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DEPARTEMENT BEDRYFS- EN SISTEEMINGENIEURSWESE
DEPARTMENT OF INDUSTRIAL AND SYSTEMS ENGINEERING

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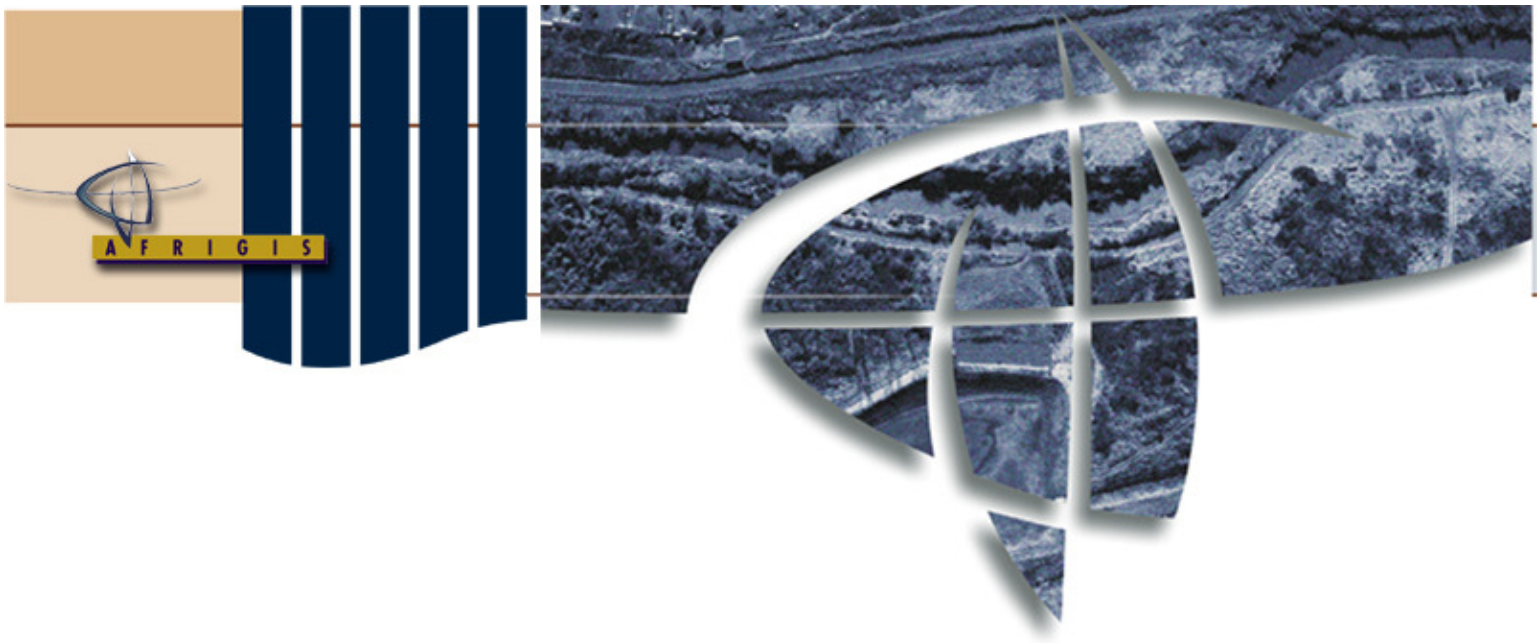

Developing a Business Process Content Management System for Software Product Development

at

AfriGIS Pty. Ltd.

by

PGJ du Toit - 22160401
BEng – Industrial and Systems Engineering

Final Year Project Document

Submission Date
2008-10-23

Executive Summary

AfriGIS is one of the leading providers of Graphical Information System (GIS) solutions and Location Based Services (LBS) in Southern Africa. Constant advances in Global Positioning System (GPS) technologies have led to a wide range of possible applications for GIS and LBS. These technologies can be used to enhance or improve business applications by exploiting a client's geographic position (e.g. location-sensitive billing, traffic updates and personalized weather services). These useful features can give a product or service the competitive edge over its competitors. The increasing demand for AfriGIS's services and products has forced the company to stretch its resources in order to meet demands.

'Whoever is first in the field and awaits the coming of the enemy, will be fresh for the fight; whoever is second in the field and has to hasten to battle, will arrive exhausted.' - Sun Tzŭ (Clavell 1981, p.36). The rapid rate at which technology advances places a lot of pressure on technology focused companies to deliver cutting edge, high quality products before its competitors. In order for AfriGIS to maintain its current growth rate it needs to meet all new and existing client and market demands. The constraints of short delivery periods of high end products with limited resources requires an effective use of workflow, content management (including development support documentation), process management and a clear definition of roles and responsibilities.

Thorough evaluation and consideration prior to taking on a new project is crucial to ensure that valuable time or resources are not wasted on projects that have a high probability of failure. A standardised system or process is required for evaluating new development projects and concepts or ideas. The *Stage-Gate Process* and *Portfolio Management* will be used to evaluate new software product development projects and to align the development business processes with AfriGIS's Critical Success Factors for new-product projects.

A business process content management system for software product development is to be developed and implemented at AfriGIS. Business process modelling tools like the *Zachman Framework* will be used to identify, evaluate and optimise (where necessary) the relevant software product development processes as well as define the roles and responsibilities. The processes will be modelled using applicable business process modelling software tools like *TIBCO* (a shareware business process management and business process integration software tool). The relevant development process support documentation templates will be compiled. *Alfresco* (a shareware Content Management System) will be implemented to manage the relevant content and to automate workflow.

Key Performance Indicators will be used to measure the operational performance of the business process content management system.

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Glossary

Business Process

A business process is a set of coordinated tasks and activities, conducted by both people and equipment that will lead to accomplishing a specific organizational goal. Whether manual or automated, all processes require input and generate output. It can be decomposed into several sub-processes, which have their own attributes, but also contribute to achieving the goal of the super-process. Business Processes are designed to add value for the customer and should not include unnecessary activities.

There are three types of business processes:

- Management processes: processes that govern the operation of a system. (e.g. Corporate Governance and Strategic Management)
- Operational processes: processes that constitute the core business and create the primary value stream. (e.g. Purchasing, Manufacturing, Marketing, and Sales)
- Supporting processes: processes that support the core processes. (e.g. Accounting, Recruitment, IT-support)

The outcome of a well designed business process is increased effectiveness (value for the customer) and increased efficiency (less costs for the company).

Business Process Management (BPM)

Business Process Management is a systematic approach to improving an organization's business processes. It is a systematic approach to improving an organization's business processes. BPM is a subset of infrastructure management, the administrative area of concern dealing with maintenance and optimisation of an organization's equipment and core operations. BPM activities seek to make business processes more effective, more efficient, and more capable of adapting to an ever-changing environment.

Content Management (CM) / Enterprise Content Management (ECM)

Content Management, or Enterprise Content Management, is a set of processes and technologies that support the evolutionary life cycle of digital information. It is a framework to generate, to administrate (organise, store and prepare), to distribute or deliver and to create possibilities of using and processing electronic content (documents, images, e-mail messages, instant messages,

video, and more), whether it is located on the Internet, Intranet or in corporation-wide systems. Attention is drawn on actuality, consistence and accessibility of the content.

Content Management System (CMS)

A Content Management System is a tool that enables users to create, edit, manage and finally publish (in a number of formats) a variety of content (such as text, graphics, video, documents etc), whilst being constrained by a centralized set of rules, processes and workflows that ensure coherent and validated electronic content.

A CMS may support the following features:

- identification of all key users and their content management roles,
- the ability to assign roles and responsibilities to different content categories or types,
- definition of workflow tasks for collaborative creation, often coupled with event messaging so that content managers are alerted to changes in content,
- the ability to track and manage multiple versions of a single instance of content;
- the ability to capture content,
- the ability to publish the content to a repository to support access to the content.

Critical Success Factor (CSF)

A Critical Success Factor is an element of organizational activity which is central to its future success. It can change over time, and may include items such as product quality, employee attitudes, on time delivery and customer satisfaction. The identification and strengthening of such factors may be similar to identifying core competences, and is considered an essential element in achieving and maintaining competitive advantage.

The identification of CSFs helps the organization to focus its attention on major concerns. These factors are easy to communicate to co-workers, easy to monitor and they can be used in conjunction with strategic planning methodologies. Clarifying the priority order of CSFs, measuring results, and rewarding superior performance will improve the odds for long-term success.

A Critical Success Factor is not a Key Performance Indicator (KPI). CSFs are elements that are vital for a strategy to be successful. KPIs are measures that quantify management objectives and enable the measurement of strategic performance.

Geographic Information System (GIS)

A Geographic Information System, also known as a Geographical Information System, is a system of hardware and software used for storage, managing, mapping, and analysis of geographic data.

In the strictest sense, it is any information system capable of integrating, storing, editing, analysing, sharing, and displaying geographically referenced information.

Spatial features are stored in a coordinate system (e.g. latitude and longitude) which references a particular place or position the earth. Spatial data and associated attributes in the same coordinate system can then be layered together for mapping and analysis. GIS can be used for scientific investigations, resource management, and development planning.

Global Positioning System (GPS)

GPS is a radio navigation system that allows land, sea, and airborne users to determine their exact location, velocity, and time 24 hours a day, in all weather conditions, anywhere in the world. GPS is used to support a broad range of military, commercial, and consumer applications.

A constellation of 21 GPS satellites and 3 spare satellites are in orbit at 10,600 miles above the Earth. The satellites are spaced so that from any point on Earth, four satellites will be above the horizon. Each satellite contains a computer, an atomic clock, and a radio. Each satellite continually broadcasts its changing position and time. On the ground, any GPS receiver can triangulate its own position by getting bearings from three of the four satellites. The result is provided in the form of a geographic position (longitude and latitude). A receiver equipped with a map display screen shows the geographic position on the map. If a fourth satellite can be received, the receiver/computer can figure out the altitude as well as the geographic position. If you are moving, your receiver may also be able to calculate your speed and direction of travel and give you estimated times of arrival to specified destinations.

GPS has applications beyond navigation and location determination. GPS can be used for cartography, forestry, mineral exploration, wildlife habitation management, monitoring the movement of people and things and bringing precise timing to the world.

Key Performance Indicator (KPI)

Key Performance Indicators are quantifiable measurements (metrics) that reflect the Critical Success Factors (CSFs) of the company, department or project. KPIs are frequently used to value difficult to measure activities such as the benefits of leadership development, engagement, service and satisfaction. KPIs are typically tied to an organization's strategy. KPIs should not be confused with a CSF. A Critical Success Factor would be something that needs to be in place to achieve a specific objective.

KPIs are, above all else, a set of indicators to measure data against a sort-of enterprise success gauge. Ultimately, they help an organization assess progress toward declared goals. The

application of KPIs provides business executives with a high-level, real-time view of the progress of a company. They may consist of any combination of reports, spreadsheets and charts.

Location Based Services (LBS)

A Location Based Service exploits a client's geographical position – obtained by mobile positioning (the ability to pinpoint the location of a mobile caller or vehicle in transit by triangulation). LBSs are information and entertainment services accessible with mobile devices through the mobile network and utilizing the ability to make use of the geographical position of the mobile device. Ideally, the information provided should be both location-specific and personalized based on the personal profile of the user. These LBSs are used for emergency purposes as well as enhanced business applications such as location-sensitive billing, traffic updates, fleet management, asset and people tracking, personalized weather services and even location-based games.

Spatial Information / Geospatial Information

Spatial or geospatial information is created by manipulating (collecting, extracting, storing, analysing and exploiting) geographic data (geodata) in a Geographic Information System (GIS). The environment in which a GIS operates is called a spatial information system, and is designed and created to respond to the strategic spatial information needs of people or organizations. Spatial information may be presented in the form of printed maps, charts, photographs or in the form of digitised maps and charts or attributed centreline data. Typical applications are land registration, hydrology, land evaluation, planning or environmental observation.

Workflow

Workflow can be described as the automatic routing of documents to the users responsible for working on them. Workflow is concerned with providing the information required to support each step of the business cycle or process. The documents may be physically moved over the network or maintained in a single database with the appropriate users given access to the data at the required times. Triggers can be implemented in the system to alert managers when operations are overdue.

