Computer Science Department

University of Crete

Business Process Management for E-Government

Master's Thesis

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Πανεπιστήμιο Κρήτης
Σχολή Θετικών Επιστημών
Τμήμα Επιστήμης Υπολογιστών

Διαχείριση Επιχειρηματικών Διεργασιών στην Ηλεκτρονική Διακυβέρνηση

Εργασία που υποβλήθηκε από τον
Τζιάβα Περικλή
ως μερική εκπλήρωση των απαιτήσεων για την απόκτηση
ΜΕΤΑΠΤΥΧΙΑΚΟΥ ΔΙΠΛΩΜΑΤΟΣ ΕΙΔΙΚΕΥΣΗΣ

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Business Process Management for E-Government

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Abstract

Information is one of the basic resources of the society nowadays, a common asset in the realm of the government the private initiatives, or individuals. The governments change their structures, so that they can increase the effectiveness of provided services, decrease the cost and increase the satisfaction and the attendance of citizens. As a result the use of information technology by the government, E-Government has been a tool to facilitate such process.

Unfortunately, the hitherto experience, that comes from the concretisation of big E-Government projects, suits the need of use of Business Process Management methods for their concretisation, so it that can decrease problems, cost, bureaucracy and improve the quality of provided services.

Our study considers the case of the General Assembly of the Department of Computer Science of the University of Crete, as a paradigm of E-Government, which we use to demonstrate the validity of the Business Process Management methodology and the associated techniques, as well as the benefits their application can bring to an organization.

The processes of the General Assembly are modelled, designed and analysed, aiming first to locate any dysfunctions and fragmentation problems that may exist and then to propose appropriate solutions. Solutions should be such, that the de-fragmentation and automation of the processes will become possible, as well as the communication of these processes with processes in other systems.

Supervisor: Plexousakis Dimitris

Διαχείριση Επιχειρηματικών Διεργασιών για την Ηλεκτρονική Διακυβέρνηση

Περίληψη

Η πληροφορία είναι ένας από τους βασικούς πόρους της κοινωνίας σήμερα, ένας πόρος κοινός ανάμεσα στην κυβέρνηση, την ιδιωτική πρωτοβουλία, ή το άτομο. Οι κυβερνήσεις αλλάζουν τις δομές τους, ώστε να αυξήσουν την αποτελεσματικότητα των παρεχόμενων υπηρεσιών, να μειώσουν το κόστος και να αυξήσουν την ικανοποίηση και την συμμετοχή των πολιτών. Κατά συνέπεια η χρήση της Πληροφορικής από τις κυβερνήσεις, Ηλεκτρονική Διακυβέρνηση, αποτελεί ένα εργαλείο που διευκολύνει αυτή τη διαδικασία.

Δυστυχώς, η έως σήμερα εμπειρία, από την υλοποίηση μεγάλων έργων Ηλεκτρονικής Διακυβέρνησης, συνηγορεί προς την ανάγκη της χρήσης μεθόδων Διαχείρισης Επιχειρησιακών Διαδικασιών για την υλοποίησή τους, ώστε να μειωθούν οι αστοχίες, το κόστος, η γραφειοκρατία και να βελτιωθεί η ποιότητα των παρεχόμενων υπηρεσιών.

Η εργασία μας μελετά την περίπτωση της Γενικής Συνέλευσης του Τμήματος Επιστήμης των Υπολογιστών του Πανεπιστημίου Κρήτης, ως παράδειγμα της Ηλεκτρονικής Διακυβέρνησης, το οποίο χρησιμοποιείται για να καταδείξουμε την ισχύ των μεθόδων Διαχείρισης των Επιχειρησιακών Διαδικασιών και των σχετικών τεχνικών, καθώς επίσης και τα οφέλη που μπορεί να φέρει η εφαρμογή τους σ' έναν οργανισμό.

Οι διαδικασίες της γενικής συνέλευσης μοντελοποιούνται, σχεδιάζονται και αναλύονται, στοχεύοντας πρώτα να εντοπιστούν οποιαδήποτε δυσλειτουργίες και προβλήματα συμφόρησης και έπειτα προτείνονται οι κατάλληλες λύσεις. Οι λύσεις είναι τέτοιες, ώστε επιτυγχάνεται η αποσυμφόρηση και η αυτοματοποίηση των διαδικασιών καθώς επίσης και η επικοινωνία αυτών των διαδικασιών με διαδικασίες σε άλλα συστήματα.

Επόπτης Μεταπτυχιακής Εργασίας: Πλεξουσάκης Δημήτρης

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1 Introduction

With the current downturn, margins are being squeezed in most industries, resulting in an urgent need for higher efficiency and greater effectiveness, including the putting in place of better-value ways of working. A true e-business of the twenty-first century is one which thinks and acts in a way that allows it to collaborate, integrate and empower by:

- internal and external business processes working together seamlessly, enabling collaboration with suppliers, partners, employees and customers across traditional enterprise boundaries;
- ensuring that employees have at their fingertips the information, applications and services they need to do their jobs.

It is the Web and the applications, standards, tools and services that have been developed around it that have removed the traditional barriers to building collaborative relationships and now made it an economically attractive option. The benefits from the transformation of business processes are derived from eliminating intermediaries like wholesalers and retailers from the value chain, removing manual operations, improving productivity and speed of operation, increasing efficiency and enhancing customer and supplier relationships.

From the beginning of the 90's, public administration has been confronted by a series of new demands and has to answer the following question:

> *How will agencies meet the challenges of automating processes and integrating people and systems seamlessly and securely with other agencies, the private sector, other governments, and the citizens they serve?*

All levels of government are facing significant challenges. The federal government faces its largest reorganization in 50 years. State and local government budgets are dwindling. Public servants worldwide have to make difficult choices about cutting costs while at the same time trying to increase services.

Government directives are providing guidance that encourages government agencies to foster collaboration and to automate and streamline business processes. Public awareness of government spending has created mandates for cost controls, forcing government agencies to meet these ambitious goals with limited resources.

Government is, in the end, all about the citizens that it serves. Whether e-government initiatives are as personal as providing social services or tax information to citizens on the Web or as universal as homeland security, integrating and sharing critical business processes and information are equally important.

Citizens and legislators alike expect the same kind of around-the-clock services and personalized experience the private sector provides. As the "customers" of government information and services continue to embrace online operations, the pressure to move forward with e-government has brought technology issues to the forefront of public policy. Initiatives to provide consistent, trans-governmental services are forming across the public sector.

Government agencies need business process management solutions that securely and reliably tie together all internal and external processes. They need an e-government architecture that leverages the millions invested in existing infrastructures and legacy systems.

1.1 How This Thesis Is Organized

This thesis is composed of six chapters that can be read either in sequence or as standalone units:

Chapter 1, E-Government This chapter explains what E-Government is and its nature, and the E-Government Categorization and Models. Also presents the challenges, the obstacles and the benefits of using it. At the end presents the results from transition from traditional government to e-government and the need of using Business Process Management techniques.

Chapter 2, Business Process Management, this chapter covers all aspects about: what is Business Process Management, the Challenge of Cross-Functional Processes and the benefits of Business Process Management. Also explains the use of Workflows in Business Process Management, the Workflow Reference Model and the benefits of Workflow Management. Gives a Lifecycle View of the Business Process and a view about the relationship of information and its relationship to process and organization, the Business Process Management Component Model, the Business process analysis methods how Business Process Management Works and finally the Workflow Standards for Business Process Management.

Chapter 3, IBM WebSphere Business Integration Modeler, this chapter is a short presentation about the aspects that the Business Integration Modeler covers. Business Integration Modeler is a business process modelling tool that enables us to model, design, analyze and generate reports for business processes, integrate new and revised workflows, and define organizations, resources, and business items.

Chapter 4, Case Study, this chapter explains the use of techniques of Business Process Management and Workflow Analysis in order to model, design and analyze the processes of General Assembly of the Department of Computer Science of the University of Crete. Also presents the four processes.

Chapter 5, Implementation & Results, this chapter first described how modelled the current business to get a better understanding of the business process, the activities, and to prepare for simulation and analysis. Then the simulation and analysis of the current process model shows significant bottlenecks that must be reduced. After we described how to implement changes in a business process based on simulation and analysis results. Finally, we simulated the future processes and analyzed the results. We have seen a major improvement after the redesigning and the using of General Assembly Application.

Chapter 6, Conclusions, this chapter gives a clear view about the results of using Business Process Management techniques to modelling, designing and analyzing the processes of General Assembly of the Department of Computer Science of the University of Crete.

Appendixes, provides additional reference material and background information.

2 E-Government

From the beginning of the 90's, public administration is being confronted with a series of new demands. Society is being transformed by the influence of new technologies. There is a conspicuous trend towards growing individualization, whereby there are increasing demands on the state, by individuals, to provide solutions to a variety of problems. At the same time, in the context of national and international competition, efficient and effective state activity and support for entrepreneurial activities in a region or country are becoming an increasingly decisive factor in location decisions. No one has yet succeeded in improving the performance and capability of the state, in a manner and degree that is commensurate with the increasing number of responsibilities. A modernization and performance gap has arisen because of the discrepancy between the volume of work and the resulting performance. For some years, the term e-Government is being universally proposed as a way of closing this gap. But what is e-Government we shall see next.

2.1 What is E-Government?

Since the advent of computers, and more recently the Internet, pressure on governments to perform better has increased, and information and communication technologies (ICTs) have provided them with the capacity to do so via e-government. The impact of e-government at the broadest level is simply better government. It enables better policy outcomes, higher quality services and greater engagement with citizens. Governments and public administrations will, and should, continue to be judged against these established criteria for success.

E-government initiatives refocus attention on a number of issues: how to collaborate more effectively across agencies to address complex, shared problems; how to enhance customer focus; and how to build relationships with private sector partners. Public administrations must address these issues if they are to remain responsive.

There are many definitions of e-government but no single definition has been widely accepted. Some emphasize on gains cost savings, in administrative efficiency, or on high service availability, others enumerate the areas of impact on e-government. These definitions reflect the anticipation of desired outcomes rather than the particular technologies and tools used which may or may not enable these outcomes.

According to Hans J. (Jochen) Scholl the following two definitions are proposed:

Definition 1**:** *Electronic Government*[1] *is any process that the citizenry, in pursuit of its governance*[2]*, conducts over a computer-mediated network*[3] *[1].*

Definition 2: *Electronic government is the use*[4] *of information technology to support government operations, engage citizens, and provide government services [1].*

The first definition of e-government specifies the underlying technology of computer-mediated networks and the processes conducted over them as the differential between e-government and its government predecessors. The second definition invokes the aspect of efficiency of government operations, while it emphasizes the involvement of citizens at the same time. Both definitions overlap to some degree but also highlight distinct perspectives.

2.2 The Nature of E-Government

E-government involves many, heterogeneous types of business processes. When law or regulation changes these processes and their supportive systems have to adapt. The adaptation, of these changes, is realised by a chain of processes. First translate these law texts into specifications, design of processes and supporting systems, development of these processes and systems and finally implementation and use ([34]). The complexity in the above chain is that more than one governmental layer exists. Also an interaction between these layers occurs. A dominant factor which complicates further this process is the need to adapt to legislation from the European Union.

The following **Figure 1** shows the fragmented nature of E-government. Legislation and service provisioning efforts are distributed over the European, State, Region and local level. Many agencies of

[1] Also referred as ICT-enabled Public Administration, e-government or e-gov.

[2] This clause encompasses all processes, by which the citizenry forms its government institutions, elects its representatives, as well as how this government operates, and how it interacts with the citizenry.

[3] Computer-mediated networks are electronically linked devices that communicate interactively over network channels

[4] This is meant to be the innovative use

various types exist within each level. For example at the local level prefectures, municipalities and many other public and public-private agencies exist. This makes the situation more complicated.

The consequences of a new legislation are known only after the implementation in the processes and the supporting systems. A complicating factor in the adaptation of this legislation is that, many different parties and information systems can be involved.

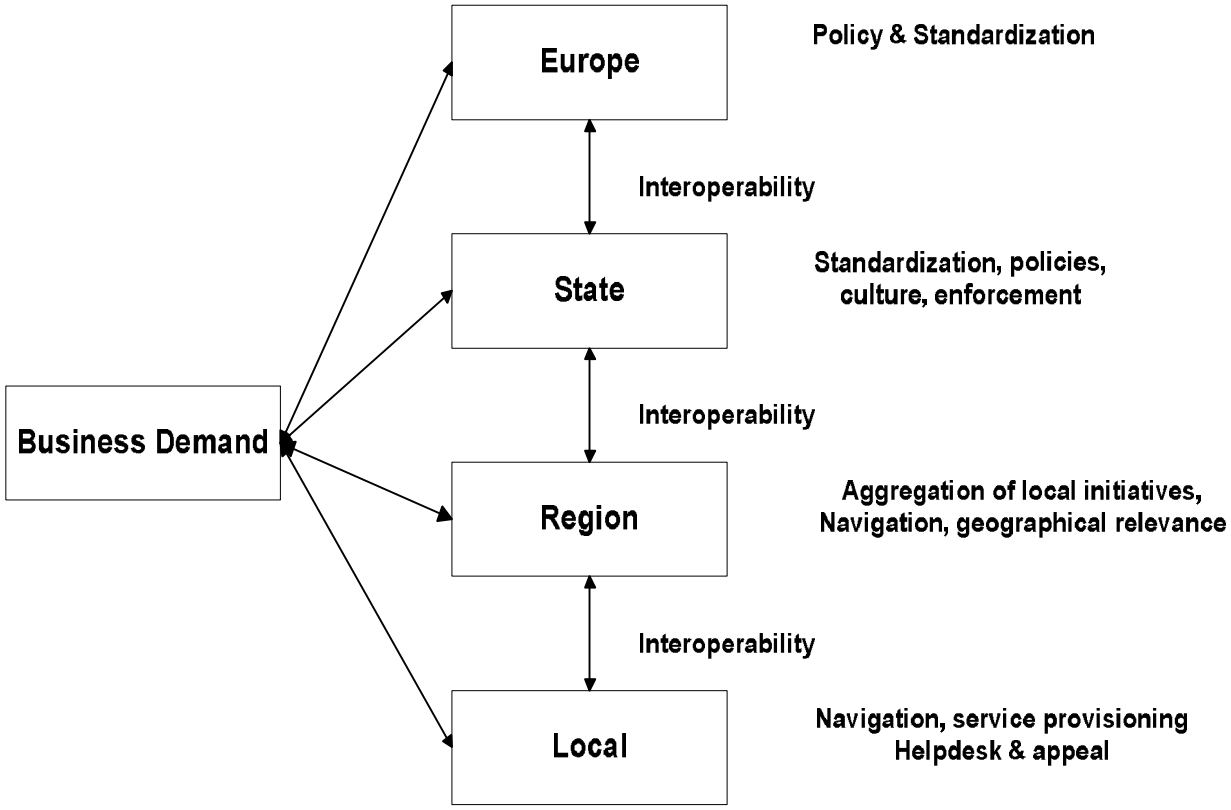


Figure 1: Fragmented nature of public administration

In order to make the description of the E-Government approach more understandable, we define here the basic structure of an E-Government system. **Figure 2** shows four basic roles played by actors in an E-Government system:

(i) Politicians who define the law,

(ii) Public administrators who define processes for realizing the law,

(iii) Programmers who implement these processes and

(iv) End-users (applicants) who use E-Government services.

Nowadays, businesses demand from governments to reduce the administrative burden that involves them. Governments can achieve this goal by creating a smart, service oriented, public administration. Public administrators have the key role. They possess a very good knowledge about the

e-Government domain. This knowledge is needed for the design of a public service. It includes the legislation that a service is based on, the respective law, related decrees, directives, prerequisites etc. Based on the interpretation of a law, a public administrator describes a service as a sequence of activities that have to be done, which represents a business process.

