicable in the Value Creation area. The value of Augmented Knowledge for the knowledge worker is that, even without ever hearing about the Business Function beforehand, the knowledge worker can understand what the Business Function should perform, how it will work, what the results should be, what value it should create (relative or absolute, for all value focus areas), etc. The value of Augmented Knowledge for the organization is a general one. The organization will profit from the fact that Augmented Knowledge is formalized, externalized, and maintainable.

All the Enterprise Functions within the framework will hardly change. There are other components within the

[1] To keep it time independent not the different names of people should be addressed as well as their roles or functions

business that will not change very much either. For instance the types of events from outside the organization, like an incoming invoice, an order, a complaint, etc., will not likely change every year: the rate of change lies around decades as investigations on this matter have shown. When we describe these business components well, they become of value and importance to the organization and represent a lot of knowledge.

Because they represent value we called them Knowledge Assets. Other types of Knowledge Assets are Results (the counterpart of the Events described above, as a result of a business process to the outside world of the organization), and Enterprise and Business Objects, that describe on a high level the structure of data and information of the organization. Business Rules also form a class of Knowledge Assets, although they will be changed more often than Results and Business Objects that change more often than Events, Enterprise Functions, and Enterprise Objects. When we use the EFF and enrich the Enterprise Function with Augmented and Actionable Knowledge, in which way we transform them into **Business Functions**, in fact we do not only define knowledge with which the knowledge workers understand the information related to the functions, but we also create so – called Knowledge Assets.

Structure of the GEFF

We will describe some structuring rules that ensure that a Generic Enterprise Function Framework (GEFF) can be developed which is applicable, at a very high level, to any type of organization. When studying different types of organizations, we distinguished differences between the used Enterprise Functions of organizations belonging to different Lines of Business, but we can also found that at a medium level there are many similar Enterprise Functions used by organizations belonging to the same Line of Business. Therefore we developed Line of Business Enterprise Frameworks (LEFFs). At a lower level we found more differences between each organization, so therefore we developed specific Enterprise Function Frameworks (SEFF) for various organizations.

An EFF for the national government would be a LEFF, applicable to all ministeries. It is still possible to deveop one or more LEFFs for NGOs and Agencies. For some IT-related organizations within the government there would be another LEFF, with more project-oriented, tactical, functions, and (IT) service-oriented, operational functions can be defined, which are reusable across the IT LoB. Each organization can then, depending on its form of organization - department, agency, autonomous administrative authorities, ICT-driven organization - its own LEFF choose and expand and complement SEFF creating a hazard. Later, we will give an example of the hierarchy of the various EFFs.

For the different EFFs the same structuring rules applied. Here they are, from the gEFF argued, was appointed. We recognize the following Structuring Principles (Figure 2):

- Layered Model
- Demand and Supply side
- Proposition
- Grouping of functions by combining supply / demand side and Proposition

Layered Model

Within the GEFF and other models we distinguished four top-level layers which we subdivided further. The following layers are recognized:

- Supporting Layer

here, all Enterprise Functions are grouped that cannot be categorized in other layers. The Enterprise Functions in this layer are mainly determining policies to Enterprise Functions in other areas (strategic, but also tactical and

operational preparation)

- Strategic Layer

The appointed Enterprise Functions directed to focusing the organization on the future situation, three main groups are recognized:

  - Strategic Analysis

concerned with analyzing the external changes and strategic choices as a response to these changes

  - Enterprise Architecture Analysis

engaged in translating the strategic choices in designing a blueprint organization in all its aspects and consistency