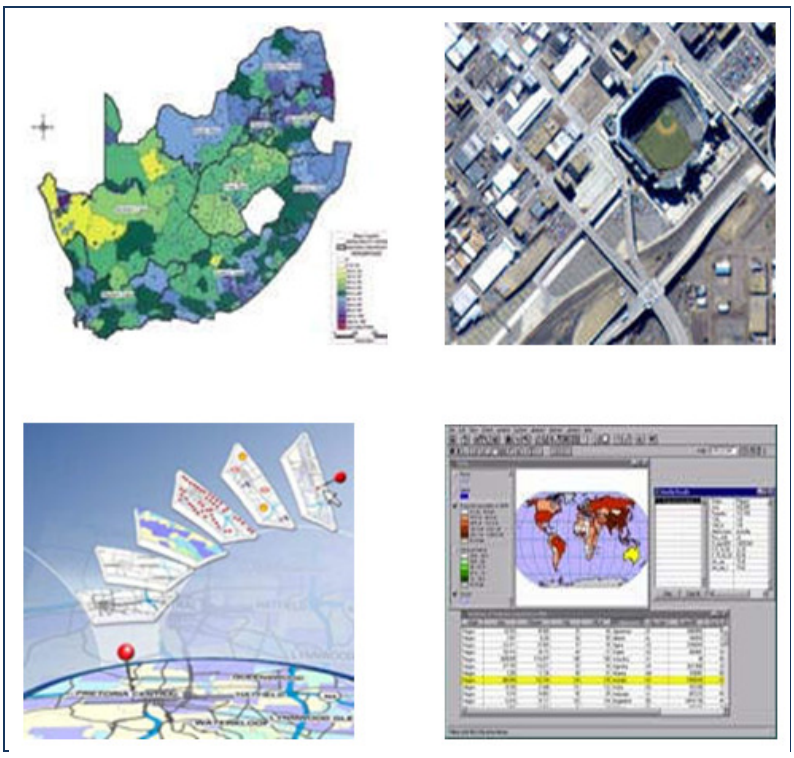
1 Project Planning

1.1 Background of AfriGIS

Since its establishment in 1997, AfriGIS has grown to one of the largest GIS (Graphical Information Systems) firms in South Africa with offices in Pretoria (Head Quarters) and Cape Town and points of presence in the UK, the Netherlands and Bangladesh. By utilising its comprehensive graphical and spatial databases, AfriGIS specialises in location based business consulting, building customer solutions and products around GIS technology and providing spatial datasets to a range of clients.

AfriGIS provides end-to-end solutions and products to corporate, government and consumer clients. Its commercial spatial datasets are combined in the various applications and software products to provide location business intelligence and location based consumer products. AfriGIS also provides consulting services to solve location related business problems, such as trade area analysis and least cost routing.

AfriGIS has been involved, and in most instances is still involved, in the spatial information strategy for numerous organisations. Most prominent of these include TDS (Telkom Directory Services – Yellow Pages), Vodacom Group (Pty) Ltd, Gautrans (Gauteng provincial government Department Transport and Public works), African Bank and the IEC (Independent Electoral Commission).



1.2 Background on the problem

AfriGIS encounters four types of software product development projects:

1. A new software product to be introduced to the market (the product idea comes from an internal idea generation process, usually to fill a gap in the market).
2. A new software product developed for a client according to specifications (the product idea comes from a client request in consultation with the product development team).
3. Upgrading or expansion of an existing software product already on the market (a need arises to expand the current product capabilities or technology is developed that allows for the product to be improved).
4. Upgrading or expansion of an existing software product that was developed for a client (the client requires the capabilities of the product to be expanded or technology is developed that allows for the product to be improved).

For new or existing products where a client has already placed an order the risk of project failure is very low because the product is developed in cooperation with the customers in order to meet their specific requirements as well as fall within the developmental limitations. The product already has a buyer so the risk of a financial loss is also at a minimum.

For new or existing products that are developed or improved to be introduced to the market, the risk of failure and financial loss is significantly higher. There is no certainty that the market will embrace the product and that it will be a success. This increased risk factor requires extra calculation and evaluation when it comes to the feasibility study for the project.

1.3 Problem statement

The constant advances in GPS (Global Positioning System) technologies and GIS applications have placed a constantly increasing demand on AfriGIS's services and products. As a result the company has to stretch its resources in order to meet demands. For AfriGIS to maintain its growth it has to meet all new and existing client and market demands. The constraints of short delivery periods of high end products with limited resources requires an effective use of workflow, content management, software product development management and a clear definition of roles and responsibilities. Currently there is no standardised system in place to evaluate projects and concepts / ideas, track workflow progress and produce front-end documentation.

1.4 Project aim

The aim of the project is to develop and optimise a business process content management system that will ensure AfriGIS's capability to meet its operational requirements.

Thorough evaluation and consideration prior to taking on a new project is crucial to ensure that valuable time or resources are not wasted on projects that have a high probability of failure. A standardised system or process is required for evaluating new development projects and concepts or ideas. A standardised system or process is required for evaluating new development projects and concepts or ideas. The *Stage-Gate Process* and *Portfolio Management* will be used to evaluate new software product development projects and to align the development business processes with AfriGIS's Critical Success Factors for new-product projects.

1.5 Project scope

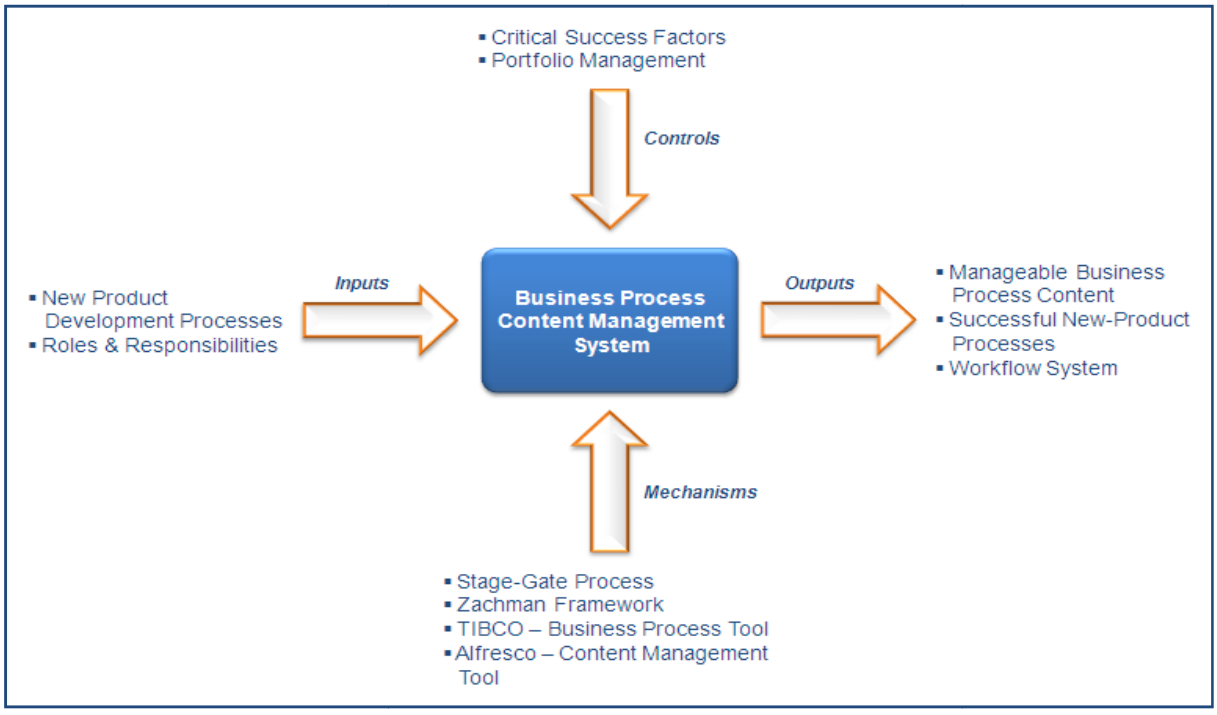


Figure 1 – Overview of the TO-BE Business Process Content Management System

A business process content management system for software product development is to be developed and implemented at AfriGIS. Business process modelling tools like the *Zachman Framework* will be used to identify, evaluate and optimise (where necessary) the relevant software product development processes as well as define the roles and responsibilities. The processes will be modelled using applicable business process modelling software tools like *TIBCO* (a shareware

business process management and business process integration software tool). The relevant development process support documentation templates will be identified and evaluated. *Alfresco* (a shareware Content Management System) will be implemented to manage the relevant content and to automate workflow.

The guidelines associated with *Portfolio Management* and the *Stage-Gate Process* will be used to align the product development business processes and procedures with the critical success factors for new-product projects.

Key Performance Indicators will be used to measure the operational performance of the business process content management system.

The project will be done with cooperation from AfriGIS and its relevant employees. The project will run from the middle of February 2008 until the end of October 2008.

1.6 Budget and resources

The project is an in-house project to be conducted solely in Pretoria at the AfriGIS Head Quarters and the University of Pretoria Main Campus. The management software tools that will be used in the project are shareware and are available to download for free from the internet. Existing product licences will be provided by the University of Pretoria or AfriGIS for any software that needs to be purchased.

The only equipment to be used during the project will be a laptop (purchasing expense not applicable), an existing AfriGIS server to host the Alfresco Content Management System and personal computers provided by the University of Pretoria Post Graduate Labs. There will thus be no expenses regarding travel or software or equipment.

Pietman du Toit will be responsible for the development, management and implementation of the project.

Other resources available for input include:

- Magnus Rademeyer – AfriGIS Managing Director
- Charl Fouché – AfriGIS Director
- Colin Abouchabki – AfriGIS Project Manager
- Theo van Heerden – AfriGIS Process Manager
- Iaan Roux – AfriGIS Software Product Development Manager
- Other relevant AfriGIS staff
- Dr Antonie C Janse van Rensburg – Project Leader at the University of Pretoria.

1.7 Project phases

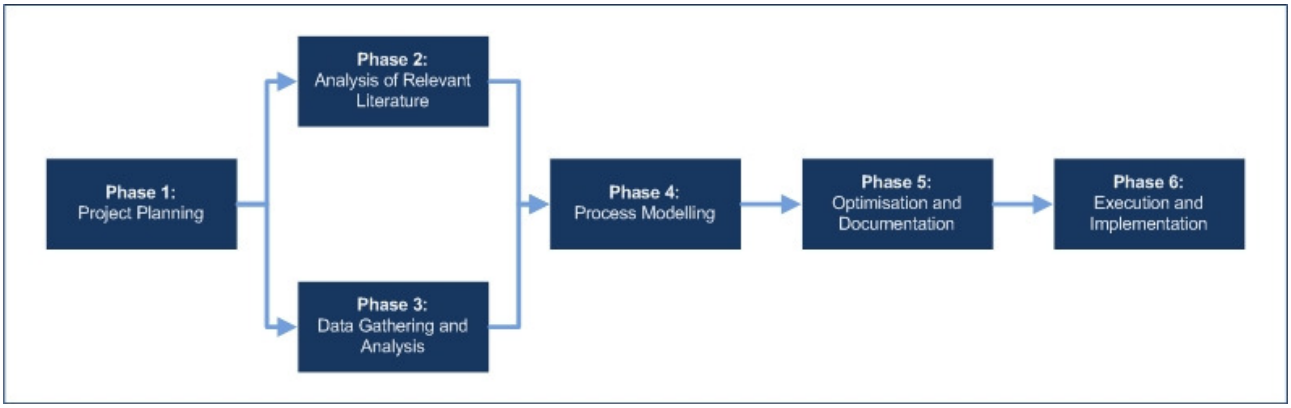


Figure 2 – Project phase diagram

Phase 1: Project planning - *Completed*

- Information gathering.
- Compile project proposal.

Phase 2: Analysis of relevant literature - *Completed*

- Research: literature study.
- Compile interim project report and presentation.

Phase 3: Gather and analyse data **-** *Completed*

- Evaluate process modelling and business process integration tools.
- Evaluate content management tools.
- Identify processes to be modelled.

Phase 4: Process modelling - *Completed*

- Model relevant development processes.
- Evaluate relevant development processes.

Phase 5: Optimisation and Documentation - *Completed*

- Optimise relevant development processes.
- Develop relevant process support documentation.

Phase 6: Execution and Implementation - *Completed*

- Implement Business Process Content Management System using *Alfresco*.
- Compile final project report and presentation.

2 Project Analysis

2.1 Cornerstones of performance

'What the ancients called a clever fighter is one who not only wins, but excels in winning with ease.' - Sun Tzŭ (Clavell 1981, p.29).

To excel at winning and ensure successful product development projects, it is essential that all the relevant components, processes, role-players and resources work together and complement each other. Cooper & Edgett (1999, p.27) notes that benchmarking studies have revealed that the more successful companies have mastered the three critical success factors that drive the performance of a new product / service: strategy, resource commitment and process.