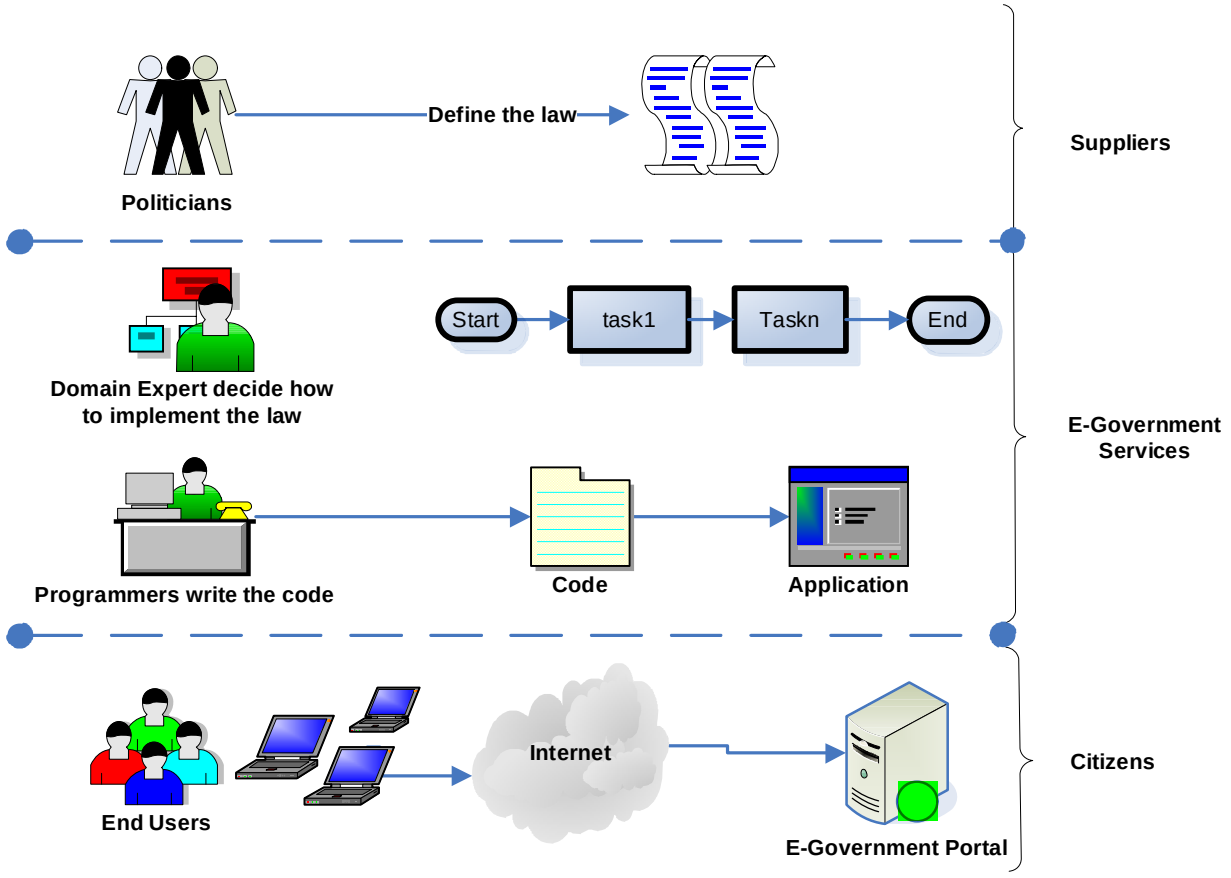


Figure 2: Basic roles in E-Government services

2.3 E-Government Categorization

One of the main propose of E-government is to provide high quality public services and value-added information to citizens. E-Government makes interactions between citizens and government agencies smoother, easier, and more efficient. This creates better relationships between government and the public. In this aspect, e-government seems to serve similar purposes as Customer Relationship Management.

Also E-government enables government agencies to work together more efficiently and provide a one-stop service to citizens and businesses. Supply Chain Management uses such practices to do somewhat analogous. There are also E-government initiatives that focus on the internal efficiency and effectiveness of operations, resembling Enterprise Resource Planning. Finally E-government actions

are intended to produce an overarching infrastructure to enable interoperability across different E-government practices, which seems to the efforts of Enterprise Application Integration.

The categorization of E-Government presents in the bellow Table 1.

E-government category	Business metaphor	Description	Sub-category	Example practice
Government to Citizens (G2C)	Customer Relationship Management	Providing opportunities for greater citizen access to and interaction with the government	Managerial interaction	Government's informational Web sites
			Consultative interaction	E-voting, instant opinion polling
Government to Business (G2B)		Seeking to more effectively work with businesses	Businesses as suppliers of goods or services	Government's e-procurement
			Businesses as regulated economic sectors	Electronic filing with various government agencies
Government to Government (G2G)	Supply Chain Management	Enabling government agencies at different levels to work more easily together	Vertical integration	Sharing a database among agencies within the similar functional walls but across different levels of government
			Horizontal integration	Sharing a database among agencies at the similar levels of government but across different functions
Government to Government (G2G)	Enterprise Resource Planning	Focusing on internal efficiency and effectiveness	Government to employee	Web-based payroll/health benefits system
			Integrating internal systems	Implementing ERP-like systems to integrate different functions within a single agency
Overarching Infrastructure (Cross-cutting)	Enterprise Application Integration	Facilitating the interoperability across different practices	Hardware and software interoperability	Public-key Infrastructure Interoperability
			Authentication	e-Authentication across different e-government initiatives

Table 1: E-government categories.

2.4 Models of the Stages of E-Government

The implementation of e-Government implies different objectives and levels of transformation in public services in different countries. For instance, in the USA, the main objective is to automate and integrate different islands of information to simplify and maximise the benefits of technology [29],

whereas in Europe the emphasis is to modernise public services and offer better services to citizens [28].

A stage approach became a need nowadays for developing robust E-Government infrastructures. An advantage of having a staged approach is the ability to generate momentum that can then be maintained. This may attract more and more citizens to using government e-services and to make them fell more secure and trust these procedures that becomes natural.

An E-Government system implementation passes through different stages starting from the lower to the highest potential stage. The integration of government information and services, as cross functional services, enabling citizens obtain government services and information online from a single point of access.

All academic researches agree that there are different stages in e-Government provision ([54], [55], [56], [57], [58]). The information systems are growing and evolving with confidence, acceptance and resources while the Governments are going through a number of stages before reaching maturity.

In Table 2 is shown the various models of the stages of e-Government and their perceptions. As we can see there is no agreement on how many stages of maturity an e-Government system goes through. Some believe that only three stages are necessary, like Howard, while others believe that four, like Layne and Lee, and others even five or six stages are required.

Layne and Lee (2001) [54]describe a four stage model for the development of a fully functional e-government. Layne and Lee see the development of government agencies as a natural progress in which the agency evolves because of and in response to functionality needs and customer expectations. E-government progress does not necessarily follow a linear path. The four stages – cataloguing, transaction, vertical integration and horizontal integration - of this model are shown in **Figure 3.**

Stage 1: Catalogue

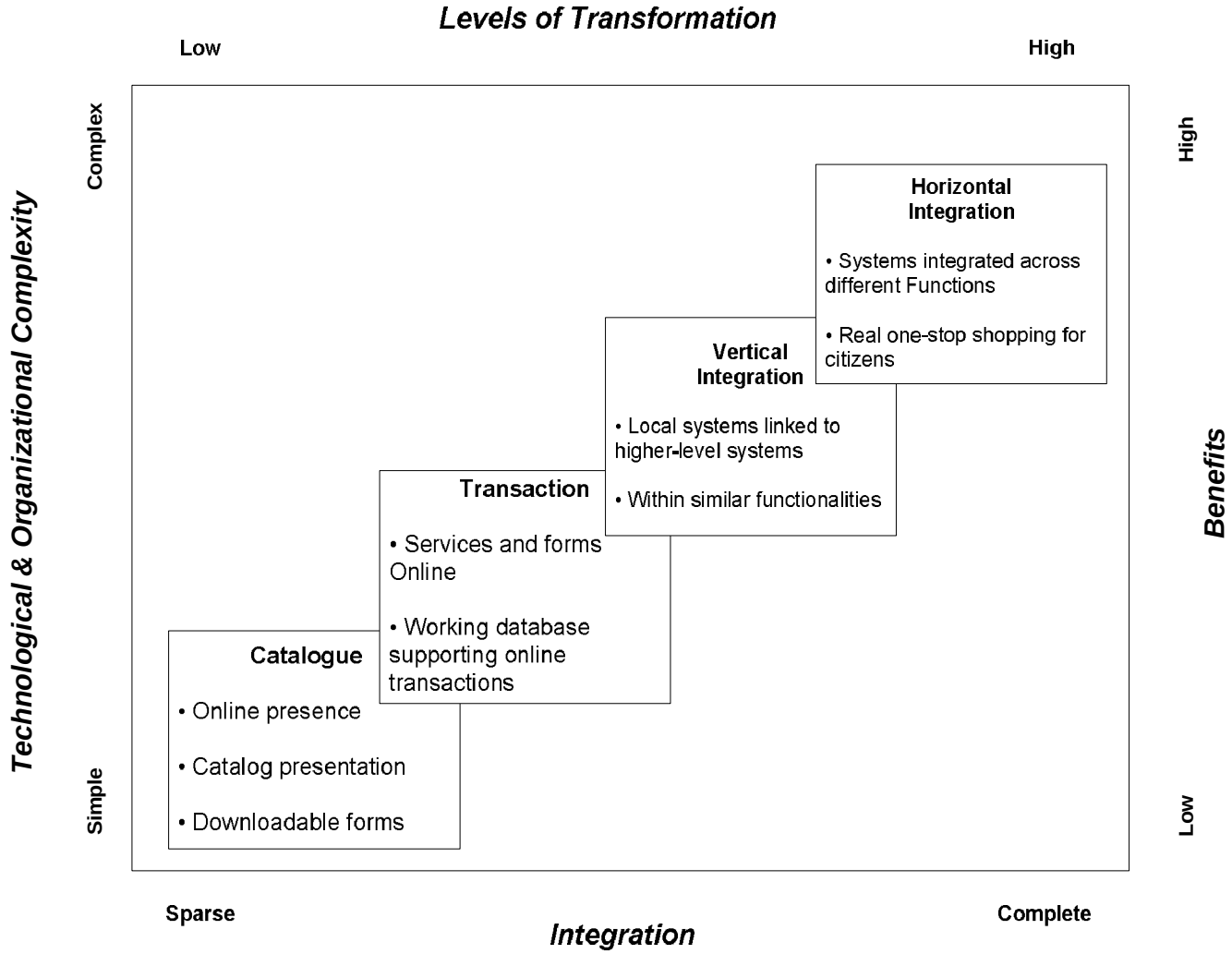
According to Layne and Lee [54] in the *cataloguing stage*, governments focus on establishing an online presence by publishing index pages or a localised site where electronic documents offer the public information relating to government services.

Stage 2: Transaction

According to Layne and Lee [54] in the *transaction stage* the focus is on connecting the internal government systems to online interfaces thus allowing citizens to electronically transact with government organization.

Stage	Perception	Reference
Stage 1: Publish Stage 2: Interact Stage 3: Transact	1. Information about activities of government available online. 2. Enables citizens to have simple interactions with their governments such as sending e-mail or 'chat rooms'. 3. Provides citizens with full benefits from transactions over the Internet, such as applying for programmes and services, purchasing licences and permits.	Howard [60]
Stage 1: Information Stage 2: Interaction Stage 3: Transaction Stage 4: Integration	1. Delivery of government services online. One-way communication between government and citizens. 2. Simple interaction between citizens and governments. 3. Services that enable transactions of value between citizens and government. 4. Integration of services across the agencies and departments of government.	Chandler and Emanuels [61]
Stage 1: Cataloguing Stage 2: Transaction Stage 3: Vertical integration Stage 4: Horizontal integration	1. Creating websites and making government information and services available online. 2. Enables citizens to interact with their governments electronically. 3. Focuses on integrating disparate at different levels. 4. Focuses on integration of government services for different functions horizontally.	Layne and Lee [54]
Stage 1: Emerging Stage 2: Enhanced Stage 3: Interactive Stage 4: Transactional Stage 5: Seamless or fully integrated	1. Creating a government website with limited / static information. 2. Updating information regularly. 3. Provides users with reasonable levels of interaction enabling them to download forms and 4. Enables users to complete transactions such as obtaining visas, licences, passports, birth and death records, etc. online safely and securely. 5. Provides services across administrative and departmental lines with the highest level of integration.	United Nations – DPEPA [62]
Stage 1: Information publishing Stage 2: Official' two-way transactions Stage 3: Multi-purpose portals Stage 4: Portal personalization Stage 5: Clustering of common services Stage 6: Full integration and Enterprise transformation	1. Creates websites by departments and agencies. One-way communication. 2. Enables customers to have electronic interaction with government services such as renewing television licences and paying parking tickets. 3. Enables customers to obtain government services and information from a single point. 4. Provide customers with opportunities to customize portals according to their need. 5. With portals becoming better, government departments will disappear where government will seek to gather common services to hurry the process of delivery. 6. Government departments will disappear others will appear; some departments will keep the same names but become entirely different internally.	Deloitte Research cited in Silcock [63]

Table 2: Different Classifications of the Stages of E-Government



Source: Adapted from [54].

Figure 3: Dimensions andstages of e-government development.

Stage 3: Vertical integration

According to Layne and Lee [54] in the third stage, *vertical integration*, federal, state and local governments are expected to connect to each other to offer a higher level of integrated service. The main challenge is to ensure compatibility and interoperability between various government databases

Stage 4: Horizontal integration

According to Layne and Lee [54] the fourth stage is *horizontal integration*, where different services and functions within the same level of government are integrated to provide a one-stop-shop for all major services

2.5 Challenges and Obstacles in E-Government

All levels of government are facing significant challenges during the largest reorganization in 50 years. Government budgets are dwindling and the public administrators have to make difficult choices about cutting costs while at the same time trying to increase services. Citizens and legislators alike expect the same kind of around-the-clock services and personalized experience the private sector provides.