  - Strategy Planning Domain

focused on developing (sub)strategies in various areas of the organization

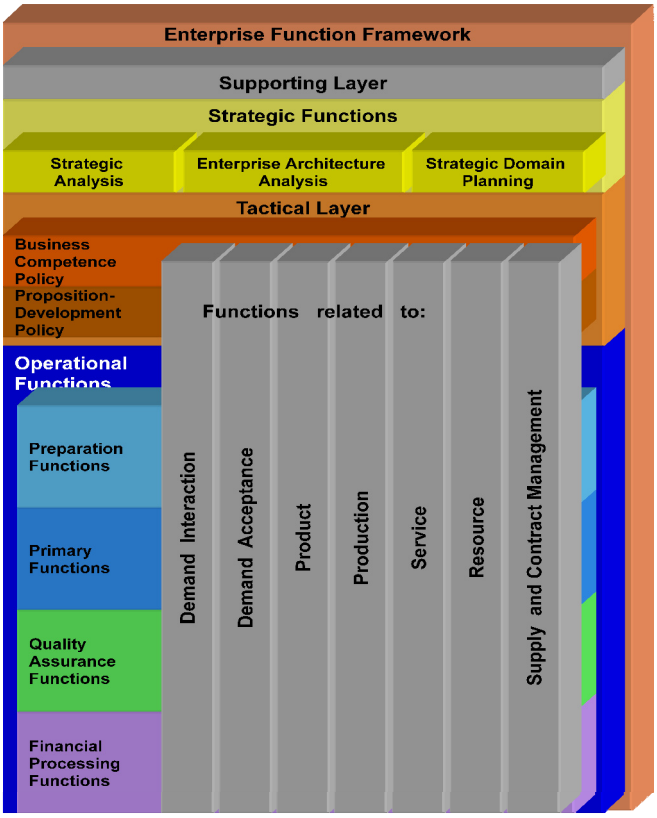

Figure 2: Structure of the GEFF

- Tactical Layer

All Enterprise Functions that deal with setting up the organization in the short term, two main groups of functions are identified:

  - Business Competency Policy

focused on developing the core competencies of organization and staff; will also see on the changes within the organization to be prepared. Examples include performing large scale changes, programmes, portfolio management, and projects focused on large scale maintenance

  - Proposition Development Policy

focused on developing the Proposition of the organization, the Proposition (see below) is a combination of Products, Services and Resources, but also promoting, pricing and the introduction of the Proposition to the

market (marketing and sales areas such as marketing campaigns, promotions, marketing segments and customer profiles)

- Layer Operational

Again, all functions are grouped dealing with the delivery of the Offer;

  - Preparation
  - Primary Process
  - Assurance
  - Financial Processing

Demand and Supply side

In many EFFs it is not clear whether functions work on the support side, belong to the operational side or are dealing with marketing or sales. However, a simple and clear distinction can be made through placing demand side (selling, the proposition, and the customer) on the left position of the EFF and the supply side (i.e. purchasing, and suppliers) right. The advantage is that there is clarity as to the position of various features that serves the searchability of Enterprise Functions.

Proposition and Performance Functions

Between the Enterprise Functions of the demand and supply side are the Performance Functions. The Performance Functions ensure that the proposition to the market can be realized. This is applicable to any organization, because each organization must create value for its stakeholders or, in other words, should offer its proposition while creating (competitive) value. These Performance Functions in many cases, exhaust stocks. This results in functions for replenishing these stocks like purchase orders to suppliers. For some organizations for example the government, this exhaustion is more difficult to recognize. Often, however, in this area functions to allocate budgets or grants are relevant. Full utilization can be carried out on the basis of a physical inventory, but also as a financial budget. In some cases, organizations are engaged in providing information. Stocks may in that case be regarded as information. An example can be the case when data is made available for use by third parties, such as geo-information and open data.

The question is, which parts of the Proposition should be used for this? Within the standard EFF a clear distinction is made between Products, Services and Resources. These principles are useful for any organization:

Product

A product is a physical good, a financial asset, a collection of information or intellectual results that the market sees as the main component of the Offering of the organization. A product is produced as a physical property (article) by a production or assembly process, a result of an intellectual process, in the form of an execution process, etc.

Service

A Service is a (group of) features or activities that realize the delivery of Products in the market. An example of a Service within Governmental Departments could be the execution of Supervision, Inspection, Detection, Incident Management, Disaster Management Research Laboratory, etc.

Resource

A Resource enables the delivery of a Service or Product on the market. A Resource is mostly a physical asset, such as a shop truck, a communications network, etc. or a regulation, like a Grant or a Tax regulation. As stated, other aspects are concerned with the proposition, but for the structure of the output functions, they are not so important. These aspects include the functions for Policy Development at the Offer Tactical level.

Operational Enterprise Functions

Based on the above, the following seven groups of executive functions are recognized:

1. Demand Interaction - both educating and advertising and sales
2. Registering the Question - the (product dependent) recording the question by the applicant
3. Order Acceptance - accepting questions, such as declarations or grant completeness check ensures that the application is accepted can be
4. Production, Assembly or Implementation - the process of demand including approve or decline
5. Service - performing audits, etc.
6. Resource - delivery (physical), consumerisation (financial budget) or use (information)
7. Purchasing - ordering of raw materials, etc. or give instructions

Standard EFF Structure

Because the Demand and Supply sides in the EFF processed, the processing application, implementation, providing products, services and resources, and assigning sequential assignment grouped into the EFF regarding the Operational layer. These columns beslaag both the tactical and operational layers and are conveniently call processing columns. Thus the following picture emerges of a EFF.

Conclusion

The presented Generalized Enterprise Function Framework supports Business Transformation and Value Proposition Development. Based on a novel approach in process design and engineering, including knowledge management, the integrated Enterprise Architecture Framework offers value creation and development of re-usable knowledge assets.

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