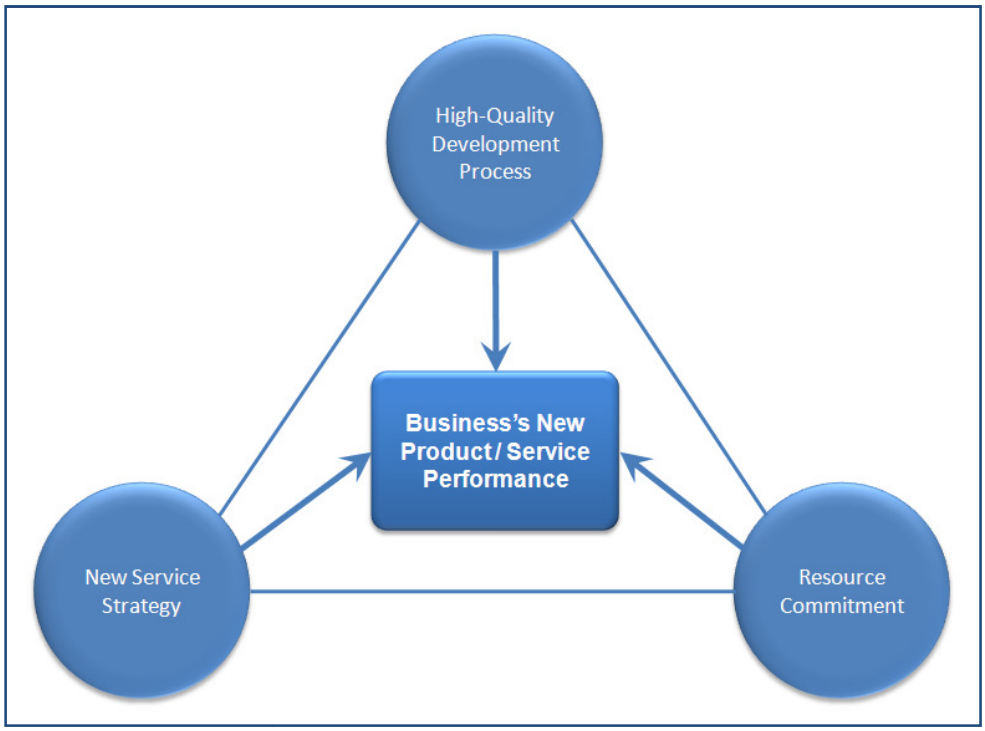


Figure 3 – The three cornerstones of performance (Source: Cooper & Edgett, 1999)

2.1.1 High-Quality Development Process

'Like the Hubble Telescope peering back into the origins of the universe, business processes are the fundamental building blocks that have so far been hidden and shrouded in theory and technology. Today, however, they can and must be made visible, explicit and transparent to all stakeholders, so they can be improved and optimised, for business processes are indeed *the*

business – products and services are only the by-products of processes.' (Smith & Fingar 2003, p.2).

Optimising the product development process will involve an in-depth look at the various sub-processes and role-players. By using tools such as the Zachman Framework the business processes can be optimised to best assist a successful output. The various role-players can be identified along with their responsibilities documented in a workflow management system.

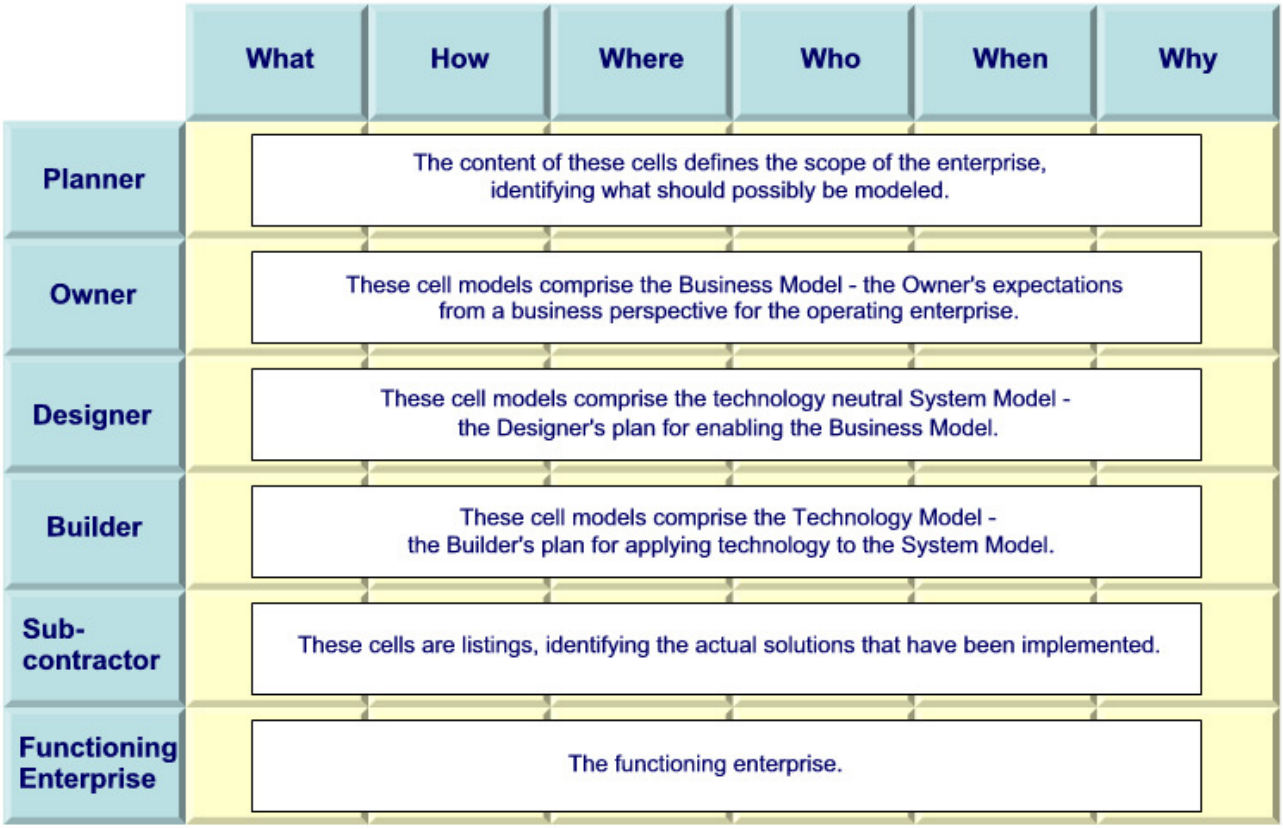


Figure 4 – Overview of the Zachman Framework (Source: www.zifa.com)

2.1.2 New Service Strategy

'Sun Tzŭ said: Whoever is first in the field and awaits the coming of the enemy, will be fresh for the fight; whoever is second in the field and has to hasten to battle, will arrive exhausted' (Clavell 1981, p.36).

This point is very true when compared to introducing a new product into the market. Being the first to enter a market gives the advantage of a greater market share. Failing to enter the market first leads to a constant struggle to try and catch up with the competitors.

'In warfare, first lay plans which will ensure victory, and then lead your army to the battle; if you will not begin with stratagem but rely on brute strength alone, victory will no longer be assured' - Lionel Giles (Clavell 1981, p.30).

2.1.3 Resource Commitment

Sun Tzŭ (Clavell 1981, p.26) argues that the first essential for victory is to know when to fight and when not to fight. This is a valuable point to keep in mind when considering taking on a new project.

To fully utilise the resources, knowledge management needs to take place in order to ensure a faster learning curve for new processes as well as optimal performance by the all resources.

Kang *et al*. (2003, p.286) states that often, a certain knowledge activity is related with many other activities. This means that a knowledge worker needs to refer the results of other tasks that are somehow related with the worker's current task. This is known as task-related knowledge.

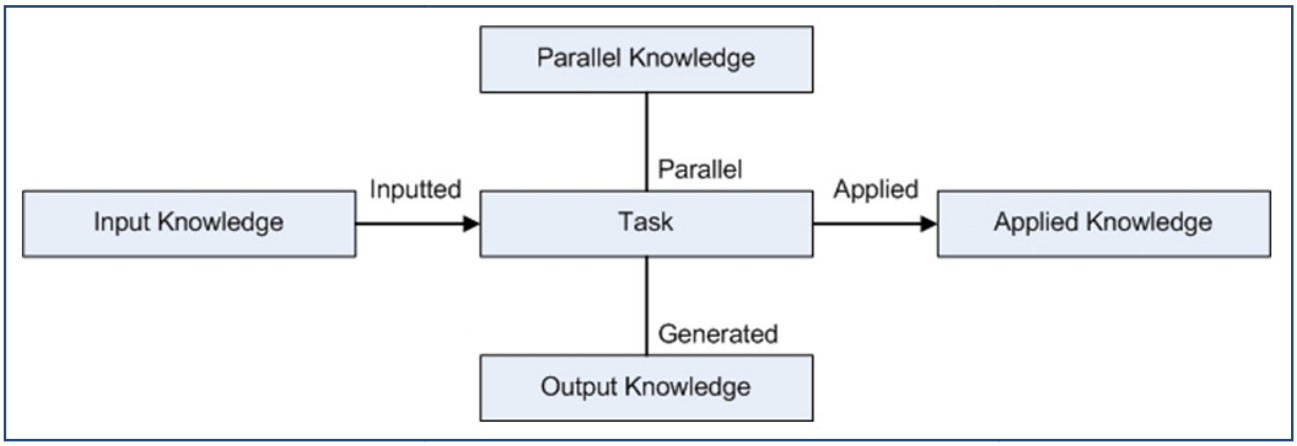


Figure 5 – Task-related knowledge (Source: Kang, Park & Kim, 2003)

Input knowledge is generated in previous tasks. The knowledge worker builds on the input knowledge by dealing with the current task. The output knowledge is used in the current task because it was created while performing the same task in the past. Applied knowledge is created in following tasks. Referring to applied knowledge, the knowledge worker may be able to predict the effects and outcome of the current task. Parallel knowledge is generated in tasks not directly related to the current task, but tasks executed parallel to it. Workers performing parallel tasks may need to collaborate and exchange knowledge in order to coordinate their task results.

Knowledge = Information + [Skills + Experience + Personal capability]

Kalpič & Bernus (2006, p.44) concludes that knowledge is created from data which becomes information as interpreted and remembered by a person with given skills, experience, personal capabilities and previously developed mental models. Knowledge gives a person the ability to use information to guide the actions of the person in a manner that is appropriate to the situation.

2.1.4 Automating Workflow

The manual flow of documents in an organization is prone to errors. Documents can get lost or be constantly shuffled to the bottom of the in-basket. Automating workflow sets timers that ensure that documents move along at a prescribed pace and that the appropriate person processes them in the correct order.

'The essence of BPM innovation is that, based on the mathematics, we now understand data, procedure, workflow and distributed communication not as apples, oranges and cherries, but as one new business "information type" (what technologists call an "abstract data type") – the business process. The recognition of this new fundamental building block is profound, for each element in a complete business process (the inputs, the outputs, the participants, the activities and the calculations) can now be expressed in a form where every facet and feature can be understood in the context of its use, its purpose and its role in decision making.' (Smith & Fingar 2003, p.6).

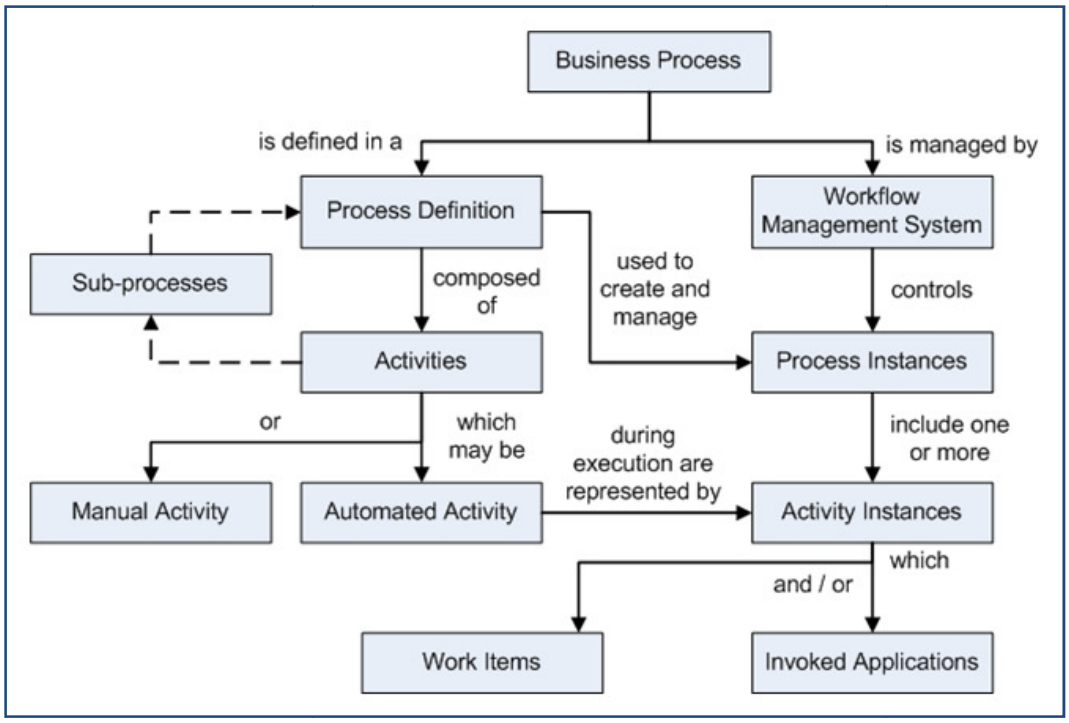


Figure 6 – Concepts of workflow (Source: Aguilar-Savén, 2004)

Aguilar-Savén (2004, p.140) explains that the workflow development process uses workflow models to capture the relevant information of the processes. This process comprises four stages: Information Gathering, Business Process Modelling, Workflow Modelling, and Implementation, Verification and Execution. Figure illustrates the concept of workflow within a business process.