As with any other new technology or organisational concept, the introduction of e-government to a country will also result in a number of challenges for the citizens as well and not just for the government [48]. The main Government challenges that arise in the age of e-government are:

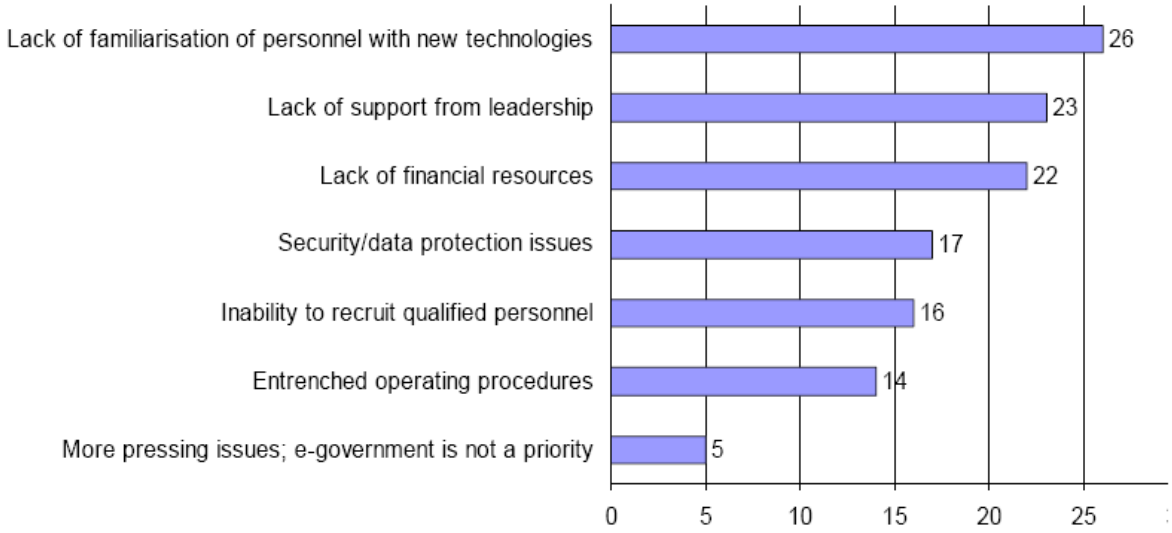
- Creation of a process-centric foundation and infrastructure for mandated e-government initiatives
- Bridging of existing information systems by facilitating the sharing of information among organizations
- Adoption of information sharing culture and integration of workflows across organizations
- Automation of commonly performed tasks
- Gaining visibility and control over internal and external processes
- Elimination of redundancies in systems requested and built by different agencies
- Integration of internal processes with existing disparate back-end systems and data sources
- Improvement of overall efficiency and effectiveness
- Ensuring privacy and security at all levels of interaction
- Decrease the administrative burden
- Reduce the lead times for adopting new legislations.

Overcoming the e-government challenges would be one of the biggest tests for both the government and the citizens of any country planning to implement the concept. Research on e-government has identified issues such as lack of awareness [38], access to e-services [40][39], usability of e-government websites [41][42], lack of trust [43][44], security concerns [51][46][47], resistance to change [48], lack of skills and funding [49], data protection laws [50][51], and lack of strategy and frameworks [38] which are hindering the adoption of e-government in many countries.

Hahamis P., Iles J. and Healy M. [35] suggest according to survey results that there are also serious institutional obstacles to e-Government evolution such as the lack of familiarisation of

employees with new technologies and lack of management support. The lack of financial resources and issues of security/privacy are considered to be major obstacles too – see Figure 4 bellow.

These barriers, in combination with the inability to recruit qualified personnel and the entrenched operating procedures, highlight the need for institutional change and re-engineering of the business processes.



Source: Adapted from [35].

Figure 4: Possible obstacles to e-Government implementation

However, experience of e-government is growing in different parts of the world and empirical evidence is being produced within government agencies and industrial organisation domains [52], offering a practical slant to e-Government initiatives. While such research is invaluable for the further development, understanding and promotion of e-government initiatives, the success of an e-government implementation will, at the end, largely depend on the benefits and levels of usefulness of the services it delivers to citizens [53].

2.6 Benefits of E-Government

According to Prins [3] E-government is defined as: "*the delivery of online government services, which provides the opportunity to increase citizen access to government, reduce government bureaucracy, increase citizen participation in democracy and enhance agency responsiveness to citizens' needs"*.

E-government is more than just putting government forms on the Web. It's about going beyond this and making a true connection among all the parties involved. The focus should be on providing the citizens with the best possible value for their citizen-centric services. While pledging to promote trust

between governments and citizens [5], e-government encompasses a broad spectrum of e-activities and allows the provision of an improved service by the government to the citizens [2].

There are many substantial benefits of e-government initiatives, including improved efficiency by reducing the time spent upon manual tasks, providing rapid online responses, and improvements in organisational competitiveness within public sector organisations [4]. The benefits of e-government can categorized in terms of:

- ***Agency benefits*:**
    - **lower cost channels of communication with citizens and businesses** - e-services channels offer an additional way of communicating with citizens which often costs far less; and
    - **increased resource efficiency** – Sharing information with other agencies, via electronic ways, cuts back the cost and reduce the time to transfer the information.
- ***Consumer financial benefits:***
    - **faster turn-around of information requests** – businesses can now access information directly from agencies' web sites or lodge an electronic request for information rather than lodging forms and attending government offices to ask for information; and
    - **faster access to documents and forms** – The online service delivery channels speeding up turnaround of documents and forms is extremely beneficial.
- ***Social benefits*:**
    - **Faster turnaround of service delivery** – People can access information directly via online service delivery channels without having to visit the agency, thus improving service levels significantly.
    - **24-hour service delivery** - people are able to seek information outside of business hours.
    - **More self-service** - people can now access information on a self-serve basis, making the information available at the right time for decision making.
    - **Improved ability to find information** - the ability to find information enable citizens to understand more about their government and to find the support program that meets their specific needs.
    - **Wider reach of information to the community** – The penetration of information and transaction-based capability is increasing.
    - **Better communication with rural and remote communities** - Broadband infrastructure improves the possibility for regional and rural communities to have the same levels of

access to information and government transactions, and their service expectations are aligned with the enhanced capability of the technology.

2.7 E-Government as a Global Phenomenon

The next literature review identifies the work that has been carried out in the U.S.A. and other countries, in the European Community and in Greece.

2.7.1 E-Government in USA & other Countries

At e-Gov, the official web-site of the US president's e-Government initiatives, e-Government is understood as "*the use by government agencies of information technologies that have the ability to transform relations with citizens, businesses, and other arms of government"*. The purpose of e-Government, stated the American way, is *"... to make it easy for citizens and businesses to interact with government, save taxpayer dollars, and streamline citizen to government communications"* [33].

During a 2001 U.S. Congressional Hearing on e-government, Congressional members and technology industry experts concurred that "*the future of democracy is digital*" and that e-government must be successfully implemented in the U.S. as they are in other parts of the world ([6]). Governments representing developing nation-states such as those of Namibia, Armenia, Jamaica, Pakistan and others have executed programs to implement some form of e-government ([8]). Namibia established a parliamentary web site, which allows citizens to access and react to pending legislation. Armenia has developed an online forum to discuss public policy issues. Jamaica is offering Internet access in local post offices and training postal workers to help citizens learn how to use the technology. Pakistan is using the web as an anti-corruption tool by listing government officials guilty of the crime of corruption to dissuade people to commit similar offences ([8]).

And the lure of e-government is impinging on forms of governments beyond democracies. For example, the communist government of China requested that all local inland and coastal governments implement websites because of the benefits of Internet technology. The paradox is that the Internet provides greater communicative inter-connectedness; something the government rebukes ([7]).

2.7.2 E-Government in European Union

Since the 1990s the E.U. has been making e-government a major administrative and political priority. In June 2000, the European Conference endorsed the eEurope 2002 Action Plan designed to develop a "*competitive, dynamic and knowledge-based*" European economy based on ICT ([13]). The

eEurope 2002 plan had three objectives; a secure, faster more cheaper Internet,improve peoples skills and stimulating the use of the Internet ([11]).

The aim, articulated at the Lisbon Summit of March 2000, was to make Europe "*the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion*" by 2010 ([30]).

This plan was superseded by eEurope (2005), presented to the Seville European Council in June 2002, which stated that "*modern online public services*" including "*e-Government, e-learning services, e-health services*" as well as "*a dynamic e-business environment*" should be prevalent in the E.U. by 2005. It was claimed in the plan that the "*widespread availability of broadband access at competitive prices*" operating in tandem with "*a secure information infrastructure*" would be critical to the successful implementation of the strategy. In a further refinement of the strategy, in September 2003 the European Commission defined e-Government as:

> "*the use of information and communication technology in public administrations combined with organisational change and new skills in order to improve services and democratic processes and strengthen support to public policies*" ([12]).

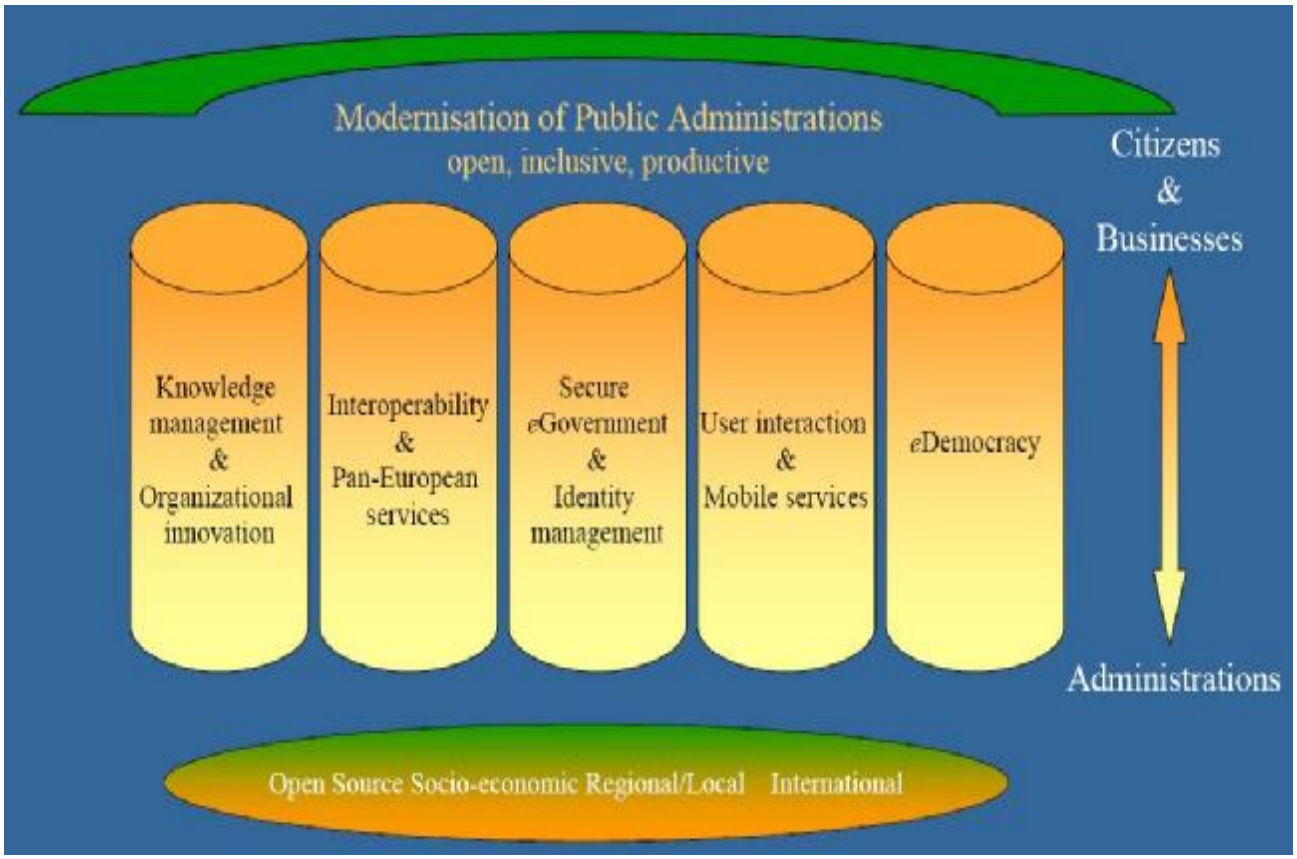
This definition could be described as the mission statement for e-Government in the European context, see Figure 5, and implied that enhancing the democratic process was just as important as improving public services. In many ways the rhetoric surrounding e-Government initially echoed that of advocates of the expansion of ICT in the private sector sphere. There, for example, talk of open, transparent organisations evolving into flatter more democratic structures is a repeated theme ([21]). During this period, European Commission documents concerning e-Government talked of empowering citizens, "*the improvement towards more transparent, accountable and open public institutions*"; the fight against corruption and fraud; and the re-enforcement of democracy ([26]).

By October 2004, the focus of the EU's e-Government drive had undergone a significant policy shift. The new e-Government target was the improvement of public "administrative efficiency", recalling the objectives of the Lisbon Summit. In short, the dual focus on democracy and efficiency was effectively dropped in favour of the latter. At the same time, the EU was expanding from 15 to 25 members states. As a result, a persistent theme in many of the eEurope 2005 documents was the need to use ICT to encourage inclusiveness within the enlarged Union. Despite this, the emphasis was increasingly put on the efficient delivery of services.

The change in direction was articulated through the specific targets outlined in the eEurope 2005 Action Plan which covered interactive public services, public procurement, Public Internet Access Points (PIAPs), interoperability, culture and tourism as well as secure communications between

public services ([14]). Each of these areas had specific target dates by which a number of objectives had to be completed. For example, member states have been urged to ensure that by the end of 2005 …

"…basic public services are interactive, where relevant, and accessible for all. The Commission and Member States must agree on a list of public services for which interactivity and interoperability are desirable. Relevant issues include exploiting the potential of broadband networks and multi-platform access, and addressing access for people with special needs..." ([14])



Source: Adapted from [30].

Figure 5: Lisbon Agenda eEurope Internal Market European Citizenship Enlargement Security & Stability Europe in the World.

More recently, John Borras ([9]) of the UK e-Government Unit has emphasised that "*e-Government strategies are about harnessing the information revolution to improve the lives of citizens and businesses and to improve the efficiency of government*". However, none of the twenty basic supply-side public services key indicators defined by the European Commission to monitor progress on e-Government relates directly to e-democracy. In spring 2005, the European Council will undertake a mid-term review of the Lisbon objectives, and the evidence so far indicates that

there has been less progress than anticipated. In the circumstances it is likely that the development of e-Government will focus ever more tightly on the efficient delivery of public services.

2.7.3 E-Government in Greece

The Greek government published, in February 1999, a paper titled *'Greece in the Information Age Strategy and Actions'* ([18]). According to official reports and statements, the Greek Government was keen to promote ICT in general and e-Government in particular. However, relative to the then 14 other EU members, Greek online capability was low, with Internet household penetration less than 14% in 1999, a figure that increased only marginally between 2001 and 2003. On a range of measures including Internet access by household, Internet hosts and PCs per 100 inhabitants, Greece in that period was at the bottom of the EU league ([25]). Despite more recent data indicating growing Internet access in Greece, it is still low compared to other EU countries' ([10]).

In addition, the broadband penetration rate in Greece is very poor. In January 2004, Greece was at the bottom of the 15 E.U. members list with just 0.1% penetration compared with an EU average of 6.1% ([15]). A year later, Greece had made little progress and remained at the bottom place; it was the only EU member state with lower than 1% broadband penetration. The EU average in 2005 had risen to 10% for the old 15 states, and the average for all 25 states was 9% ([16]).

The Community Support Framework 2000-2006, known as 3rd CSF, is "*the development plan, agreed and adopted by both the Greek Government and the European Commission, to deliver assistance to the Greek regions for the period 1/1/2000 to 31/12/ 2006*" ([22]). This plan seeks to address a number of the ICT inequalities mentioned above.

> *"The 3rd CSF was approved in July 2000 and signed in November 2000. While the main priorities of this development programme were defined in cooperation with the Commission, the choice of projects and their management are solely the responsibility of the Greek national and regional authorities. Once projects are selected, they are financed from both national and community funds, since programme budgets always comprise European Union funds as well as national sources (public or private). The 3rd CSF aims to reduce the gap between Greece and the other member states of the European Union. Its priorities focus on investment in natural, human and knowledge resources." ([22])*

There has been a degree of success in the development of e-Government at a national level. *Taxis* (an online tax facility), the National Printing House, *IKAnet* (a national insurance transaction facility) and *Syzefxis* ([24]) (the national public administration network) are some of the examples of

progress so far ([19]). Also the information system *Politeia* ([27]) has implemented. As part of it are the Citizens' Service Centres ([31]) designed as 'one-stop' shops for services to the citizen, were introduced under the Ariadne Project, and operate using up-to-date ICT where the citizens can obtain applications of around 851 standardised administrative services covering virtually all public sectors.

In addition, there has been progress in building general information web sites and portals.

2.8 Results from the transition from "traditional government" to "e-Government"

The transition from "traditional government" to "e-Government" will be very complicated and difficult, and we must have certain standards to measure the success of e-Government projects and the benefits they can bring to citizens, enterprises and the society.

E-government is costly, involves tremendous risk, requires a skilled technical pool of resources, and a stable technical infrastructure. According Basu ([67]) implementing e-government necessitates the evaluation of the following risk factors: political stability, adequate legal framework, trust in government, importance of the government identity, the economic structure, the government structure (centralized or not), levels of maturity within the government and citizen demand. Furthermore, according Jaeger ([69]) inherent issues of e-government include: security and privacy, homeland security, diverse educational levels of users, accessibility issues, prioritization of e-government over basic functions of government, building citizen confidence in e-government, and whether certain forms of government do better with e-government than others.

E-government programs not only present arduous challenges in their preparation, but are also difficult to execute successfully. According to a 2002 Gartner study ([68]), 60% of government agencies have failed or fallen short of e-government modernization efforts. The report also concluded that only 10% of governments would be able to move toward e-government by 2005.

According to the research done by Standish Group, among all the information technology projects in the governments and companies carried out in the US in 2000, approximately only 28% were successful, and 23% were abandoned while the rest can only be considered partially successful [66].

The chief information expert of the World Bank Mr. Rober indicated that *"among the e-Government projects in developing countries, according to estimation, 35% totally failed, and 50% partially failed. Only 15% can be considered completely successful." "By 'fail', I mean the government can not provide service for the public or provide convenience for commercial activities through those projects."* [65].

In the UN's report for E-Government was divided into 3 types. The first type was called the wasteful e-Government, i.e. investing without producing; the second type was called the pointless e-Government, i.e. producing without benefit; and the third type was called the meaningful e-Government, i.e. producing with benefit. The research done by the UN shows that the e-Government projects in developing countries have a high failure probability, ranging from 60% to 80% [64], *E-Government at the Crossroad* in 2003.

The research on e-Government, carried out above, indicates that the development of e-Government projects, at present, has high risk associated with it. Also researchers contend that e-government programs are failing due to a *lack* of understanding of effective planning, development and deployment [68].

2.9 The Need for Effective Business Process Management in the Public Sector

The aim of E-government is to get aware of structured governmental and administrational tasks and make them executable via electronic media. Business, administration and legal relations must be worked out in an integrated way. The provisioning of services in the public administrations, via online transactions, requires continuous process restructuring - starting from the reallocation of activities to topics like data security, digital signature or online payment. Some processes are no longer executed by the authority alone but are partially done by the citizen.

The main characteristic of e-government applications is their ***complexity***, as a number of actors (citizens, clerks, authorities, etc.) as well as business processes have to be integrated (according to more or less defined roles and heterogeneous technologies). The modelling of processes with respect to electronic administration therefore is a big challenge.

The solution for connecting all parties in government processes into a single, unified machine that supports productivity and collaboration in government is ***Business Process Management***. Business Process Management addresses the challenges that government agencies face by enabling them to organize and manage people, activities, and resources such as capital assets and information technology to more effectively reach their goals and meet legislative and executive mandates. Business Process Management acts as a catalyst for transforming government agencies and the way they work by ***automating and simplifying processes, enforcing best practices, improving quality and productivity, and fostering collaboration*** internally and externally with other agencies, local governments, the private sector, and citizens.

Traditional modelling tools are not adequate for Business Process Management in e-government. On top of that, one has to be aware of the flows, the necessary resources, the responsible roles and the competencies of the authorities. According to the literature the most important requirements of Business Process Management in e-government are:

- the identification of actors and their roles,
- the definition of possible communication channels,
- the transparency of the flows,
- the standardisation of terminologies for an efficient and transparent communication,
- the holistic modelling from the portal to the back office and
- the integration of the citizen as service consumer.

Current modelling of organisations and business processes is based on fixed metamodels. With fast changing business conditions and the requirements of the public sector for an appropriate tool for the depiction of e-government processes, the complexity to find an appropriate solution for each application area rises tremendously. Important parts of the ***Business Process Management*** are the acquisition of relevant data and the illustration of models of the organisation, the products and processes as well as the usage of resources like information technology. The analysis and simulation of the models deliver advice for the strategic optimisation and quality assurance.

2.10 General Assembly of Computer Science Department

Our study considers the case of the General Assembly of the Department of Computer Science of the University of Crete, as a paradigm of E-Government, which we use to demonstrate the validity of the Business Process Management methodology and the associated techniques, as well as the benefits their application can bring to an organization.

The processes of the General Assembly are modelled, designed and analysed, aiming first to locate any disfunctions and fragmentation problems that may exist and then to propose appropriate solutions. Solutions should be such, that the de-fragmentation and automation of the processes will become possible as well as the communication of these processes with processes in other systems.

3 Business Process Management

It's as hard as ever to keep an organization running smoothly after a decade of investment in enterprise applications. The work environment is not getting simpler, but faster and more complicated. The problem boils down to two simple words: complexity and change. In 1995, 62 per cent of UK managers were affected by some sort of organizational change programme: in manufacturing and financial services it was running at 75 per cent, in utilities it reached 90 per cent [74]. The organizations, which manage change skilfully, presenting a new opportunity to increase efficiency. But in others, which do not realize the challenges it brings, too often change fails [72][73].

The use of process-based management as the basis for managing the business became a need [70][71]. Business process management techniques have evolved from being used as just one-off tools applied for a particular purpose within the organization, such as costing or business improvement, and have become an all-embracing advanced planning, monitoring and control system. Business Process Management software is now being developed to allow data to be passed between disparate operating systems, converting data into business intelligence, managing application-to application integration and application-to-human interactions.

3.1 What is Business Process Management?

Business Process Management is founded on the notion that organizational success depends on optimizing key underlying *processes*. Unfortunately most organizations are assembled around discrete functional units and systems, not processes. Business processes generally span multiple functional units, cutting across departments and enterprise applications that in the past had no need to talk to each other directly.

In government organizations the process begins with an application from the citizen through one of several channels – paper, telephone, or web – and continues through a variety of information-

gathering, fact-checking, approval, notification, and record keeping steps that cross functional boundaries within the agency or department and may extend to third parties as well. The process is composed of multiple activities, some of them essentially manual, like reviewing documents or managing exception cases, and others automated by various business systems, both front-office and back-office.

Business Process Management works by *modelling* the end-to-end process – diagramming the sequential flow of activities and information, along with the rules that govern it – and then *executing* that model, which means routing each instance of the process through the steps as dictated by the process diagram.

Business Process Management *automates* human tasks, managing work-lists for process participants with pre-defined deadlines, alerts, and escalation actions. It also *integrates* the diverse systems involved, exchanging data and coordinating transactions among them even though they may be based on different IT platforms or programming languages. Business Process Management also *optimizes* process performance, continuously tracking average cycle times, costs, and other process metrics, and making them available in analytical tools and management dashboards for reporting and remedial action.

Business Process Management brings together two key technologies that have been around for a decade or more:

- ***Workflows***, pioneered by FileNet in the 1980s, improves process efficiency and cycle time by automating human tasks, performing rule-based routing and exception-handling, controlling the flow of data and documents, and managing the necessary record-keeping and audit trail.
- ***Application integration***, which arose in the 1990s, is IT middleware that lets applications exchange data with and execute functions on other applications across the organization.

In today's Business Process Management architecture, this integration middleware allows the Business Process Management server ("process engine") to route process tasks to diverse business systems in the same way that it does to human participants.

3.2 The Challenge of Cross-Functional Processes

Organizations have traditionally been organized around discrete business functions. Each unit has its own IT system which is designed to meet its' own internal goals. The strategic objectives of the organization are met fragmented and not as a whole. For a decade the investment in Information Systems has focused on integrating and automating operations *within* each functional unit. Thus this

widespread implementation has made those operations highly automated and internally efficient. On the other hand this made them less able to communicate with each other. Also the response to changes was too difficult.

Business Process Management attacks this situation, both at the organizational and systems level. Using Business Process Management techniques we are able to describe the organization as a collection of *core business processes* that each span functional boundaries and not as a set of discrete functions. The organization strategic goals are addressed more successfully by using processes. Dr Geary Rummler, one of the founders of Business Process Management as a management discipline, talks about *"managing the white space in the organization chart,"* the handoffs *between* organizational units where things are most likely to go off track.

The processes need to penetrate the barriers between traditional organizational structures and systems for succeeding bottom line success and customer satisfaction. In fact, the above situation has created several problems:

- **Inefficiency.** Exceptions are handled manually, resulting in processes that are inefficient and take too long to complete.
- **Rigidity.** Critical organizational systems are hard to integrate and even harder to change.
- **Lack of compliance and control.** The same process is done differently in different departments and sites.
- **Poor visibility.** Business performance can't be measured at the end-to-end process level.
- **Inertia.** *The process rules keep changing,* while IT resources are already stretched to the breaking point.

3.3 The Business Process Management Benefits

Business Process Management attacks the above challenges and provides significant business benefits:

- **Lower operational costs.** Automating manual tasks cuts costs. Also allows business volume to grow and frees key knowledge workers from tasks that can just as well be performed by a computer.
- **Faster cycle time.** Besides automating individual tasks, automates the handoffs between process steps, gathering the information needed at each one, translating it into the proper format, and ensuring that the most critical work gets done first.

- **Compliance and auditability.** Ad hoc procedures are brought under strict rules-based control. Also ensures that the rules for a process are followed *in every instance* and in every location, and can back it up with an auditable history.
- **Global consistency and control.** Enforces consistency, while reducing the burden of change (reorganization and consolidation).
- **IT investment protection.** Protects investment by leveraging existing systems in new and ever-changing business processes without rip and replace them.
- **Responsiveness to changing demands.** Business process solutions are not hard-coded, but are rapidly assembled out of reusable components. The process logic – the sequence of tasks in the process, the resources assigned to each, and the rules governing the flow – is embodied in a graphical diagram that requires no programming. This translates into faster response to changing requirements, and increased agility overall.
- **End-to-end performance visibility.** Provides global visibility by collecting the data, mapping it to a common format, and processing it with advanced analytics and management dashboards.

Beyond those quantifiable benefits, Business Process Management adds strategic value as well.

3.4 Workflow Management

Workflow Management is a fast evolving technology which is increasingly being exploited by businesses in a variety of industries. Its primary characteristic is the automation of processes involving combinations of human and machine-based activities, particularly those involving interaction with information technology applications and tools.

3.4.1 What is a Workflow?

In any process the specific tasks or activities used to implement it may vary from one instance to another. According to the **Workflow Management Coalition** (WFMC, www.wfmc.org) [78], *"a workflow is the automation of a process, in whole or in part, during which documents, information or tasks are passed from one participant to another for action, according to a set of procedural rules"*. Thus each such combination of tasks or activities comprising an enactment of the process represents a ***workflow*** for that process.

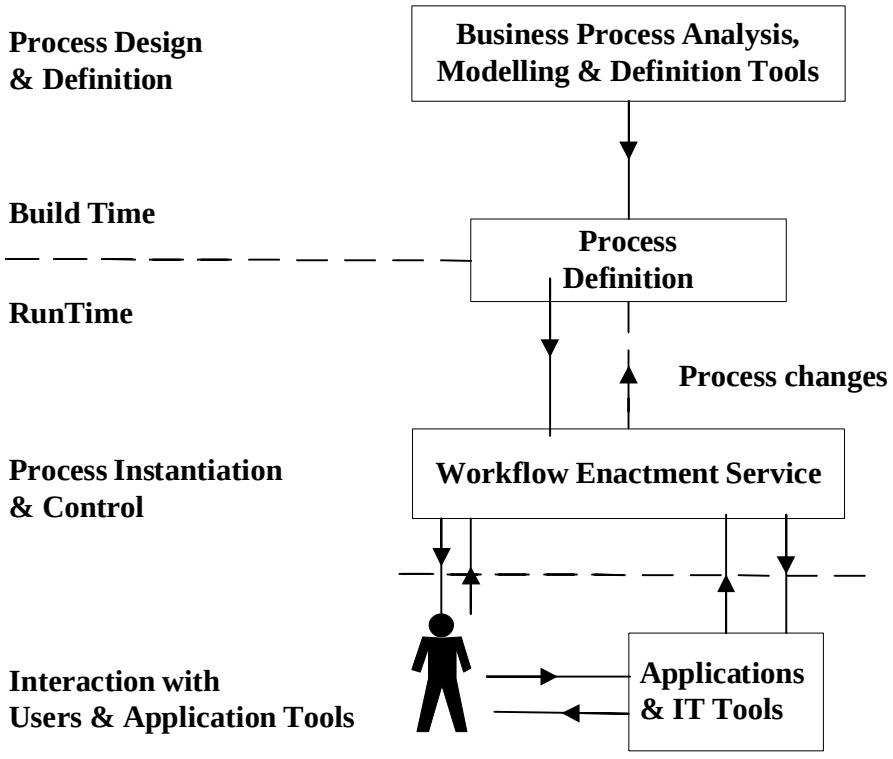
The primary definition related to workflow support of e-Government services is:

"Workflow is concerned with the automation of procedures where documents, information or tasks are passed between participants according to a defined set of rules to achieve, or contribute to, an overall business goal."

Whilst workflow may be manually organised, in practice most workflow is normally organised within the context of an IT system to provide computerised support for the procedural automation.

3.4.2 Workflow Management Systems

According to Workflow Management Coalition [78], a Workflow Management System provides procedural automation of a business process by management of the sequence of work activities and the invocation of appropriate human and/or IT resources associated with the various activity steps. An individual business process may have a life time ranging from minutes to days (or even months and years), depending upon its complexity and the duration of the various constituent activities.