Some of the advantages of a workflow system are that work is not forgotten, workers have shorter learning times for processes, effective data transfer, process improvement, easier to make process changes and accurate progress tracking. In the software product development process, these contributions will greatly improve the quality of the product as well as the ability to meet deadlines. In the long run the decrease of production cost due to labour expenses will also be visible.

2.2 Business Process Management Tool

Business Process Management is a systematic approach to improving an organization's business processes. It is a systematic approach to improving an organization's business processes. BPM is a subset of infrastructure management, the administrative area of concern dealing with maintenance and optimisation of an organization's equipment and core operations. BPM activities seek to make business processes more effective, more efficient, and more capable of adapting to an ever-changing environment.

TIBCO Features: (TIBCO, 2006)

- *Recognizing the importance of processes*: This design parameter is a natural extension of the previous one as it is people who design your business processes and it is people who execute your processes.
- *Ease of implementation*: TIBCO iProcess Suite produces rich graphical output and the documentation provides a powerful implementation tool to guide your enterprise process integration effort.
- *Scalability*: The applications can be distributed across your network, and just as your process can be sub-divided to encompass additional business requirements, your process applications can be deployed within the context of these additional sub-processes.
- *Proven success*: TIBCO provides industry-leading products that have been implemented at over 800 customer sites. TIBCO has been providing business process management products and technologies for more than 15 years, and has demonstrated success across industries.
- TIBCO offers a solution that can join your systems and people together in one business process. Add to that 24/7 processing and transactionality that operate under a highly scalable architecture, which allows TIBCO iProcess Suite to lead the market today.

2.3 Content Management System

A Content Management System is a tool that enables users to create, edit, manage and finally publish (in a number of formats) a variety of content (such as text, graphics, video, documents etc), whilst being constrained by a centralized set of rules, processes and workflows that ensure coherent and validated electronic content.

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- the ability to track and manage multiple versions of a single instance of content,
- the ability to capture content,
- the ability to publish the content to a repository to support access to the content.

Alfresco Features: (Shariff, M 2007)

- Document Management
- Records Management
- Web Content Management
- Image Management
- Collaboration
- Business Process Management
- Enterprise Content Repository
- Federated Search Engine

Alfresco workflow is flexible, extensible and highly scalable:

- Workflow can be attached to any content type.
- Workflow can have any number of nodes and any number of transitions.
- Security can be easily plug-in to the workflow nodes.
- Groups or individuals can participate in the process.
- Workflow audit trail will help you track the history.
- During the workflow process:
    - document properties can be added and modified,
    - notifications can be sent to various parties,
    - other business rules can be triggered.

2.4 The Stage-Gate Process

The Stage-Gate Process, developed by Robert G. Cooper, is the formal process that AfriGIS will use to drive and evaluate new projects from idea to launch.

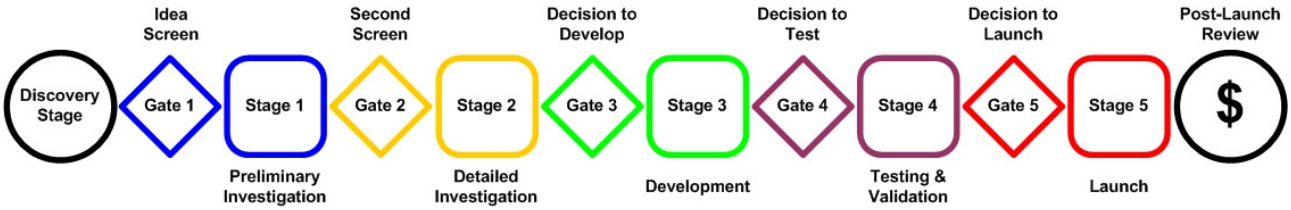

Figure 7 – Map of the Stage-Gate Process (Source: Cooper, 2007)

Stage 1 – Preliminary Investigation

Conduct a preliminary market, technical, financial and business assessment.

Gate 1 – Idea Screen

Does the idea merit any work?

Stage 2 – Detailed investigation

Build the business case: the detailed homework and up-front investigation work leading to a business case; a defined product, a business justification and a detailed plan of action for the next stages.

Gate 2 – Second Screen

Does the idea justify extensive investigation?

Stage 3 – Development

Development: the actual design and development of the new product. Additionally, the manufacturing (or operations) process is mapped out, the marketing launch and operating plans are developed, and the test plans for the next stage are defined.

Gate 3 – Decision to Develop

Is the business case sound?

Stage 4 – Testing and Validation

Testing & validation: the verification and validation of the proposed new product, its marketing and production.

Gate 4 – Decision to Test

Should the project be moved to external testing?

Stage 5 – Launch

Launch: full commercialization of the product — the beginning of full production and commercial launch and selling.

Gate 5 – Decision to Launch

Is the product ready for commercial launch?

Post – Launch Review

How did we do vs. projections?

What did we learn?

2.5 Winning at New Product Development

2.5.1 Critical Success Factors – Doing Projects Right

Robert G. Cooper (2007, p.2) states that there are two ways that the best companies can win when they develop new products: one is to *do projects right* and the other is to *do the right projects*.

Cooper (2007, pp.3-5) identified the following success factors in order to *do projects right*:

- Seek differentiated, superior products
- Up-front homework pays off
- Build in the voice of the customer
- Demand sharp, stable and early product definition
- Plan and resource the market launch early in the game
- Build tough Go / Kill decision points into your process – a funnel not a tunnel
- Organize around true cross-functional project teams
- Attack from a position of strength
- Build an international orientation into your new-product process
- The role of top management is central to success

Cooper's Critical Success Factors (CSFs) will be used to drive the operational success of the business process management project. The CSFs are supported by the following facts:

- Products with unique customer benefits and superior value have five times the success rate, more than four times the market share and four times the profitability of products that lack these ingredients.
- Solid pre-development homework drives up new-product success rates significantly.
- New-product projects that feature high quality marketing actions are blessed with more than double the success rates and seventy percent higher market shares than those projects with poor marketing actions.
- Defining the product before development begins helps to prevent problems like unstable product specifications and project scope creep.
- A strong market launch underlies the success of any product. Research and planning as well as the quality of the execution of the market launch are major contributors to the success of a product.
- Too many projects move too far into development without serious scrutiny. Having tough Go / Kill decision is strongly correlated to the profitability of new-product efforts.
- Good organisational design means projects that are organised with a cross-functional team, led by a strong project leader accountable for the entire project from beginning to launch.
- A new product fares better when it leverages the business's core competencies. This means having a strong fit between the needs of the new-product project and the resources, strengths and experience of the company in terms of marketing, distribution, selling, technology and operations.
- New products aimed at international markets and with international requirements built in from the outset fare better. Products developed for the domestic market are not nearly as profitable. Domestic products are usually compromised when adjusted for export.
- Top management's main role is to set the stage for product innovation and ensure that an environment is created for the critical success factors to be applied.

2.5.2 Portfolio Management – Doing the Right Projects

Cooper (2007, p.9) identified four portfolio management goals in order to *do the right projects*:

1. *Maximizing the value of the portfolio*: The goal is to ensure that the total worth of new-product projects in the development pipeline yields maximum value to the corporation.
2. *Achieving the right balance of projects*: Ideally, there is a balance between high-risk and low-risk, short-term versus long-term, genuine new-products versus product improvements and extensions, and so on.

3. *Achieving a strategically aligned portfolio*: Leading firms have defined a product innovation and technology strategy that will direct investments in research and development.
4. *Resource balancing - the right number of projects*: Most firms have far too many projects for the limited resources available. This leads to corners getting cut, execution quality suffers, projects under perform and they take too long to get to market. An ideal portfolio sees the correct balance of projects with the resources utilized realistically.

2.6 Packagable / Marketable Product Development

Figure 8 illustrates the process to be followed for the following software product development projects:

- A new software product to be introduced to the market (the product idea comes from an internal idea generation process, usually to fill a gap in the market).
- Upgrading or expansion of an existing software product already on the market (a need arises to expand the current product capabilities or technology is developed that allows for the product to be improved).

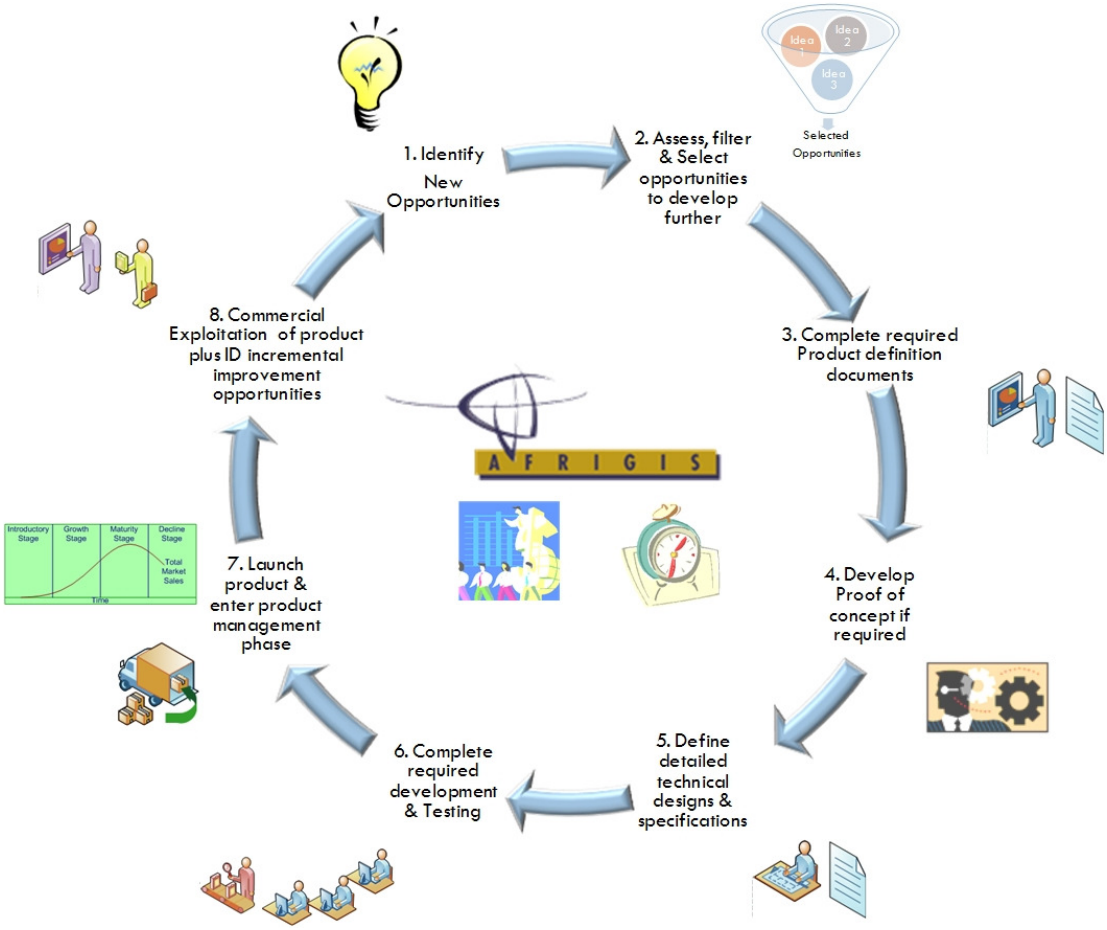

Figure 8 - Packagable / Marketable Product Development Process

1. **Identifying new ideas & opportunities:**

   New Ideas vs. Incremental Improvements & repackaging of existing products & services

   Sources of new Ideas:

   - from the end users of current products & services – Voice of the Customer
   - from AfriGIS staff
   - from customers and business partners
   - specific targeted research into new opportunities
   - new technological developments - creating platform for further innovation