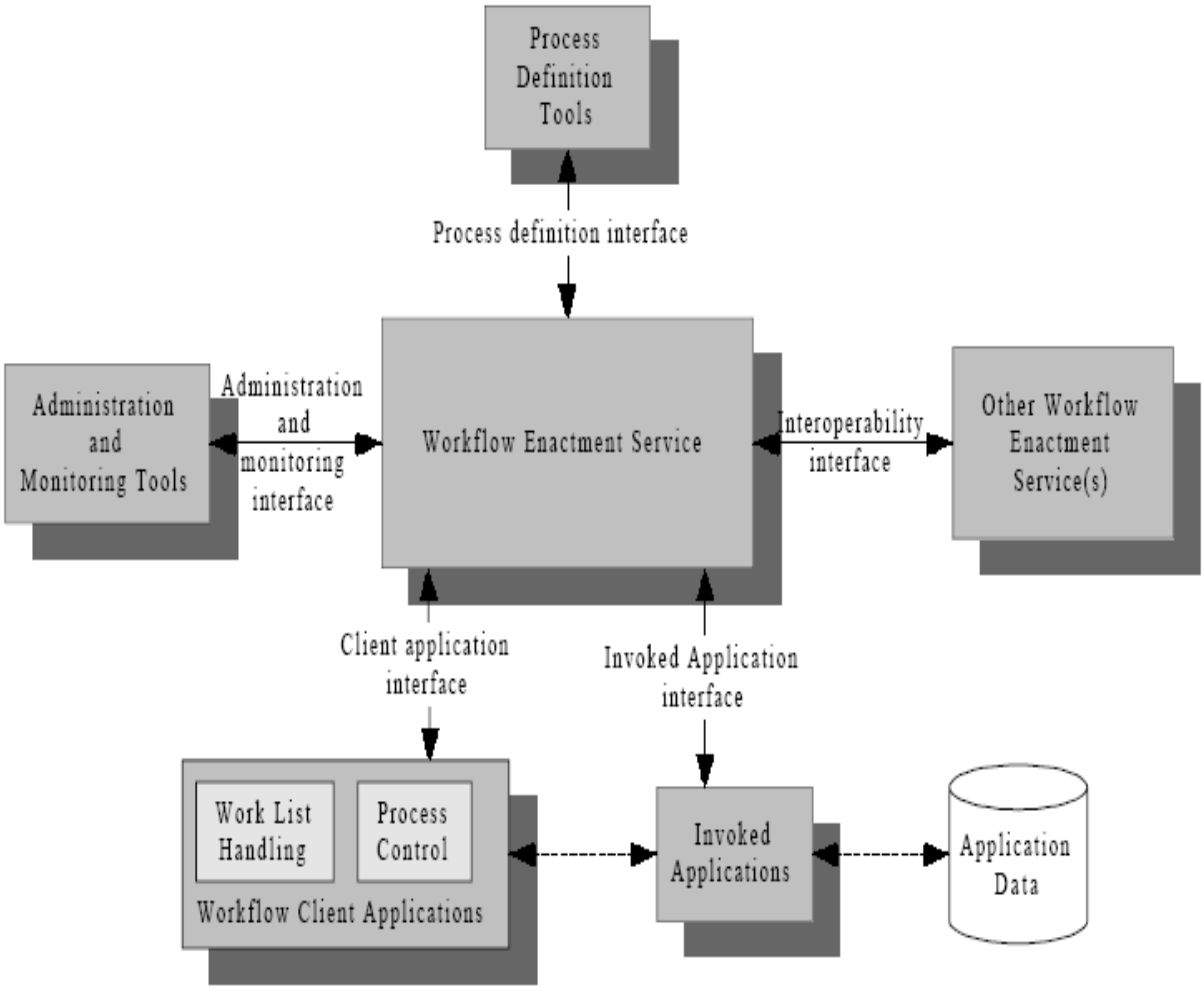
Source: Adapted from [78].

Figure 6: The Workflow Management Coalition System Characteristics by WfMC

At the highest level, all WfM systems may be characterized as providing support in three functional areas, see **Figure 6**:

- the Build-time functions, concerned with defining, and possibly modelling, the workflow process and its constituent activities
- the Run-time control functions concerned with managing the workflow processes in an operational environment and sequencing the various activities to be handled as part of each process.
- the Run-time interactions with human users and IT application tools for processing the various activity steps.

3.4.3 The Workflow Reference Model



Source: Adapted from [78].

Figure 7: The Workflow Management Coalition Reference Model by WfMC

The *Workflow Management Coalition Reference Model* [84], see **Figure 7** above, identifies the functional areas addressed by the Workflow Management Facility and typical usage scenarios:

- **Process Definition**: specifications for process definition data and its interchange with the Workflow Execution environment.
- **Workflow Interoperability**: interfaces to support interoperability between different workflow systems
- **Invoked Applications**: interfaces to support interaction with a variety of IT application types
- **Workflow Client Applications**: interfaces to support interaction with user interface desktop functions
- **Administration and Monitoring**: interfaces to provide system monitoring and metric functions to facilitate the management of composite workflow application environments

3.4.4 Typical Features of a Workflow Management System

Listed below are some typical features associated with many Workflow Management Systems.

- ***Process Definition Tool:*** A graphical or textual tool for defining the business process. Each activity within the process is associated with a person or a computer application. Rules are created to determine how the activities progress across the workflow and which controls are in place to govern each activity. Some workflow systems allow dynamic changes to the business process by selected people with administrative clearance.
- ***Simulation, Prototyping and Piloting:*** Some systems allow workflow simulation or create prototype and/or pilot versions of a particular workflow so that it can be tried and tested on a limited basis before it goes into production.
- ***Task Initiation & Control:*** The business process defined above is initiated and the appropriate human and IT resources are scheduled and/or engaged to complete each activity as the process progresses.
- ***Rules Based Decision Making:*** Rules are created for each step to determine how workflow-related data is to be processed, routed, tracked, and controlled.
- ***Document Routing:*** In simple systems, this might be accomplished by passing a file or folder from one recipient to another. In more sophisticated systems, it would be accomplished by checking the documents in an out of a central repository. Both systems might allow for redlining of the documents so that each person in the process can add their own comments without affecting the original document.

- ***Invocation of Applications to View and Manipulate Data:*** Word-processors, spreadsheets, production applications, can be invoked to allow workers to create, update, and view data and documents.
- ***Worklists:*** These allow each worker to quickly identify their *current tasks* along with such things as due date, goal date, priority, etc. In some systems, *anticipated workload* can be displayed as well. These systems analyze where jobs are in the workflow and how long each step should take, and then estimate when various tasks will reach an individual's desk.
- ***Task Automation:*** Computerized tasks can be automatically invoked. This might include such things as letter writing, email notices, or execution of production applications. Task automation often requires customization of the basic workflow product.
- ***Event Notification:*** Staff and/or managers can be notified when certain milestones occur, when workload increases, etc.
- ***Distribution (Routing) Lists for Messages/Mail:*** Distribution lists can be created for sending ad-hoc messages among the staff.
- ***Process Monitoring:*** The system can provide valuable information on current workload, future workload, bottlenecks (current or potential), turn-around time, missed deadlines, etc.
- ***Access to Information over the World Wide Web:*** Some systems provide Web interfacing modules in order to provide workflow information to remote customers, suppliers, collaborators, or staff.
- ***Tracking and Logging of Activities:*** Information about each step can be logged. This might include such things as start and completion times, person(s) assigned to the task, and key status fields. This information might later be used to analyze the process or to provide evidence that certain tasks were in fact completed.
- ***Administration and Security:*** A number of functions are usually provided to identify the participants and their respective privileges as well as to administer routines associated with any application (e.g., File back-ups, archiving of logs).

3.4.5 Benefits of Workflow Management

The introduction of workflow management tools should be seen as an opportunity to improve both the underlying business process and the existing organizational structure. Many benefits can be accrued if the workflow management system is implemented as part of a broader business solution.

Opportunities for Organizational Change: Workflow Management Systems can help agencies and departments achieve the organizational changes necessary to operate effectively in today's world. These changes might include the move to a *flatter organizational structure* and *greater team orientation.* Since activity steps, roles, and rules are built into the system, less intervention should be needed to manage the business process. In addition to improved communications provided by notifications, document sharing, and an improved understanding of the process itself can lead to increased collaboration among team members and/or across teams and business units. Workflow management systems tend to unify people with diverse skills into a more cohesive unit.

Workflow definition tools also allow for the ***separation of IT from workflow management***. This puts the business process immediately and directly under the control of the people using the system.

Opportunities for Process Change: Since workflow systems force organizations to examine and define their business processes, it is the ideal time to consider ***business process reengineering***. In fact, it is essential that an underlying process be analyzed and improved prior to workflow system implementation in order to avoid further embedding of bad practices. *James Kobielus* [75] suggests that an organization optimize a process with any of three goals in mind: *"minimizing process time, maximizing value-added process content, or maximizing flexibility at the initial point of customer contact"*. He provides some guidelines for achieving each of these:

- To ***minimize process time***:
  - reduce the number of participants in a process
  - reduce the maximum completion time of each task (automate tasks, notify staff of approaching due dates)
  - reduce time to transfer work between tasks
  - reduce maximum queuing time for any one project (prioritize items that have been awaiting action for a long time)
  - increase the number of tasks running in parallel
- To ***maximize value added content***:
  - apply standard workflow routes, roles, and rules automatically to each new case; deviate from the standard only when certain predefined thresholds are crossed or certain flags are raised
  - provide participants with immediate, on-line access to all information bases
  - enable continual tracking and notification
  - eliminate costs associated with paper documentation

- . To ***maximize flexibility at the initial point of contact***:
    - provide multiple access options
    - capture customer data only once
    - support distributed transaction processing
    - enable ad-hoc flexible work-flow by allowing the first point of contact with the customer to tailor the process to the customer's needs

Just as important as reengineering is workflow management's support for ***continuous business process improvement***. Systems which log information about how the defined process is actually working in practice provide valuable insights into areas which might be better tuned. Since business people can define workflow without IT involvement, there is more likelihood that process changes will occur.

Improved/Increased Access to Information: Workflow management systems build corporate knowledge. "*Workflow takes the business intelligence that comes from experience and embeds it ...*" [76] Process information that may have been scattered among various staff members is now combined and available to all employees. This is especially useful to newer employees who may have limited understanding of a more complex business operation. *"Workflow environments encourage knowledge workers to add greater structure - in the form of routing lists, receipt notifications, version controls, (and procedures)..."* [75] Staff are now more likely to provide information to other members of the team. *For any particular project or job, more information about both the history and the current status of the process* is now available for any staff member to view.

Improved Security & Reliability: Workflow management "*provides secure storage and access to a consistent set of all of the data related to a service."* [77]. Workflow management unites data from many different applications and provides this data with organization and integrity. Using mechanisms such as role privileges (determines who can access and/or change information), process control (e.g. a document may need management approval before moving on to the next step), version control, and system back-ups, the data becomes more reliable.

3.5 A Lifecycle View of the Business Process

The Business Process Management provide a lifecycle view of three broad phases, see **Figure 8**, but attempted to ensure that all were "joined up" in the sense that each contributes to the overall consistency of view and uses a common model for the representation of the business process.

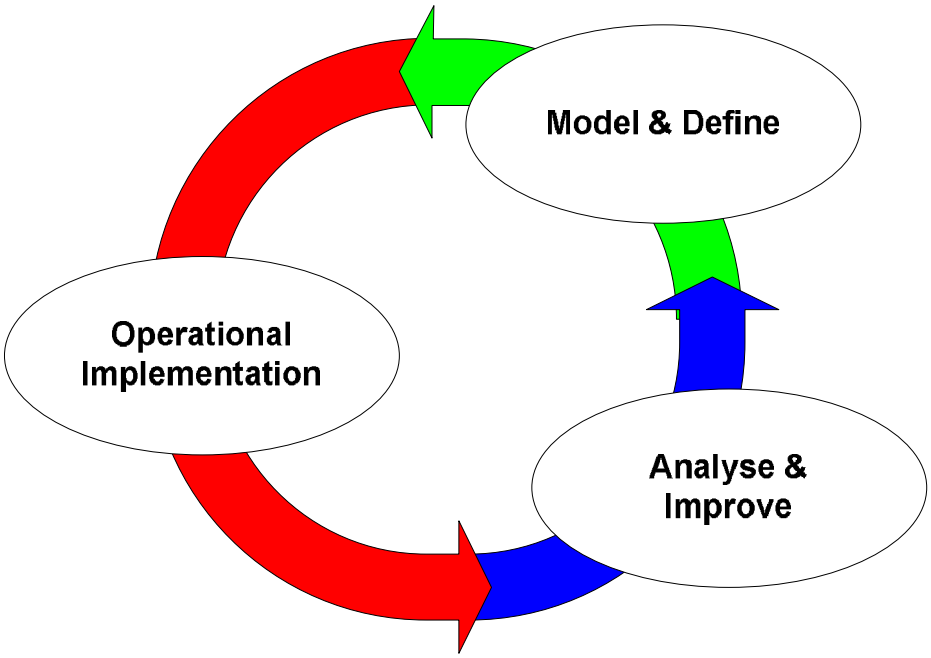


Figure 8: Process Lifecycle Model

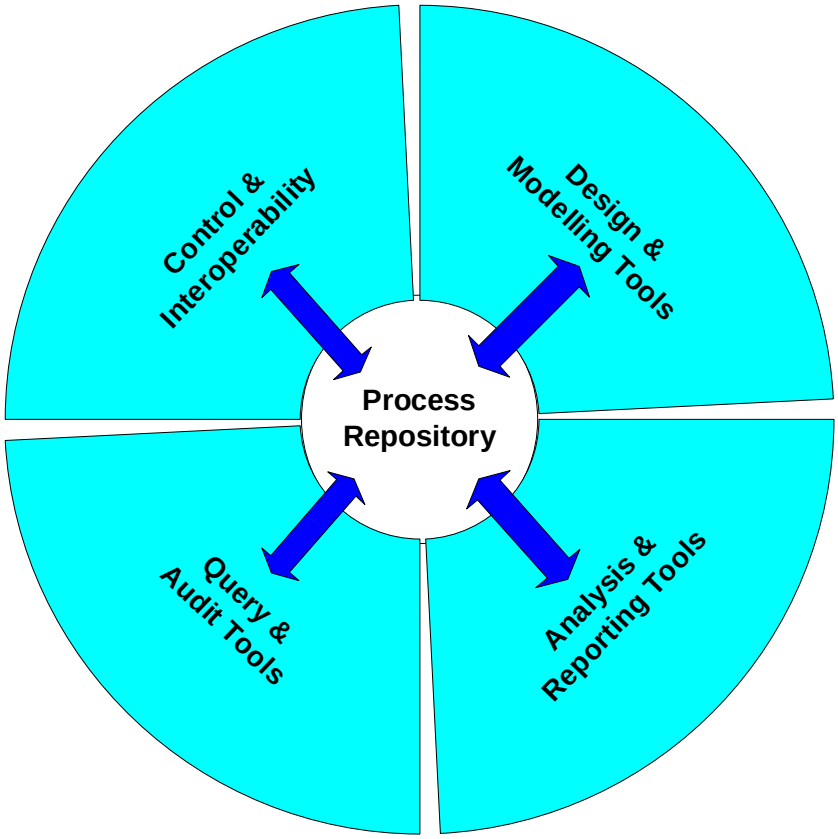


Figure 9: Business Phases and BPMS Components

In this model, see **Figure 9**, change was supported by the concept of a central process repository, with the ability to incorporate a set of modelling and business process definition tools

around it. Audit and analysis tools operating on a common audit data specification supported the feedback loop to allow improvements into the process definition.

More emphasis is required on the decomposition of processes into fragments and their consolidation in various ways to support more dynamic operational business processes. This model identified various ways in which process fragments could interact and develop runtime models for binding them in execution terms.

3.6 Information and its relationship to process and organization

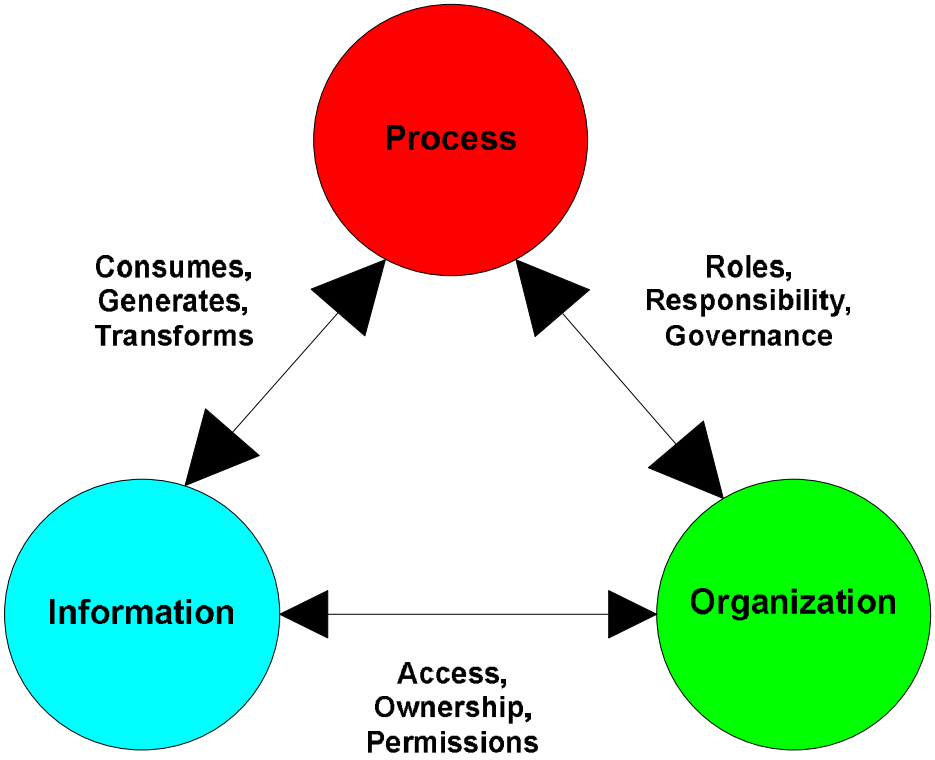


Figure 10: Relationship between the three viewpoints

Process, information and organization are inexorably linked; one can approach an architectural model from any of the three dimensions but for coherence all three must fit together. Process-based architectures tend to emphasise process as the dominant dimension; processes consume, generate or transform information, behaving in accordance with a set of corporate governance rules. By contrast, information based architectures emphasis the information dimension, viewing processes as operations that are triggered as a result of information change. In **Figure 10** is shown the relationship between the three viewpoints.

The Model does embrace all three dimensions but takes a relatively simplistic view of the information dimension. It recognises three different data classes' workflow control, workflow relevant

and application data, but can be validly criticised as weak in the area of information marshalling within a process. In retrospect, activity attributes could have been defined identifying incoming and outgoing information flows associated with the activity, which would have aided generality. Equivalent provisions are provided for information at process level.

Some provisions for data co-ordination and recovery were identified within the original model; the assumption was made that either two phase commitment mechanisms would be in place and/or transaction compensation would be invoked. Many products support either or both, but specific standards to assist their specification within a process definition were not developed.

Instead a simple concept of exception transitions was developed to allow specific failure handling or compensation activities to be user defined following an exception event.

3.7 Business Process Management Component Model

Business Process Management component model is illustrated in **Figure 11.** The diagram is divided in two parts. The top part illustrates the derivation of a process model along with its service delivery characteristics. The lower part half illustrates the enactment of the process in a service delivery environment.

In some respects the above can be thought as a restatement of the workflow reference model into a sequential flow from process conceptualization through to realization as a series of service interactions with either process execution or human resources.

However, when looking at the components there are several areas of refinement that deserve to be considered in some detail within such a model.

3.7.1 Conceptual Model

The conceptual model is concerned with the formulation of the business process in terms of business component objects and their interactions. Increasingly this phase needs to focus on the position of the process within an end-to-end process delivery chain, involving interfaces with existing or planned processes within other organizational domains.

The overall process can be view as a combination of process “fragments” which can be recombined in various ways to deliver new or modified business capability. Business Agility is supported by this. The increasingly integrated business relationships between organizations and the intermeshed of business process between organization not always be supported by formal automation. Business process outsourcing operations also require this capability to support efficient reuse.

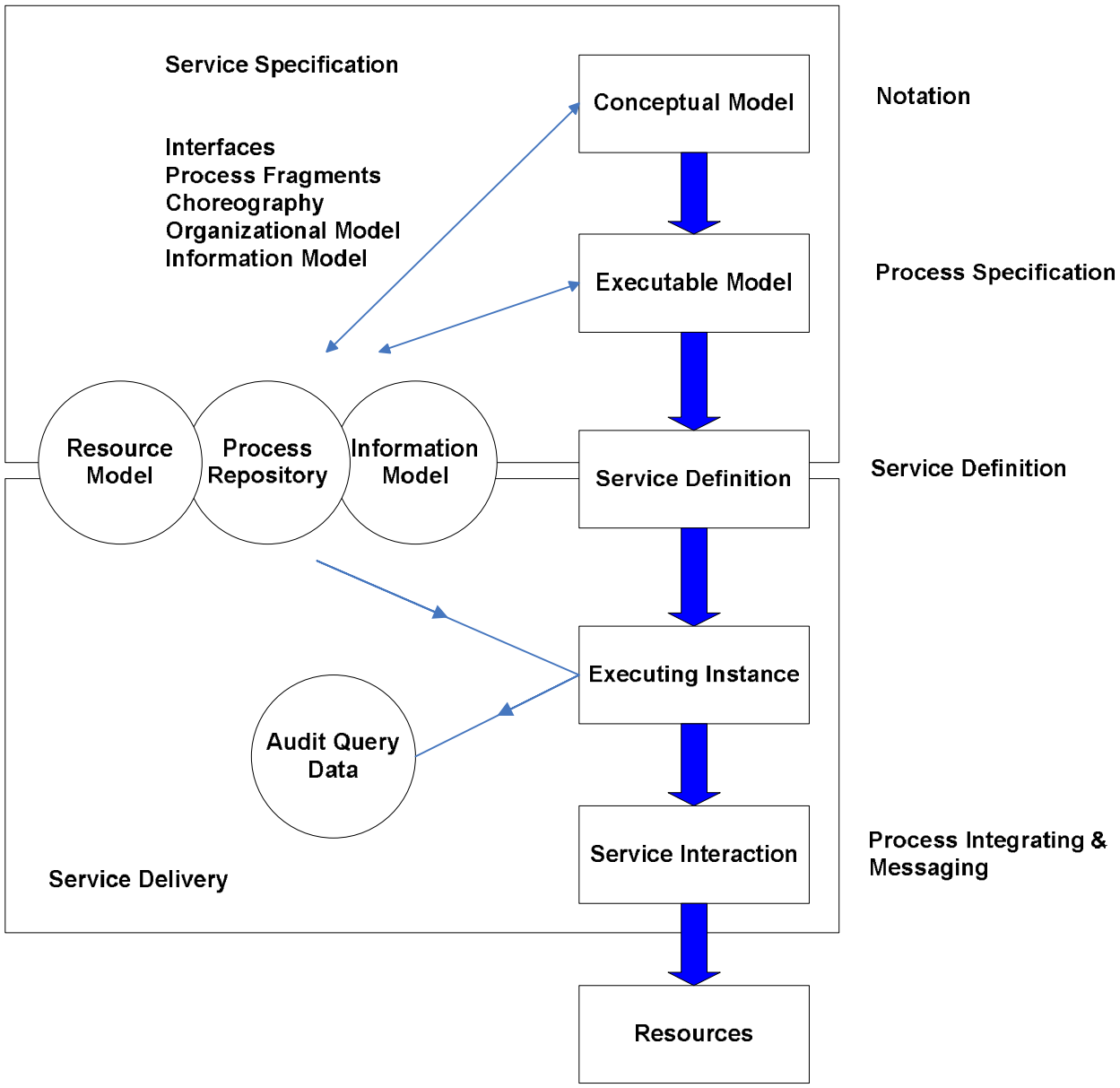


Figure 11: Business Process Management Component Model

Process fragments can be seen to have both an "internal" and "external" view, see **Figure 12** bellow. The internal view defines the actual or intended internal behaviour of the process fragment. It includes not just the activities and transitions between them but, also the internal resources required to support enactment of the process. It will also identify the boundaries of the fragment in terms of interactions with other process fragments or outside objects. The external view defines the behaviour of the fragment as a "black box", seen from the outside and addressed through its interfaces. This view sees the process fragment very much as a source and sink of messages or events of different types.

In summary, the process definition for a fragment can be seen to fall into two halves, each of dealing with the different properties required for internal and external behaviour. At the conceptual model stage not all these properties will be known; in particular the detailed internal behaviours

associated with resources are unlikely to be fully defined. The principal modelling and definition tools required at this stage are likely to focus on graphical design and interface definition.

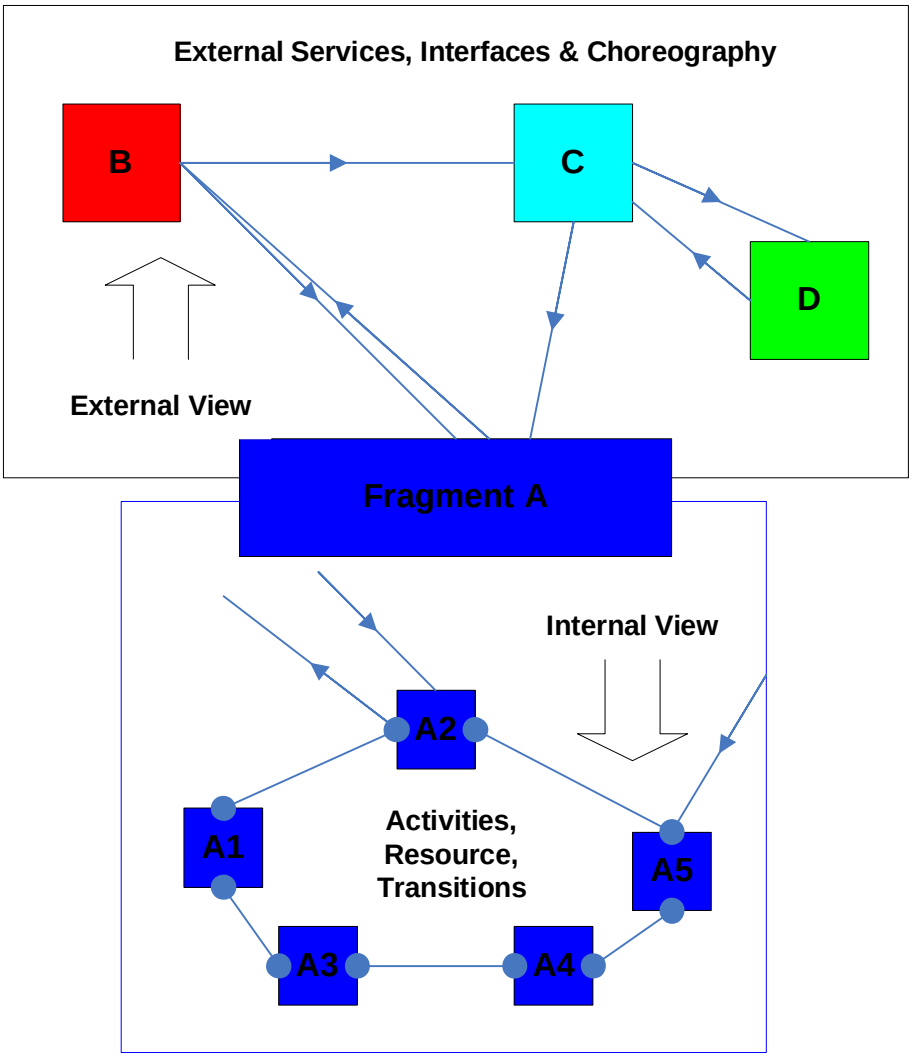


Figure 12: "Internal" & "External" view of process fragments

3.7.2 Executable Model

To turn the conceptual model into an executable model requires a more detailed specification of the process in a process machine form, including not only its detailed internal structure but also its interfaces and internal resource usage.

3.7.3 The Service Definition

The service definition is required to instantiate the executable model(s) into operational process instances, where local resources are used within the operational process. However, where access to

external process fragments is required, or incoming access from other external processes is offered, the service definition must provide the necessary addressing and resource identification information.

3.7.4 Service Interactions

Service Interactions represent the actual, run time exchanges between the resources associated with execution of particular process fragments.

Again, a distinction is drawn between interactions internal to the process fragment and those between fragments. Those internal to a service will be regulated by the local Business Process Management System. To coordinate the external service interactions some form of choreography is required. This will identify what permitted set of process operations and context data exchange is possible between the executing fragments and how this set of operations should be sequenced under various circumstances arising within the end to end process.

In one sense the choreography could be likened to a very high level process definition that links together process fragments by providing a set of high level business rules and identifiers for the locations of the resource implementing each process fragment.

3.7.5 Resources

The above diagram, see **Figure 11** above**,** identifies a resource model as one of the required components on the boundary between process specification and delivery. Again, this has separate characteristics when looking at internal and external perspectives of a process fragment.

In the internal view, a model of the resources to be applied to enactment of the process fragment, permitting the binding of appropriate resource(s) to activities according to a set of rules during the process definition stage. These need to embrace both human and system resource and be flexible enough to permit (controlled) resource substitution, late binding of resource to task. A special case arises where two or more process fragments are executed within a single, common resource domain. This is, in effect, internal distribution of a larger process fragment operating under a single resource management system.

The external view is essentially one of externally accessible services or other resources, each associated with a particular process orientated service delivery capability. These accessible external services may be predefined within a resource directory or may be subject to dynamic discovery at fragment execution time.

3.8 How Business Process Management Works?

A Business Process Management system, see **Figure 13**, starts with the *process model,* a template describing the flow of activities, assigned participant roles, process data elements, rules for routing and exception handling, the electronic forms used by human participants to perform tasks, and the integration actions with external business systems. Also provides a process design tool used to construct the model, which takes the form of a graphical diagram showing the activity flow, with details configured as properties of individual steps, sub-processes, and the process as a whole.

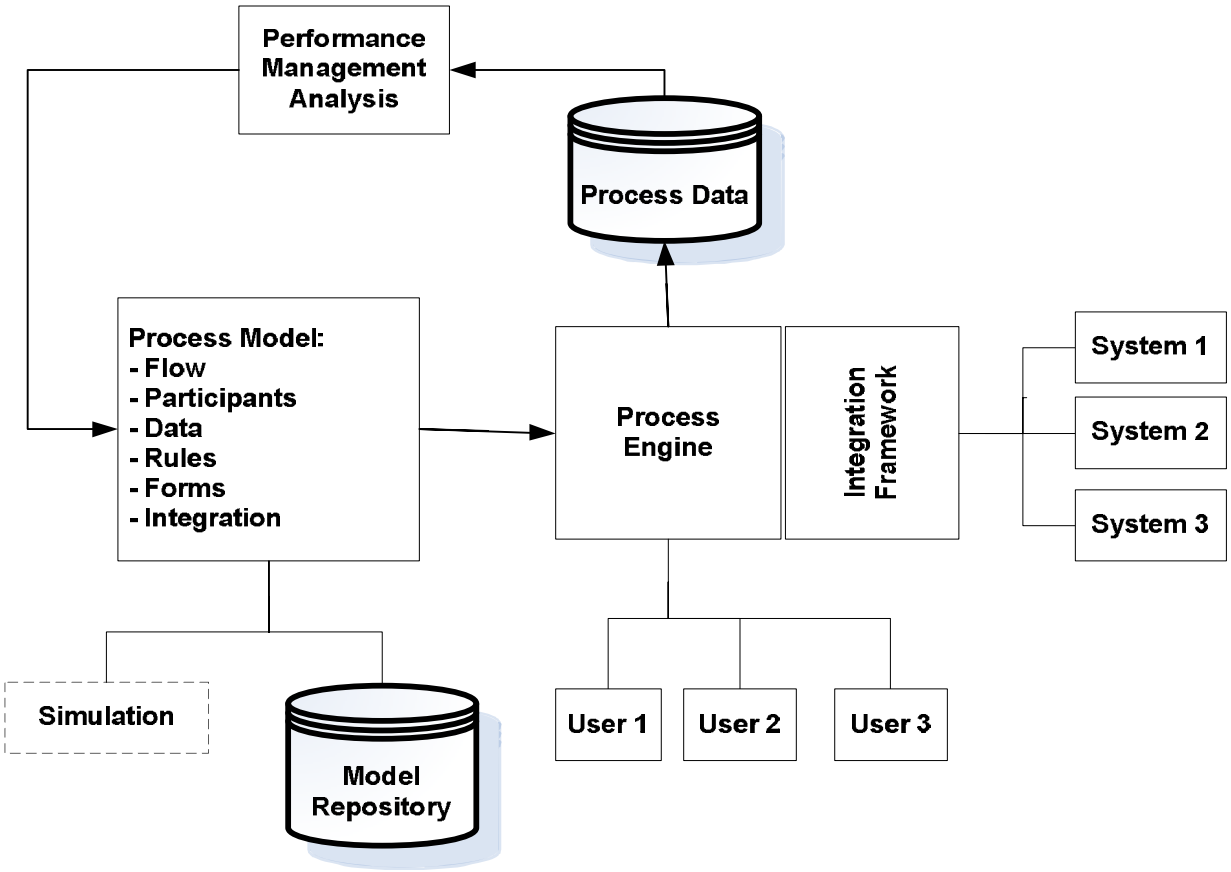


Figure 13: Business Process Management component architecture

One of the critical aspects is the promise of *agility*. Changing the process just means modifying the diagram and its associated property dialogs. New processes can be developed and deployed quickly to respond to shifts in the competitive or regulatory landscape. Also the performance of models can be simulated without actually deploying them. During the simulation the process designer is able to adjust resource allocation or test the effects of alternative configurations in a variety of scenarios, and optimize the model for shortest cycle time, least cost, or some other performance metric.