2. **Select opportunities for further development:**

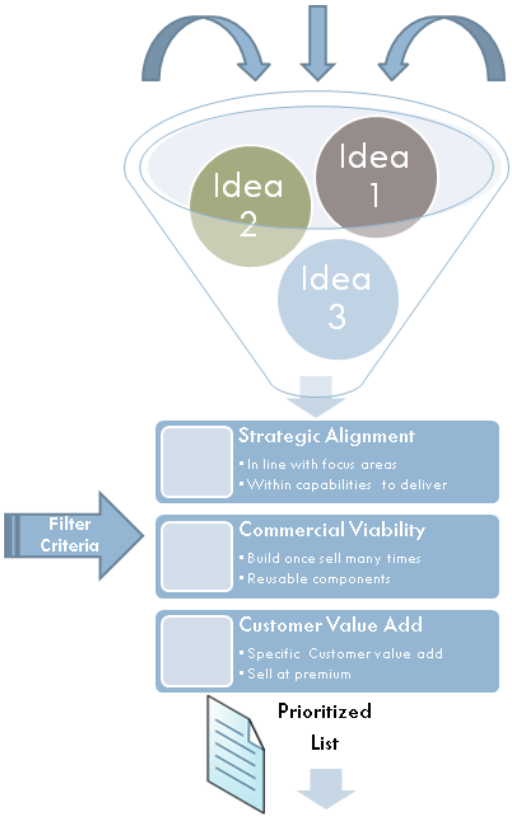

Figure 9 – New idea filtering illustration

   - Collate ideas from all sources
   - Filter out obvious less viable opportunities
   - Draft one pager overview per idea
   - Assess remaining ideas against set criteria
     - Strategic Alignment
     - Match with skills/capabilities
     - Commercially viable
     - Leveraging existing assets

- Customer value add
- Re-usable

- Prioritise rest using weighted formula
- Select list for further development & match with resource availability

3. Complete Requirements Definition

- Differentiate between product & custom development projects
- For every opportunity to be further developed:
  - Complete User Requirements Specification (URS) according to template required for product/project :
    - Specify specific use cases
    - Define screen flows if applicable
    - If Proof of Concept (PoC) required:
      - Specifically define limited functionality required
      - Indicate PoC success criteria
- Draft high level business plan indicating:
  - Target market
  - Potential market share & penetration
  - Suggested pricing approach
  - Revenue predictions
  - First customers to target
  - Suggested distribution approach
  - Promotional requirements
  - Ensure approval on URS before initiating technical design phase

4. Develop Proof of Concept (PoC)

- Clearly define PoC requirements:
  - Subset of functionality to be provided
  - Fully functional vs. mock-up
  - Will PoC be reused as part of full solution?
  - Priority of look-and-feel vs. functionality
  - Any specific time constraints
  - Standard components to be used
- Indicate PoC success criteria:
  - Is PoC success qualifying criteria for future project
  - What will PoC success be measured against?
- Qualitative vs. quantitative criteria

5. Complete Detail Technical Design

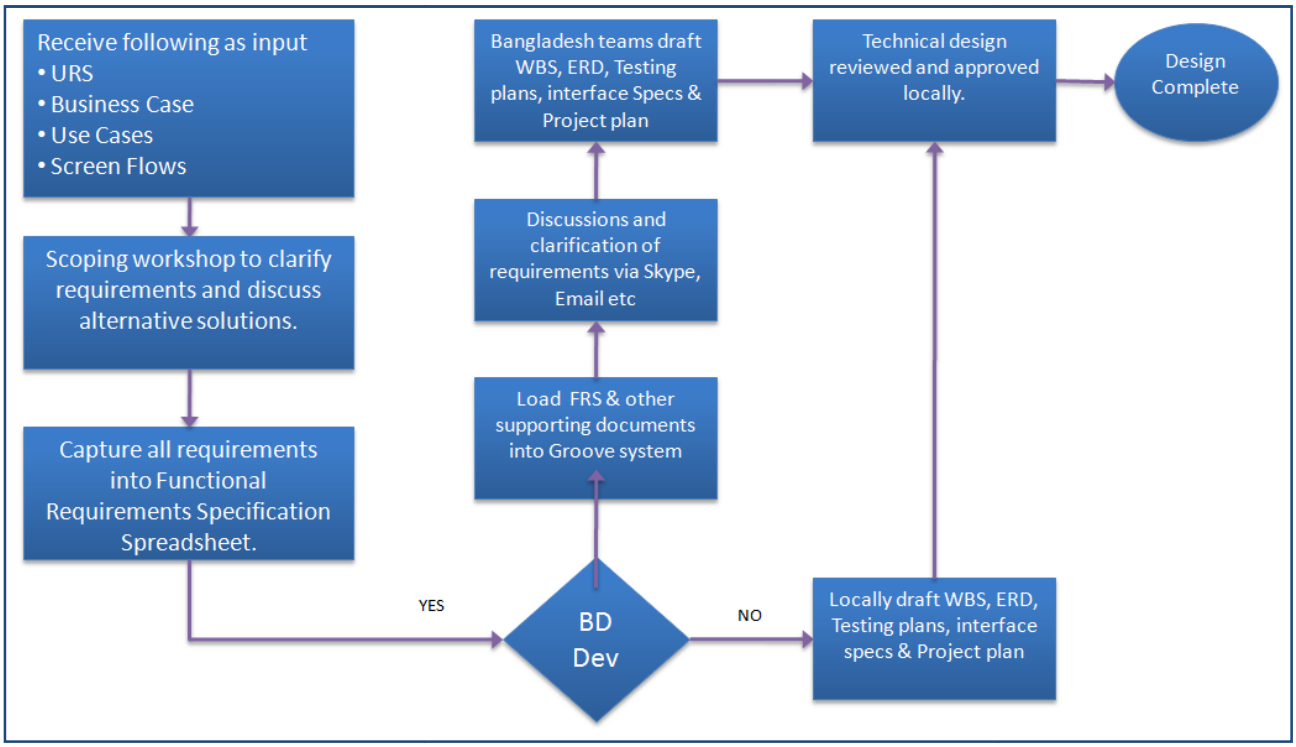

Figure 10 – Technical design process

6. Complete Development & Testing

- Workflow: approved work breakdown structure and development progress monitored to completion
- Workflow: component & end to end testing allocated to Quality Assurance (QA) teams
- Workflow: After development and QA, dispatch for final functional testing and User Acceptance Testing (UAT).
- Cycle of bug-fixes
- Product ready for Customer Acceptance Testing
- Ready for launch

7. Launch Product & Enter Product Management Phase

- Following development and successful UAT:
    - Initiate friendly user trial
    - Complete all required go to market deliverables:
        - Ensure support processes in place and working
        - Training of distribution channel
        - Final product marketing & promotional collateral in place

- Product sales targets agreed

- Commercial launch and general availability of product
- Product enter product management phase of lifecycle
- Focus shift from building to selling

8. Commercial Exploitation & Incremental Improvements

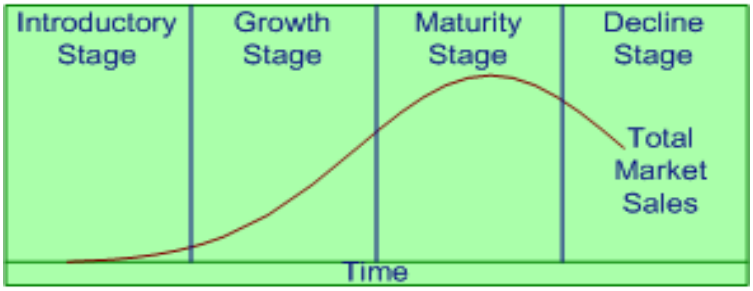

Figure 11 – Product life-cycle

- All effort now focused on selling the product
- Initially targeting earlier adopters
- Follow sales and marketing best practices associated with specific phase of adoption cycle
- To allow for further product penetration identify incremental improvements and repackaging opportunities
- Initiate development process for prioritised improvements

2.7 New-Product Development Methodology Overview

Stage-Gates are the points in the process where a decision must be made. Gatekeepers – who are defined at project conception – can choose to Go, Kill, Hold or Recycle the project at any of these points. Figure 13 illustrates the Idea to Launch process for new products

The gated process prescribes a continuous conversation between marketing and development teams, instead of the typical single handoff of requirements. The core benefit of this approach is that there is a chance to change a strategy or manage a risk early in the process, so that development time is not spent on items that do not meet customer requirements.

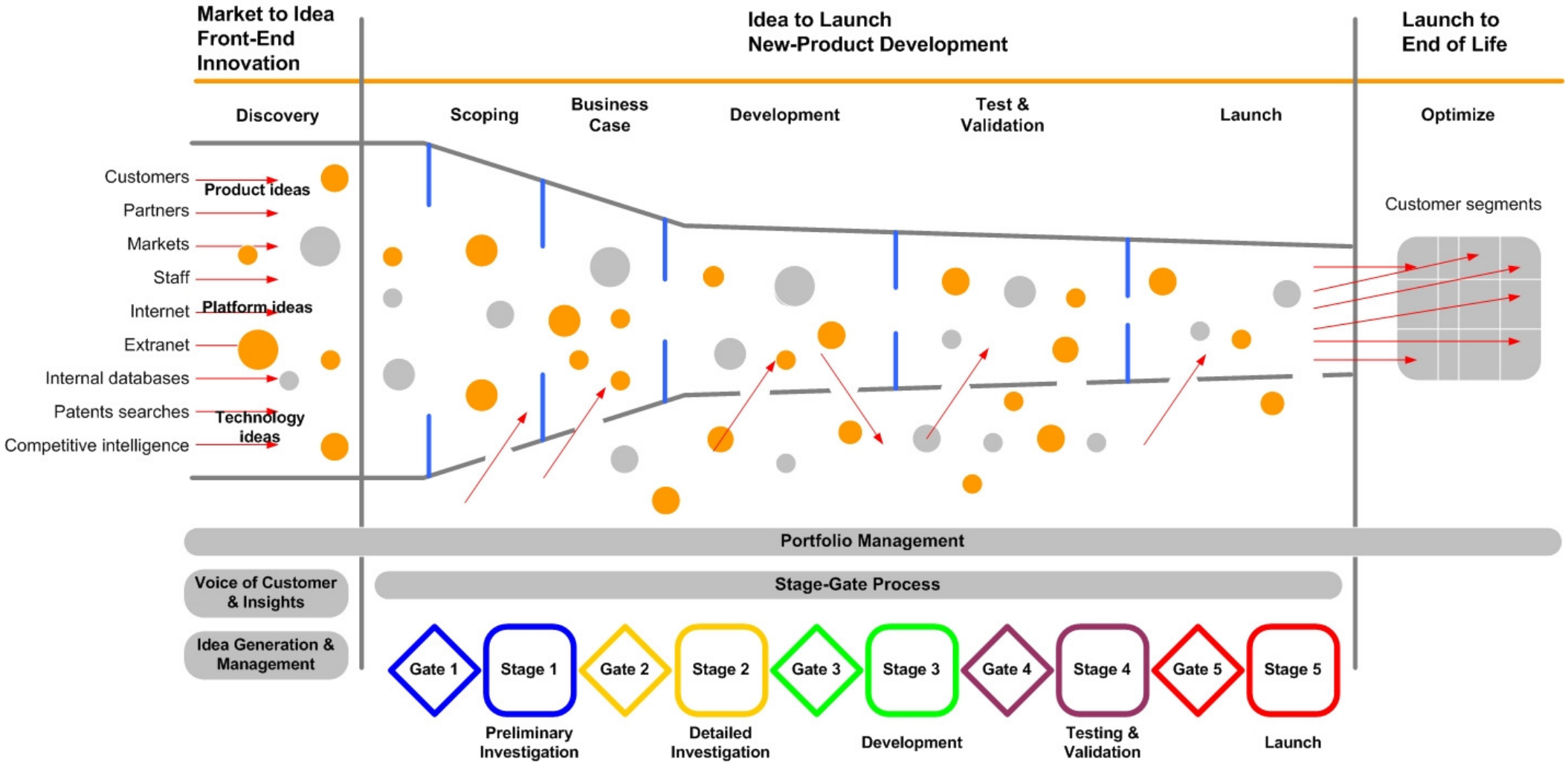

Figure 12 – New-Product Development Process (Source: Gabas-Varini)

3 Business Process Content Management System

3.1 As-Is Business Process Content Management

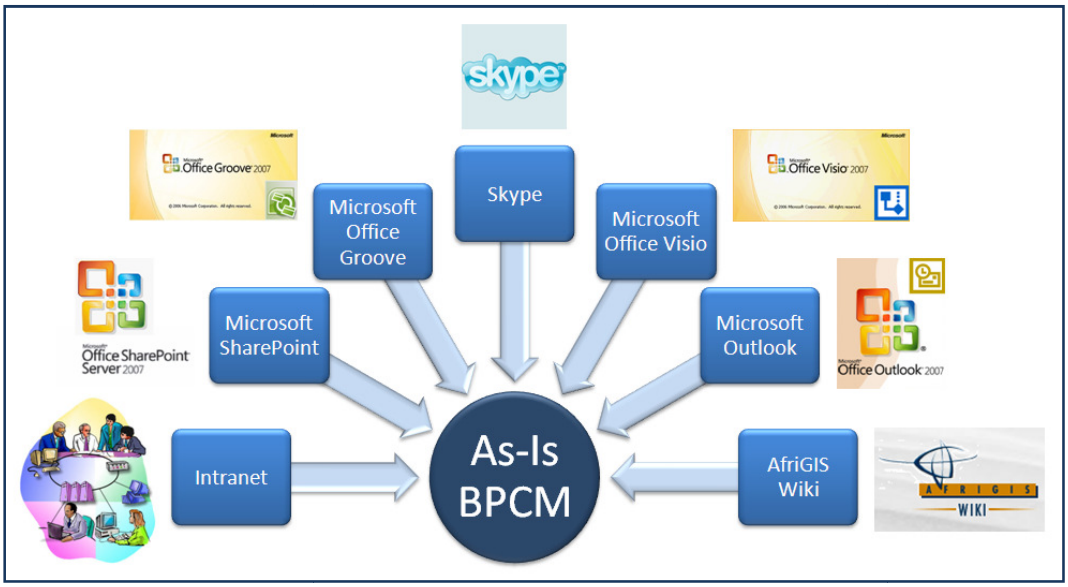

Figure 13 - As-Is Business Process Content Management

As-Is Business Process Content Management consists of an unstructured combination of the components illustrated in Figure 13.