The validated models are deployed to the *process engine*. Each instance of the process is routed by the process engine through the steps defined by the diagram in accordance with the rules specified in the process model. Participants receive notifications of tasks delivered to them, and can access them through web-based work-lists. According to process rules when the task is complete, the process engine routes the instance to the next step.

The process engine executes actions automatically on external business systems. The Business Process Management system's *integration framework* lets the process engine see them as reusable process components that can be invoked through standard interfaces such as web services. These integration adapters are the proprietary interfaces of business systems which are exposed to the process engine in a standard way.

When the process is executed, data are collected for performance analysis and to create an auditable processing history. Using those data the system can provide detailed analysis showing conformance to service level agreements, resource allocation, cost targets, and other key performance indicators, sliced and diced by any number of dimensions. Performance management can be used both to correct bottlenecks on the fly and to incrementally improve process design. In advanced Business Process Management systems like WebSphere Business Integration Modeler, actual performance data can even be fed back into the simulation tools used with process modelling, completing the cycle of continuous process improvement. This generally works best when simulation and performance management are provided directly by the Business Process Management system, as opposed to using separate analytical modelling or business intelligence tools.

3.9 Workflow Standards for Business Process Management

At the heart of any Business Process Management reference architecture lie the methodology and standards for representing the business process. The discussion above postulates the need for the business process to be considered at two levels:

(i) a lower level, internal view of each process fragment that is similar to the traditional workflow process model,

(ii) a higher level view concentrating on modelling the overall process flow, linking re-usable process fragments together via a choreography. This is a view of the external behaviours of the process fragments, the executing resource locations and the dynamics of the interactions

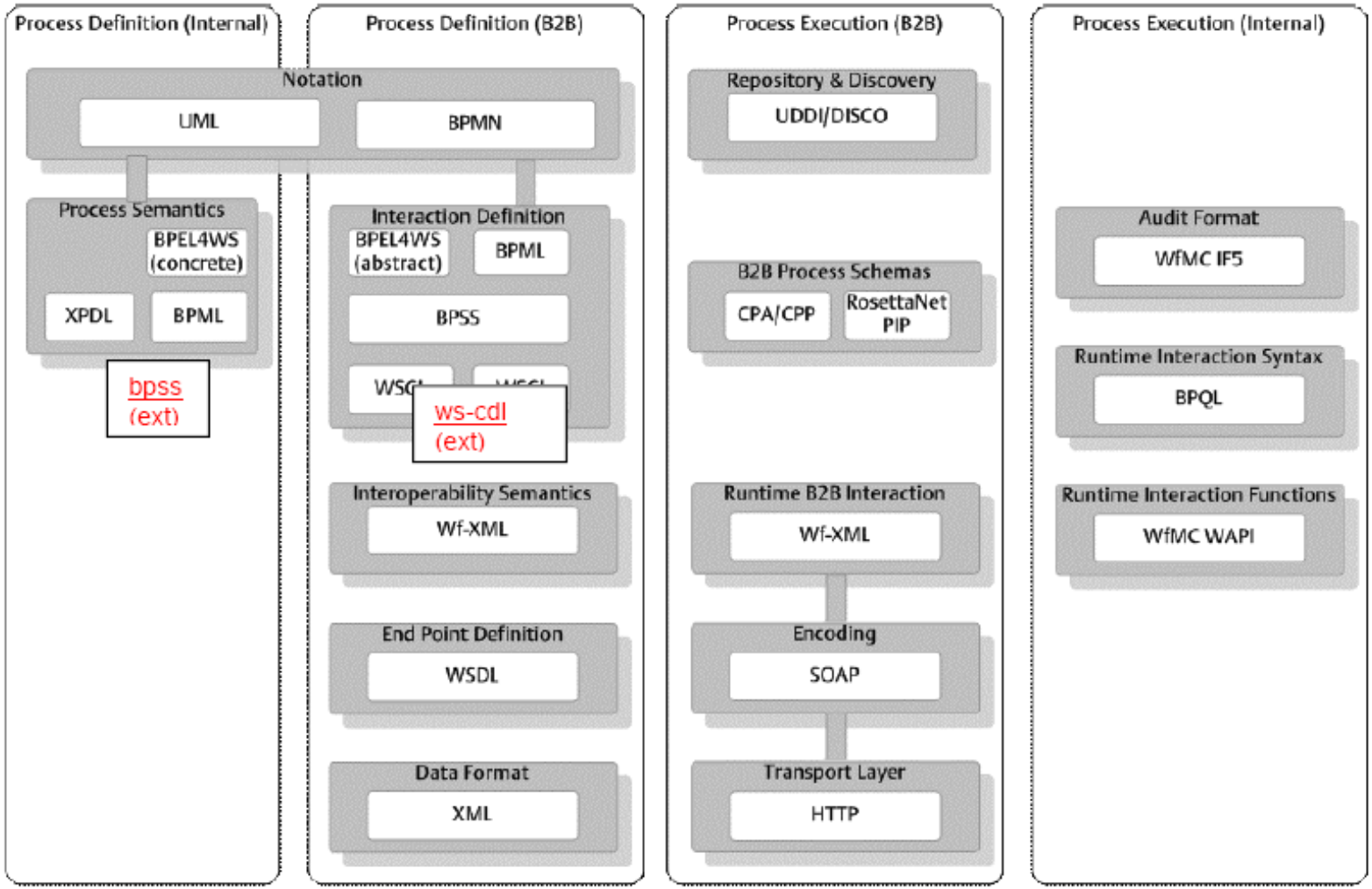
Each of these aspects is developed further in **Table 3** which shows the various standards and definitions that have come about in recent years. One interesting consideration is the extent to which a common model can be applied to both cases (as for example the BPEL concrete and abstract models).

The standards diagram in **Figure 14** was produced by the WfMC [78]. This diagram is based on four levels of separation. In the lifecycle dimension it separates *Process Definition* (1st & 2nd columns) and *Process Execution* aspects (3rd & 4th columns). The use of these terms is as defined within the Workflow Reference Model.

Wf-XML	Wf-XML and Workflow Reference Model from the Workflow Management Coalition (WfMC). Wf-XML is an XML based encoding of workflow interoperability messages. The Workflow Reference Model is a description of the underlying workflow system architecture. [84]
BPEL4WS	Business Process Execution Language for Web Services is the cooperative merging of WSFL and XLANG for Web services orchestration, workflow, and composition. [80] [88] [86] [87]
ebXML - BPSS	The eBusiness Transition Working Group carries forward the definition of workflow conversation & orchestration in the Business Process Spec. Schema (BPSS) layer of ebXML, which defines many protocols & layers for XML-based e-business. [89]
WSCI	Sun/BEA/Intalio/SAP consortium's Web Services Choreography Interface is an XML-based interface description language that describes flow of messages exchanged by a Web Service participating in choreographed interactions with other services.[90]
WSCL	W3C's Web Services Conversation Language, a submission by Hewlett-Packard to the W3C, it allows defining the abstract interfaces of Web services (that is, the business level conversations or public processes supported by a Web service), the XML documents being exchanged, and the sequencing of those documents. Note yet approved by W3C. [90]
PIPs	RosettaNet's Partner Interface Process defines business processes between trading partners via specialized system-to-system XML-based dialogs. Many PIPs have been defined for various partner scenarios. [91]
JDF	CIP4's Job Definition Format is a workflow industry standard for the Graphics Arts industry designed to simplify information exchange among different applications and systems. [92]

Table 3: Workflow Specification Standards for Business Process Management

Process Definition - The process definition consists of a network of activities and their relationships, criteria to indicate the start and termination of the process, and information about the individual activities.



Source: Adapted from [78].

Figure 14: Diagram summary of work flow standards by the WfMC

Process Execution **-** The time period during which the process is operational, with process instances being created and managed.

In the organisation dimension it separates *internal* and *external* (so called "B2B") views of the process – either in definition or execution. These are represented in columns 1 and 4 (internal) and columns 2 & 3 (external).

In the *internal* space there is typically a tighter binding between functionality and product – not all aspects of internal process behaviour will need to be standardised or made visible at external boundaries (either at definition or in execution). The use of standards in this space is primarily focussed on the integration of different software tools – for example enabling a process definition tool to pass a process definition to an execution environment. Often software from a single vendor environment will be used within a particular organisation or department for both purposes.

In the *external* space the essential requirement is interoperability. At definition time this covers specification of the permitted business interactions between different process management systems. At execution time the interoperability requirement is met through the use of a common protocol stack allowing the scoped process interactions.

3.10 Optimization Through Modelling and Analysis

Business Process Management begins not with the demand that organizations change their traditional organizational structures, but simply that they endeavour to *understand and manage their operations at the cross-functional process level*. It sounds obvious, but before Business Process Management it was not easy to implement. In many companies, cross-functional processes are not even documented end-to-end – since the business units responsible for each segment rarely talk to each other – and their respective applications and information systems were never designed to share data or talk to each other, either.

Business Process Management attacks this problem through modelling and analysis of the end-to-end process as a whole. It provides modelling tools that allow business analysts to document existing and proposed new processes using graphical flowcharts that can be analyzed in software and adjusted for optimum performance. Equally important, modelling tools allow business analysts to define *concrete performance metrics*, aligned with strategic business goals, and link them to specific process activities and parameters. Those metrics could be related to revenue, margin, costs, timeliness, throughput, productivity, citizen satisfaction – *anything!* In principle, any process performance metric

is built up, based on a set of user-defined rules, from the results of each process instance. Process models connect those metric definitions to specific activities, events, and aggregation rules – one of the fundamental prerequisites to optimizing business performance.

Linking business goals to concrete metrics is just the first step. Models are also the key to process implementation. They diagram the sequence of activities and events and identify the resources required at each step, the branch points in the flow, and the conditions that determine the path to follow in each instance. They also provide organizational information like resources and costs that are critical to process analysis. Unlike freeform flowcharts, modelling tools impose a methodology and discipline on the process diagram. For example, shapes for various activity types and the various lines that interconnect them have specific well-defined meanings. While this adds a slight learning curve, the benefits are significant. Because the semantics of the diagram are unambiguous, process details are more easily shared across organizational boundaries – even with trading partners.

The major benefit of this discipline, however, is that processes can be analyzed, and expected values of their business measures projected, through ***software simulation***. Business analysts can define alternative scenarios, differing in resource allocation, branching assumptions at decision points in the flow, and other parameters, and see which alternative results in the lowest cost, fastest average cycle time, lowest percentage of service level agreement violations, or other optimum business measure. In addition, the simulation reveals bottlenecks in the process, allowing new alternative scenarios to analyzed, resulting in an optimum configuration.

Analytical process models are not executable IT implementations. In fact, often an implementation of some of the modelled steps does not yet exist. Nor does modelling require that the business analyst even know how the implementation would be designed. Steps in the model are simply descriptive. For analysis purposes they are specified by basic business parameters – resources required, resource cost, expected duration, inputs and outputs – which can be varied in different scenarios.

But even without specifying an IT implementation, analytical modelling accomplishes a great deal:

- Corporate strategic goals are linked to explicitly defined business processes.
- Key Performance Indicators aligned with those goals are linked to specific steps and data from those processes.
- Estimated values for those Key Performance Indicators can be projected via simulation in multiple scenarios, resulting in a model that gives optimum performance results.

Modelling is just the beginning. Business Process Management assumes that we want to actually *measure* the Key Performance Indicators in an actual implementation of the business process. Comparing actual Key Performance Indicators with their expected values not only validates and refines the model, but suggests improvements that can be made in the process implementation to optimize real business performance.

3.11 Business process analysis methods

All process/activity-based techniques (P/ABT) involve analysing the business to gain a greater knowledge of what activities it performs and how those activities relate to one another. In other words, this analysis helps us understand how the business operates.

3.11.1 Activity/process analysis methodology

The tasks and activities can be grouped into activity flows forming sub-processes, which in turn can be related to the core processes of the business, **Figure 15**. In the core processes defined the purpose of the organization's existence. All activities and sub-processes must contribute towards these core processes in some way. When the relationship is clear, it is easy to understand how the business operates. The number of levels in the hierarchy varies considerably, depending on the size of organization and the level of detail required, achieving the defined objectives.

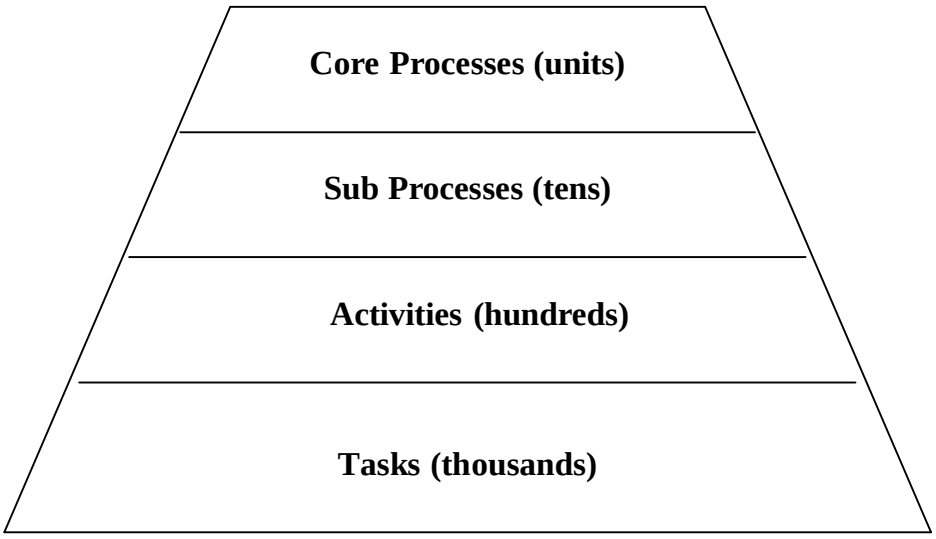


Figure 15: Process/activity hierarchy

All organizations are made up of a number of sub-processes. The sub-processes contribute to the infrastructure, which in turn contributes to the core processes. A flow of activities made up a sub-process. Every activity can be analysed into a flow of tasks. Every task can be analysed into sub-tasks.

3.11.2 Activity/process-based costing

Activity Based Costing is now accepted and widely used as the most appropriate method of costing processes, products and services. **Figure 16**, shows that while traditional methods collected overhead costs into one (or more) central pools to be arbitrarily allocated to all products and services by a percentage on-cost generally based on labour, Activity Based Cost puts in an additional step for activities. It allocates resources to activities/processes, prior to allocating activity/process costs to products and services based on actual usage. By doing so, it enables the business to understand the costs of the activities it performs and to identify their interrelationships.