- **Microsoft SharePoint** is a browser-based collaboration tool and document-management platform. It can be used to host web sites that access shared workspaces and documents. SharePoint has a web interface containing features such as a task list or discussion pane.
- A **wiki** is a page or collection of Web pages designed to enable anyone who accesses it to contribute or modify content, using a simplified mark-up language. Wikis are used in business to provide intranets and Knowledge Management systems.
- **Microsoft Office Groove** is a desktop application designed for document collaboration in teams with members who are regularly off-line or who do not share the same network security clearance. It is also used as a staging system for documents in development, where content can be worked up then transferred to a portal when complete.
- An **intranet** is a private computer network that uses Internet protocols and network connectivity to securely share any part of an organization's information or operational systems with its employees. There exists storage space on the intranet servers where files can be shared, stored or accessed by other intranet users.

- **Skype** and **Microsoft Outlook** are used to communicate via Voice over Internet Protocol (VoIP) calls, E-mail and instant messaging (IM).
- **Microsoft Office Visio** is used to map process flows and illustrate diagrams.

3.2 The To-Be Business Process Content Management System

Figure 14 – To-Be Business Process Content Management System

The To-Be Business Process Content Management System is a structured, integrated approach to Business Process Content Management. The management tools are reduced and a central repository is created for al relevant Business Process Content.

- TIBCO – Process Management
- Alfresco – Content Management
- Skype – Integrated communication tool in Alfresco

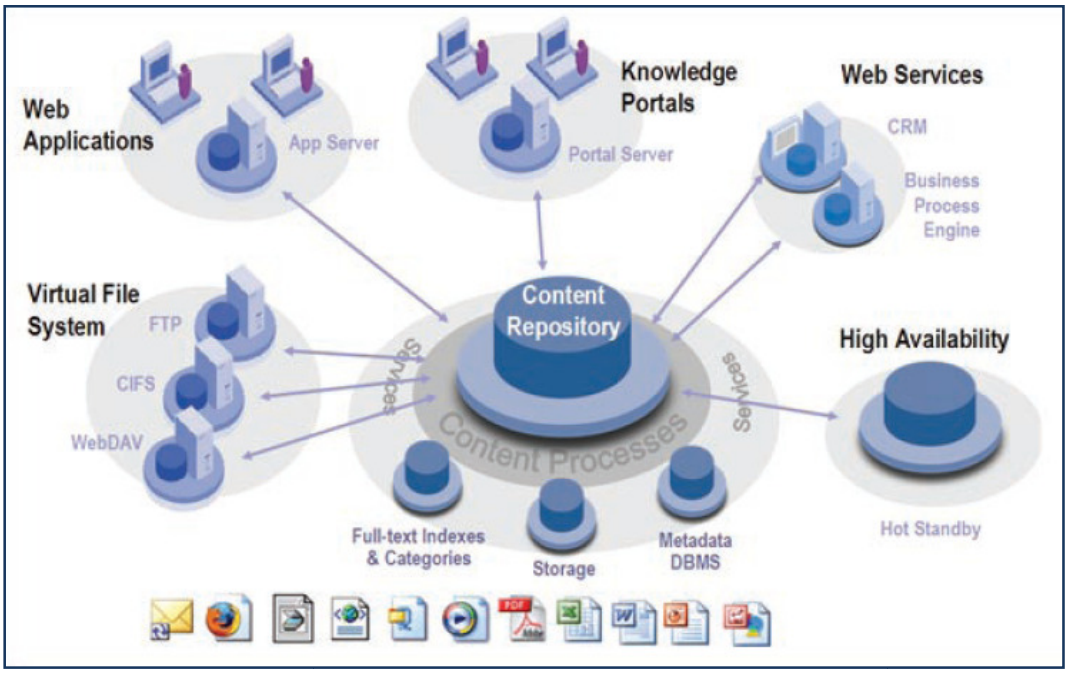

Figure 15 – Overview of Alfresco content repository (Source: Sharrif, 2007)

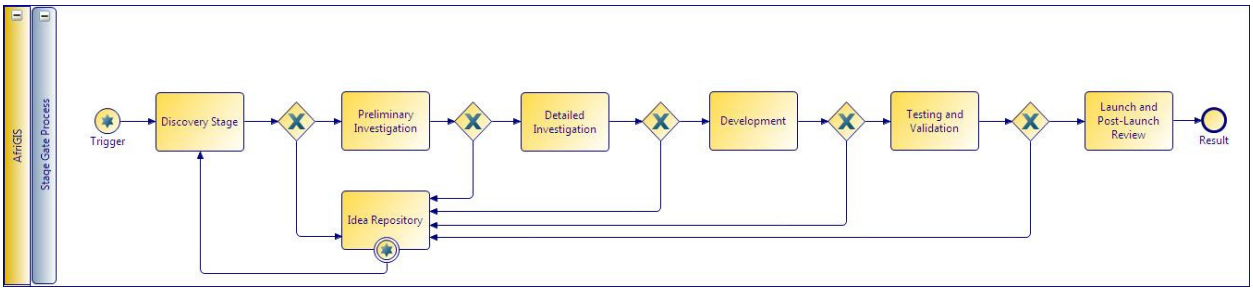

Figure 16 - The Stage-Gate Product Development Process

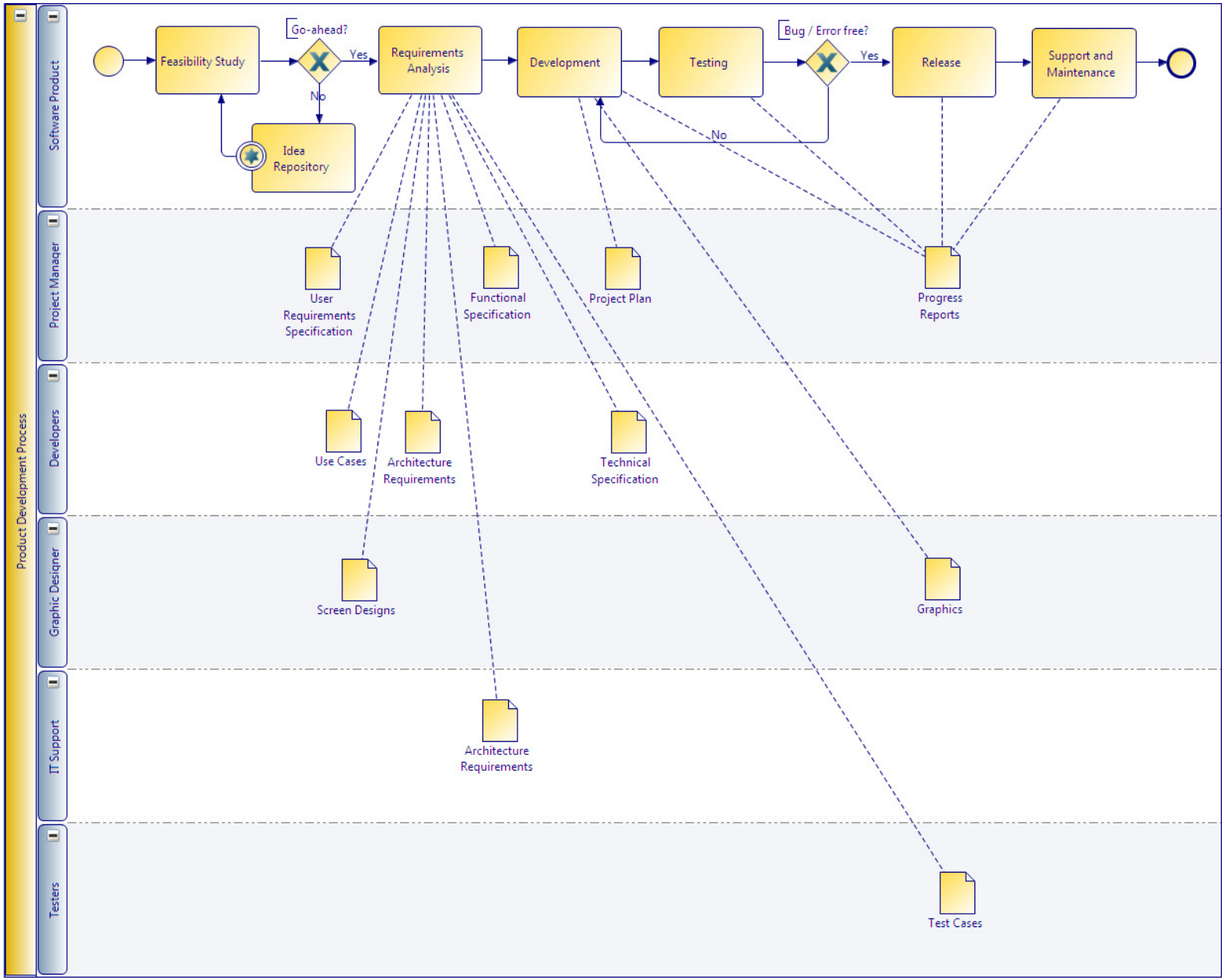

Figure 17 - Typical Product Development Process with Support Documentation

3.3 Improving Product Development Processes

A study conducted by The Standish Group indicates that as many as 80% of all software projects never make it through the full product development process. These failed projects either do not achieve business objectives or run far over budget and schedule.

The good news is that the 20% of projects that succeed share common characteristics that can be documented and reproduced. These successes contain four common traits:

- Each project has a smaller number than usual of highly skilled developers.
- Risks are actively managed throughout the development process.
- Analysis and design are actively incorporated into the project schedule.
- Iterative development approaches are used.

Product development process improvement is recognized as a key strategic objective, especially the goal of decreasing development cycle, eliminating duplication and misunderstanding and improving team work.

Improved product development processes will allow quick response to customer needs, effectively incorporate new technologies, and improve product functionality, quality and costs. A streamline and tune-up of the current processes will help to ensure AfriGIS's software products and services stays within the 20% success margin. Improvement in productivity begins by having a stable, predictable and measurable process.

3.4 Definitions, Roles and Responsibilities

3.4.1 Software Product

Software products pass through various phases during the development process:

- **Sellable** – A Program Manager can demonstrate the benefits and features of the product, but this prototype is not yet ready for end-users.
- **Shippable** – The product is now ready for end-users. The product has been demonstrated to have no major functionality problems and a manufacturing/development process has been established.
- **Supportable** – The product has been thoroughly tested by Quality Assurance and documentation has been written for end-users.

- **Scaleable** – The product has proven to be successful when many users simultaneously use the product, when numerous entries are made into the product's database, and when several applications can be used at a time.

3.4.2 Product / Project Manager

The Product Manager is the process owner of the product. The concept of ownership implies more than just responsibility; ownership suggests a vested interest in a process or project.

- Liaison between the customer and the developers.
- Conducts market analyses.
- Obtains market and client specifications, requirements and customisations.
- Coordinates User Requirement Specifications with technical developments.
- Creates Functional Specification documents to ensure parallel vision between marketing and engineering.
- Manages the product's overall design and ensures that the product addresses the needs of client or target audience.
- Manages the product development process from marketing conception to final technical development.

3.4.3 Developers

Every software product has a Lead Developer which is the technical owner of a product.

- Designs technical systems and specific programs necessary to implement product.
- Distributes work to other contributors such as IT Support and Graphic Designers.
- Oversees all technical aspects of product development.

Depending on the size of the project or the complexity of the product, the development team can consist of a sole Lead Developer or a Lead Developer with a team of developers. The Lead Developer, in collaboration with IT Support, is responsible for creating the hardware and software architecture diagrams for the software product.

3.4.4 Graphic Designers

The Graphic Designers design and provide the graphics, images and layouts that are used in the product's graphical user interface.

- Produces icons, logos, colours and screen designs according to the customer's specifications.
- Focuses on the presentation of the software product.

3.4.5 Testers / Quality Assurance

The testers are responsible for testing the product throughout the development process. This includes:

- Testing the usability, functionality and stability of the product.
- Reporting all bugs and errors that might be present.

The Testers creates the test plan for software product in its various stages of development. Their role is essential in Quality Assurance of the product.

3.4.6 IT Support

IT support is responsible for the hardware and software architecture of the product. This includes:

- Setup and maintenance of the servers and domains used by the software product.
- Integration of the various hardware and software components.

IT Support assists the Lead Developer in the creation of the hardware and software architecture diagrams for the software product.

3.5 Product Development Support Processes and Documentation

The leading cause of software product delay is the late discovery of customer requirements. Executing requirement changes late in the development process costs 50 to 100 times more than if these changes were undertaken in the design phase. If the change takes place after the product is released to the market, the cost is likely to be thousands of times greater.

After a product idea is conceived and initially screened, an implementation plan must be designed. The following guidelines are a roadmap for producing a sellable, shippable, supportable and scalable product.

3.5.1 Market Requirements

Owner: **Product / Project Manager**

Deliverable: **User Requirements Specification document**

A User Requirements Specification document describes the requirements or desires for a product. This document presents both the business case for the product or enhancement and the high-level features description.

User Requirements Specification documents should communicate what is needed in a way that both developers and customers can understand. Requirements should be specific, unambiguous and as detailed as necessary. It is impossible to build something before you understand the problem you are trying to solve.

3.5.2 Use Cases

Owner: **Product / Project Manager and Lead Developer**

Deliverable: **Use Case document**

Use Cases are descriptions of the users and their interactions with the software that is meant to accomplish a specific task. A distinct Use Case should be defined for each feature and each type of user. Use Cases illustrate the various functionalities and processes of the software product.

3.5.3 Architectural Requirements

Owner: **Lead Developer and IT Support**

Deliverable: **Architectural Requirements document**

Dependency: **User Requirements Specification document**

The underlying technology for any project must be designed and agreed upon before the Functional Specifications document is released, because technology choices could have a huge impact on how features are implemented. In cases where new technology is being implemented, or when the technology is changing, an Architectural Requirements document should be created. If technology is being reused, it is appropriate to wrap this information into the Functional Specification itself.

The Architectural Requirements document will specify:

- The programming languages being used.
- High-level database structure and targeted implementations
- Development tools, third-party controls and known issues pertaining to both.
- Installation and configuration of the development environment.
- High-level implementation plan for features specified in the User Requirements Specification document.

The hardware and software architecture diagrams for the software product are included in the Architectural Requirements document.

3.5.4 Functional Specifications

Owner: **Product / Project Manager**

Deliverable: **Functional Specifications document**

Dependency: **User Requirements Specification document**

During the design phase, storyboards are used to illustrate the flow of user interfaces and the layout of forms. All implemented user objects are identified and their functionality and navigation presented. Interaction diagrams are used to show the data flow between objects.

A Functional Specifications document will specify:

- All forms, elements, navigations and interfaces.
- Installation process including licensing, product keys, etc.
- Error handling.
- Support and maintenance.

3.5.5 Technical Specifications

Owner: **Lead Developer**

Deliverable: **Technical Specifications document**

Dependency: **Functional Specifications document**

During the Technical Specifications phase, the Lead Developer creates storyboards at the components and objects level. Basically, these documents deal with coding-related interfaces and objects.

A typical Technical Specification explicitly indicates:

- All objects, components and interfaces.
- Methods, properties, classes and data structures.
- Implementation details on specific algorithms, such as licensing, billing or encryption.
- Error handling.

3.5.6 Test Plan

Owner: **Tester / Quality Assurance**

Deliverable: **Test Cases**

Dependency: **Technical and Functional Specifications documents**

The Testers works hand-in-hand with developers throughout the development cycle. At the time that the Functional Specifications are completed, Testers can begin the Test Plan for the project.

A Test Plan will specify:

- The testing platforms that will be used.
- The type of testing that will occur; i.e. manual or automated.
- How testers will divide the testing responsibilities.
- Quality Assurance deliverables, such as those checked off the checklist.
- Consistency checks.
- Ease of navigation.
- Spelling and grammar checks.

- Error cases.
- Stress testing.
- Regression testing; i.e. testing old functionalities when new ones are added.

3.6 Technology Development Cycle

3.6.1 Project Planning

Owner: **Product / Project Manager**

Deliverable: **Project Plan**

Dependency: **Technical Specifications document**

In a traditional waterfall methodology, few plans survive throughout an entire project. Unfortunately, most development teams handle these realities by abandoning the project plan the moment reality intrudes. A better attack is to plan for continual refinement as the project progresses.

At the start of the project, the Project Manager works with the Development team to create a plan that roughly allocates periods of time to the major phases of the project.

3.6.2 Project Progress

Owner: **Product / Project Manager**

Deliverable: **Progress Reports**

Dependency: **Project Plan**

The Project Plan specifies the major milestones of the project.

As work progresses, the project schedule is updated to reflect progress and modified to include additional tasks that have been assigned.

Developers, and anyone else who is assigned to a project task, will be responsible for completing a weekly progress report throughout the life of the project. As the release date approaches, progress reports become more urgent and will be reported more frequently.

Progress regarding the identification and fixing of bugs and errors are also included in the Progress Reports.

3.6.3 Source Control

A source control system, Microsoft Visual Source Safe, is used to manage and protect source code revisions as well as analysis and design documents. Individual developers must thoroughly test changes before they are checked into source control.

3.6.4 Triage Meetings

"Triage" is a medical term. It refers to dividing wounded or sick people into three categories: those who will die no matter what you do, those who will recover even if unaided, and those who will recover only if aided. In a situation where there's too much to do, you must concentrate on the third group.

Bug Triage Meetings (sometimes called Bug Councils) are project meetings in which open bugs are divided into categories. The most important distinction is between bugs that will not be fixed in this release and those that will be.

When multiple developers are working on the project, a Triage meeting should be scheduled regularly to review bugs and assign bugs back into the Development team. As a product nears its release date Triage meetings increases in frequency to ensure that all issues are addressed.

3.6.5 Alpha Release

Owner: **Product / Project Manager**

Deliverable: **Alpha Release**

Dependency: **60% of Full Product Functionality; 95% of Core Path**

While an Alpha Release is optional, it is an extremely useful exercise for testing the Build and Quality Assurance processes and for verifying the core functionality of the product with a user

group. An Alpha Release allows for the hardware architecture, software architecture and platform readiness of the product to be tested early in the cycle.

An Alpha Release must allow a user to navigate through the simplest case of the functionality (95% of core path).

Alpha Releases are intended only for internal use. Customers do not receive Alpha Releases.

3.6.6 Beta Release

Owner: **Product / Project Manager**

Deliverable: **Beta Release**

Dependency: **Full Product Functionality**

The first Beta Release will be produced once the product is fully functional. This means that all of the product features and functions have been added.

The purpose of a Beta Release is truly for debugging the product for the full release. Beta software being released to a user group must have a specific end date for feedback.

3.6.7 User Acceptance Testing

Owner: **Product / Project Manager**

Deliverable: **Certified Beta Release**

Dependency: **Full Product Functionality**

The Product Manager performs last minute Quality Assurance together with the Testers, and sometimes the Customer as well; to make sure that all the user requirements are met. This process is repeated for each Beta Release to insure that no additional problems are inserted into the product.

3.6.8 Product Release

Owner: **Product / Project Manager**

Deliverable: **Product Release**

Dependency: **Certified Beta Release**

Once an application has moved into “Released” status, the Product Manager takes delivery of the product and sets into action any marketing plans required for its release. The Product Manager ensures that all marketing descriptions correlates to actual functionality and information contained in product.

3.6.9 Debrief

Owner: **Project Team**

Dependency: **Product Release**

Scheduled for soon after the Product Release, the Debrief is the last step in the full Development Cycle. The Debrief brings all the team members together for a review of the project and prepares the players for commencement of the next product.

Agenda items should include:

- The items, communications, plans and ideas that worked well within the project.
- The items, communications, plans and ideas that need improvement in future projects.

Debriefs are extremely valuable for the success of future projects but are normally skipped or forgotten due to overlapping of a new project.

3.7 Product Release Management

Depending on the user requirements in terms of time and urgency, a product can be released to a customer in varying degrees of completion. The following plans describe these currently and widely used management systems:

3.7.1 Classical Product Release

The Classical Product Release approach requires that the complete product be implemented and qualified before it is shipped to customers, usually initially as a beta release. In terms of structuring the project activities and performing the development work, this process sometimes represents a convenient technology approach. No imposed schedule constraints exist, the development just has to be completed on time.

3.7.2 Incremental Product Release

An Incremental Product Release approach may be selected to make the product available earlier than it would be with the Classical approach. With this approach, some functionality is left to be developed at a later stage. This type of release can be applied to make product functions available for limited or experimental use by a small customer base at an early stage.

3.7.3 Continuous Improvement Release

In a Continuous Improvement Release, the product is completed and released in incremental steps; however, market and customer feedback is expected to impact further product direction. The project management approach is to start the development based on a functional specification, which covers at least the initial product release, and then add to or change part of the functional specification while new product requirements are evolving.

While this approach allows some flexibility to react to evolving requirements, the overall project effort and in particular the project risks could be significantly higher. This release approach should be chosen carefully and only if it is demanded by a certain market situation where product requirements change quickly based on competitive products or enabling technology.

4 Conclusion

Implementing a strong product development process creates better communication in the organization, better focus and better coordination. This leads to better products in terms of usability, features, scalability and stability.

The central business process content repository allows for easy access to current and past project information. The structured storage repository ensures that time is not wasted on searching for project content.

The idea repository gives users access to previously rejected or abandoned projects. These project ideas can now be re-evaluated at a later stage when the business climate changes or when technological advances allows for products to be more easily developed.

The emphasis on idea generation and thorough evaluation ensures that valuable time is not wasted on unsuccessful projects or features. This will aid AfriGIS in meeting the increased demand for their services and products as well as further cement their foothold as one of the largest location based service providers in Africa.

5 Appendix

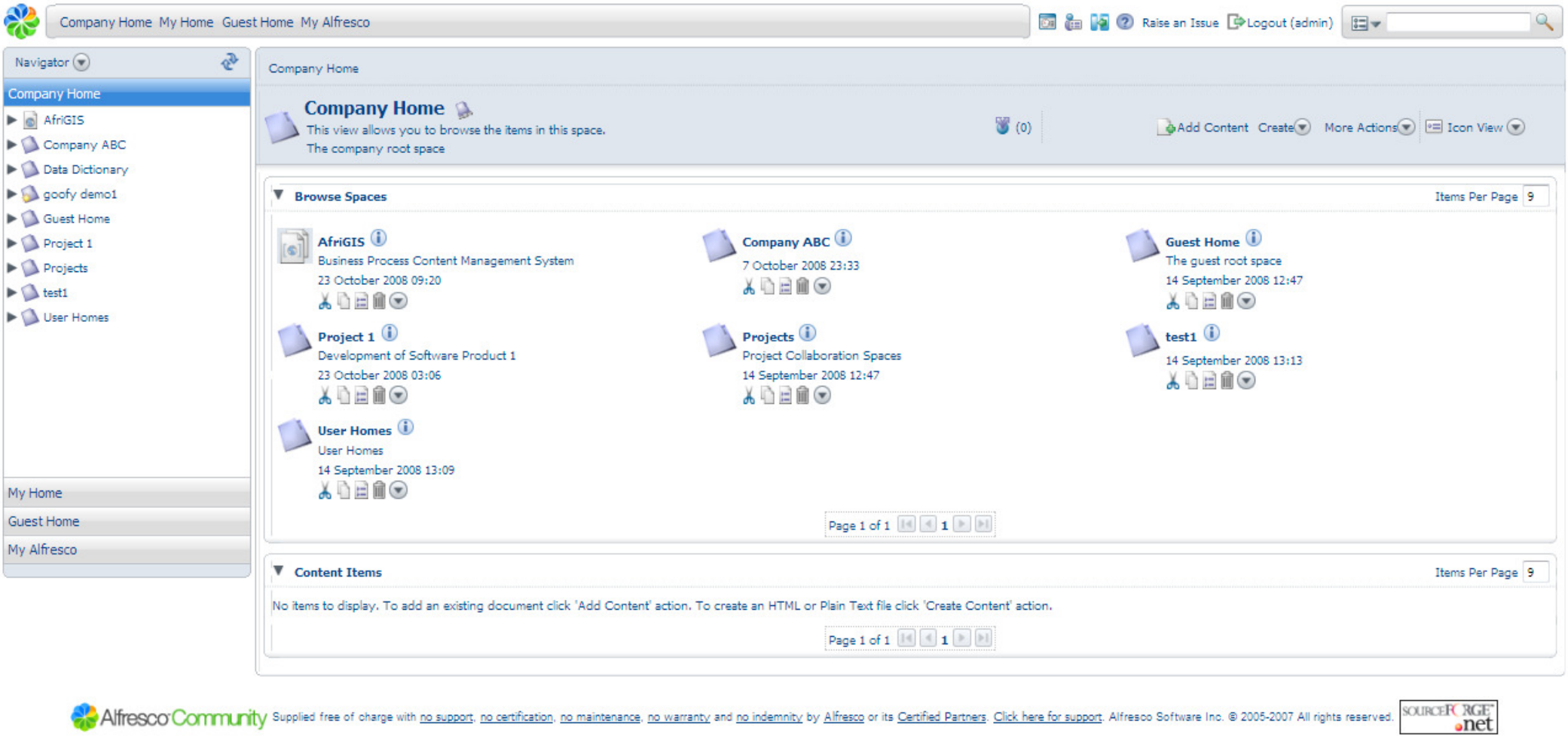

Figure 18 - Alfresco User Interface

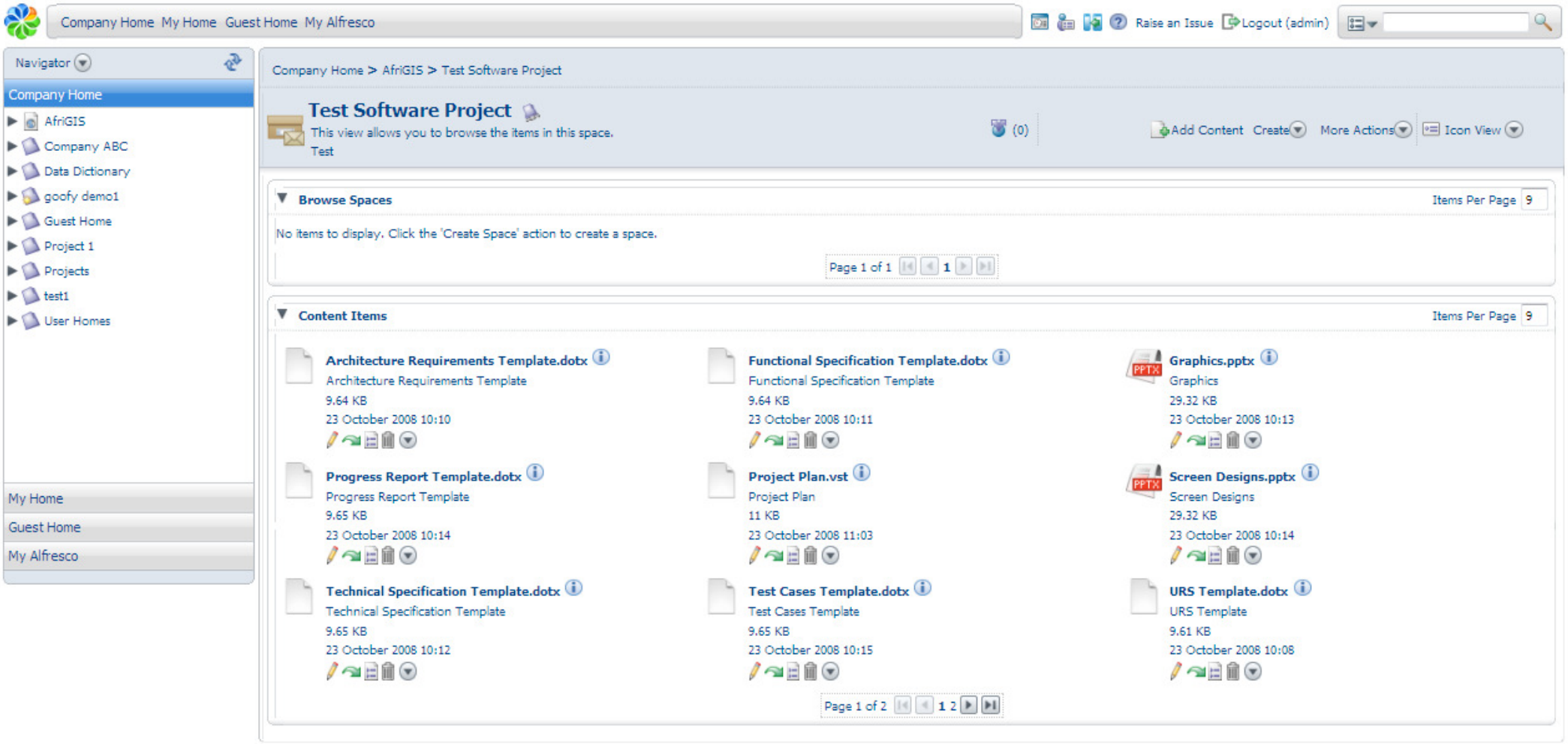

Figure 19 - Alfresco Project Space

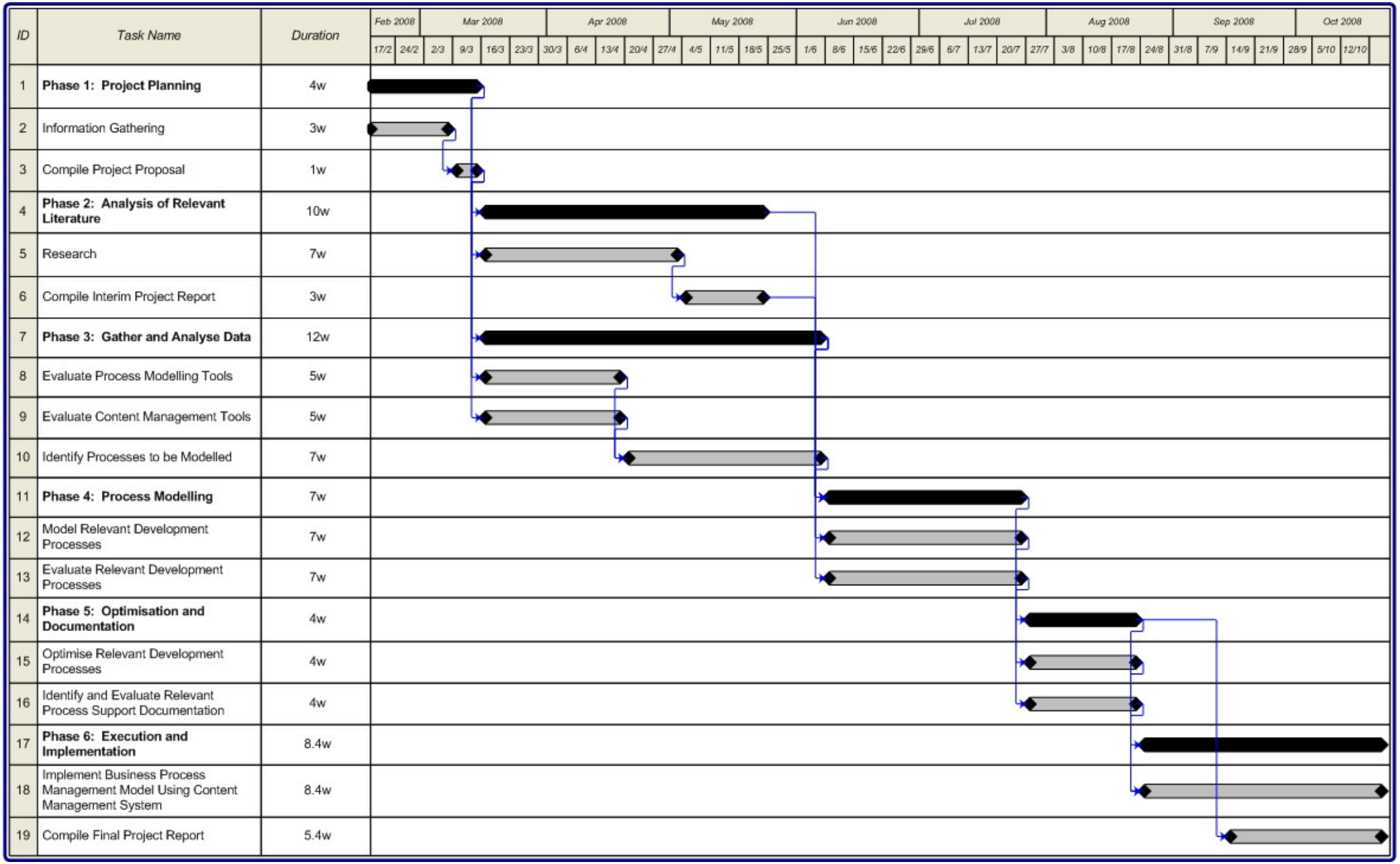

Figure 20 - Project Gantt chart

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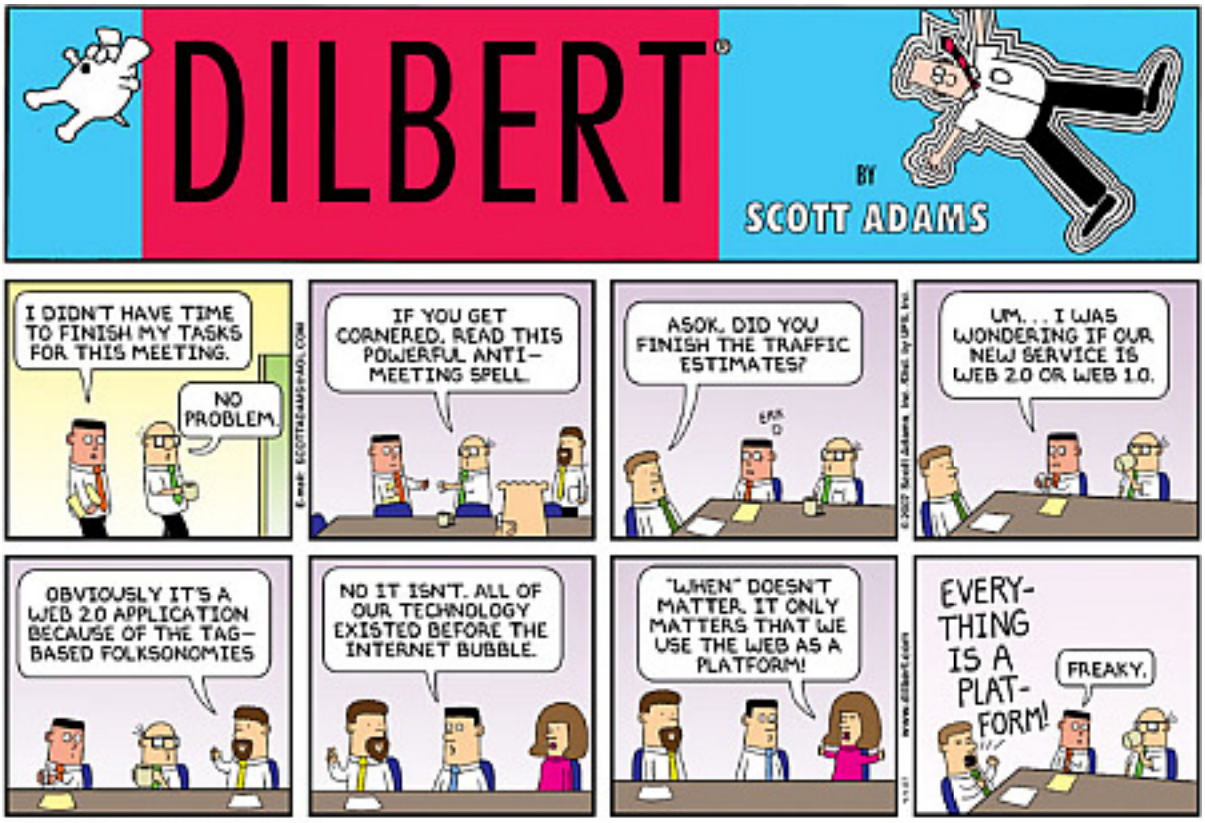
DILBERT
BY
SCOTT ADAMS
I DIDN'T HAVE TIME TO FINISH MY TASKS FOR THIS MEETING.
NO PROBLEM.
IF YOU GET CORNERED, READ THIS POWERFUL ANTI-MEETING SPELL.
ASOK, DID YOU FINISH THE TRAFFIC ESTIMATES?
UM... I WAS WONDERING IF OUR NEW SERVICE IS WEB 2.0 OR WEB 1.0.
OBVIOUSLY IT'S A WEB 2.0 APPLICATION BECAUSE OF THE TAG-BASED FOLKSONOMIES
NO IT ISN'T. ALL OF OUR TECHNOLOGY EXISTED BEFORE THE INTERNET BUBBLE.
"WHEN" DOESN'T MATTER. IT ONLY MATTERS THAT WE USE THE WEB AS A PLATFORM!
EVERY-THING IS A PLAT-FORM!
FREAKY.
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I'LL REPLACE ALL OF THE OFFICE COFFEE WITH DECAF FOR MY CONVENIENCE.
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MUST...FIND ...ANTIDOTE.

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