The Activity Based Costing allows each of these activities/processes to be allocated costs according to how they are being consumed, by identifying their activity drivers, their unit costs and where they are being used for. The method of allocating resource costs to activities is by a resource driver relating directly to the activity's consumption of resources.

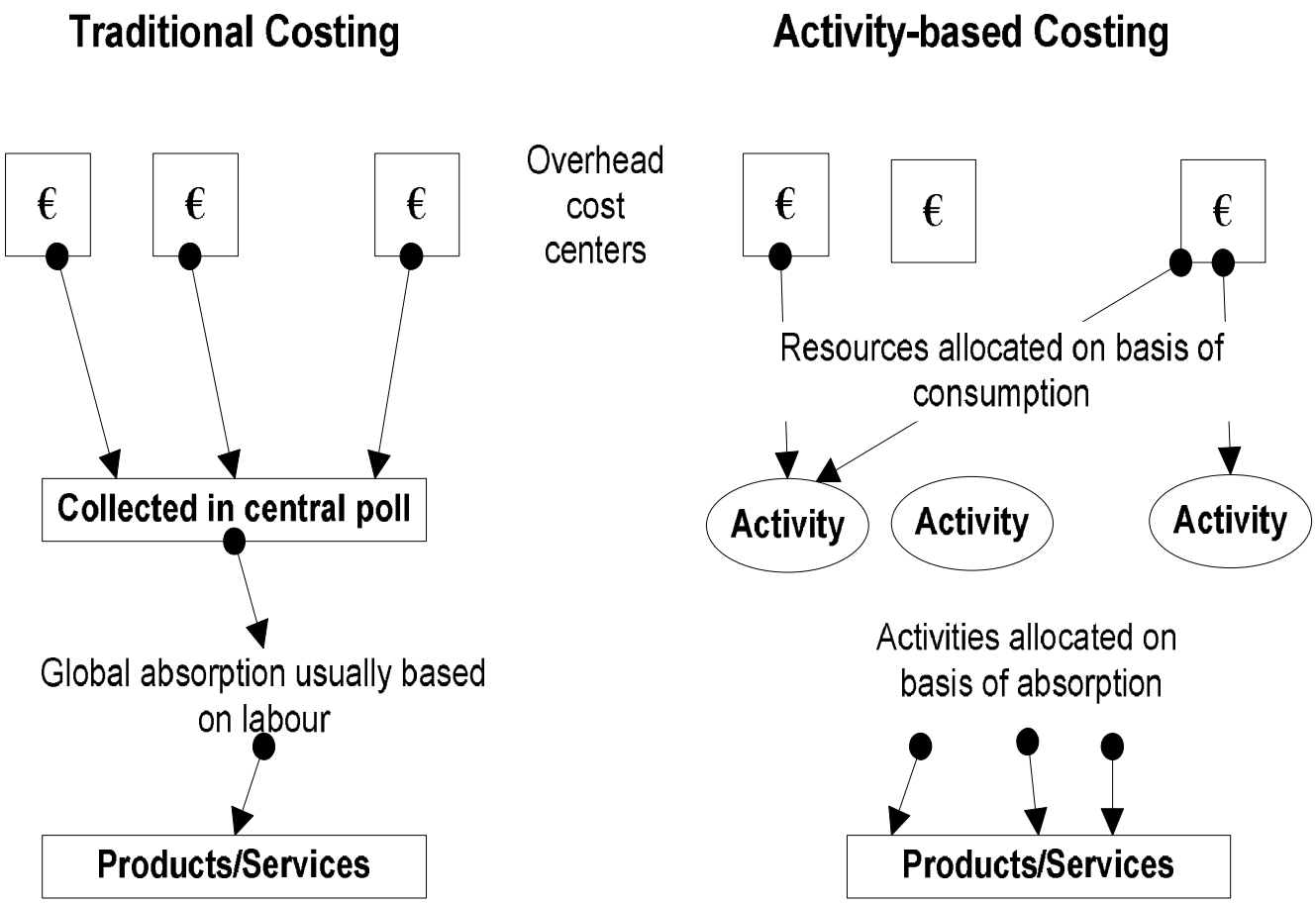


Figure 16: How ABC differs from traditional costing

3.12 Governmental Workflows & Business Process Management

There is a difference between governmental workflows and those that are used in e-Business and its cross-institutional links. In a governmental workflow several authorities are taking part with sharing resources. Unfortunately these authorities have tight limitations on remote data access and electronic interaction with one another. Workflows in e-Government are bound to laws and have to comply with legal formalities. Authority's data are well-defined and are allowed to be shared with other authorities. Also there are strong regulations on the confidentiality of other data. This requires the decomposition of the common workflow into sub-jobs with a defined interface containing all the information that is to be shared. For those sub-jobs, each authority uses its own systems and authentication methods without granting remote access to its resources. This guide in a distributed environment through complex processes helping to keep all necessary rules and time limits. Finally the use of Business Process Management techniques reduces the workload of the employees and enables faster processing of admin tasks.

Defining workflow in e-Government is ***easier,*** due to the legal background of admin tasks, as it is for non-formalised processes. On the other hand the separate definition of workflow activities adds dynamics and complexity to the distributed workflow and requires well defined interfaces between them. On of the main challenges of Governmental workflows are: to avoid heterogeneity and to allow interoperability between the workflow systems of different authorities. The activities in governmental workflows are not assigned to individuals but to roles. The role-based model helps to comply with legal regulations on the confidentiality and access limitations of governmental data. Using roles allows for a more flexible, centrally controlled way to adapt to organisational and personnel changes.

In governmental business processes the time limits that have to be kept is one of the main goals. It is important to guide the governmental staff to adhere to these terms. Whenever tasks are assigned to employees for manual processing, information on associated terms has to be given. In case where an activity can not be finished this may cause starvation of the workflow. Tasks, that require some action, have to be detected by the Business Process Engine. Those actions must have greater importance and the administrators must be notified about them, so that such problems can be solved in time by manual intervention.

Several key aspects can be determined for a workflow processing admin procedure as, the parallel execution, of activities throughout the public authority and within a workflow, and the long time frame between the start and end of a workflow. These demands necessitate Business Process

Management software that supports the distributed, fault tolerant, and parallel execution of a workflow.

3 IBM WebSphere Business Integration Modeler

Business Integration Modeler is a business process modelling tool that enables us to model, design, analyze and generate reports for business processes, integrate new and revised workflows, and define organizations, resources, and business items [86], [81]. Using formal process documentation and process management systems we reduce the business process complexity and improve business performance. A well-constructed business process model can help us locate and eliminate those hidden inefficiencies, costs, and delays.

3.1 Advantages of IBM WebSphere Business Integration Modeler

3.1.1 Create realistic models

A business process model is a visual representation of a process that contains supporting information. To create effective models, we must have a well-designed modelling structure that ensures consistent and complete representation of relevant information, including normal operations as well as alternatives and exceptions to standard procedures. We can use business process models for many purposes, including the following:

- Documenting existing procedures
- Determining requirements for staff, systems, and facilities
- Planning changes to existing processes and systems
- Testing and analyzing existing and proposed processes

3.1.2 Leverage different skill sets

Business Integration Modeler provides the versatility to fit particular set of skills. Using Business Integration Modeler, professionals with different scopes of interest and expertise can build

process models to meet a wide range of business objectives. From the business analyst who requires a high-level view of a process to drive strategic decisions, to the program developer who uses a process model as the framework for a new application, competitive businesses require a versatile modelling tool that has the flexibility to meet the needs of both business and technical professionals.

3.1.3 Maximize advantage

We can use Business Integration Modeler to simulate run-time processing that has been modelled. Business Integration Modeler provides an animated view of the business process in action. We can specify a wide variety of different conditions for the simulation, including the rate and composition of process inputs and the number of personnel and system resources available to handle the process. Through simulation we can quickly determine how the performance of our business process is affected in various real or hypothetical conditions.

Business Integration Modeler provides tools that deliver the following analysis and reporting capabilities:

- Weighted averages of time, cost, and resource allocation can be calculated for all possible alternatives, resulting in accurate measurements and key process indexes.
- Varying rates of input can be simulated and analyzed for a study of the dynamic and transient impact on resource cost, time, and requirements.
- A wide variety of predefined management reports can be generated from the conditions and alternatives we specify. We can also design our own reports.

Business Integration Modeler enables us to transform business process models to IT-level models.

Because business environments are constantly changing, requiring continual fine-tuning of processes, business improvement is a perpetual race. Business Integration Modeler facilitates communication between business organizations by allowing us to create a process model that has far broader uses than a static drawing. Furthermore, Business Integration Modeler delivers cost saving benefits by providing a single tool that effectively utilizes the same process information for many purposes, reducing the duplication of effort required by using multiple, incompatible tools.

3.2 Technical overview

3.2.1 Architecture

WebSphere Business Integration Modeler is built on the Eclipse platform, which in turn is built on a mechanism for discovering, integrating, and running modules called plug-ins. The platform provides access to services that allow this different tool plug-ins to integrate seamlessly and present a common look and feel.

3.2.2 User profiles

Business Integration Modeler provides three different user profiles, each of which offers a different view of the models that we create.

The ***Basic Business Modelling profile*** is intended for the business analyst or other user who wants to work at the high-level view of a business process model. This profile focuses on creating and displaying sequence flows and does not expose low-level technical details of process and data modelling.

The ***Intermediate Business Modelling profile*** gives the more technically focussed user the opportunity to specify and view additional details of process and data models.

The ***Advanced Business Modelling profile*** provides the most comprehensive level of detail for process models and data models.

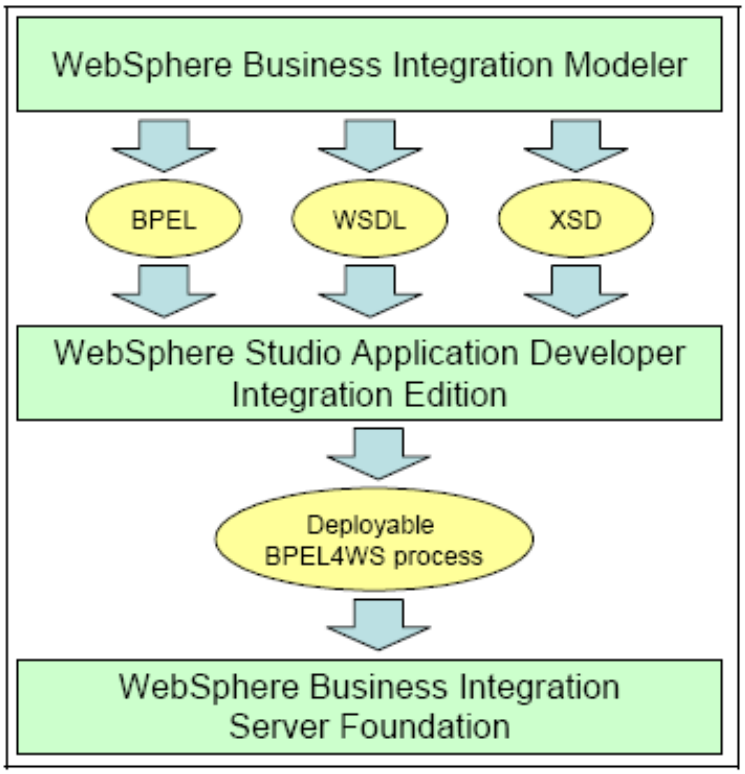
When we switch from a less detailed to a more detailed profile, the following changes occur: more information becomes visible, more notational elements become visible and available, and the ways in which we interact with WebSphere Business Integration Modeler become more flexible and more complex. Switching to another profile does not result in any changes to the underlying model, only in how it is displayed.

3.2.3 Technology modes

Business Integration Modeler provides three different technology modes that we can use when we are modelling business processes. Each of these technology modes is optimized for a different purpose.

The ***BPEL technology mode*** is optimized for output in Business Process Execution Language (BPEL) format, which we can import into WebSphere Studio Application Developer Integration Edition, where we can further define the process for deployment in a run-time environment. BPEL mode restricts certain elements from being used in the process editor diagram. When a process model

is exported as a BPEL process, three file formats are exported: BPEL, WSDL, and XSD. These files can be imported into WebSphere Studio Application Developer Integration Edition to complete the BPEL4WS process implementation see **Figure 17**.



Source: Adapted from [80].

Figure 17: Developing a BPEL4WS process

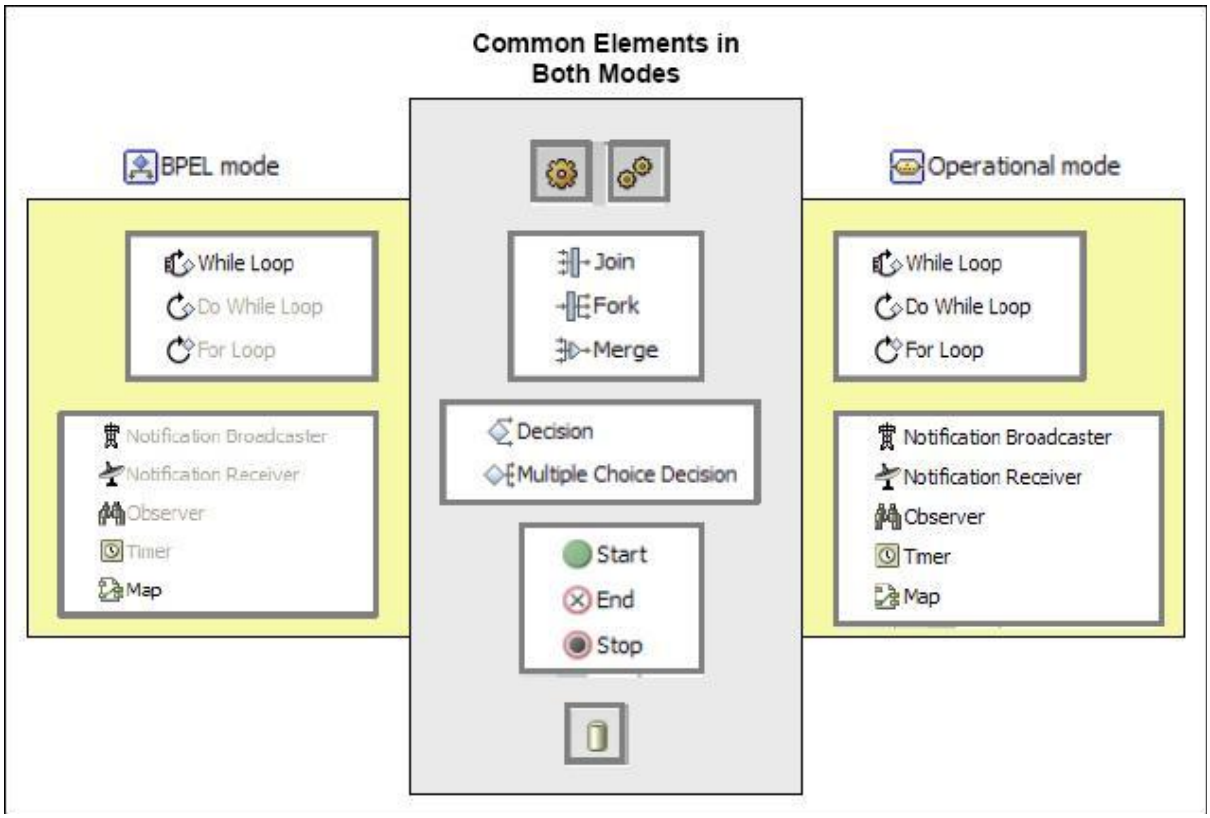
The ***Operational technology mode*** provides the most comprehensive detail of the three technology modes. Where the other two modes conceal details that would not be relevant in the intended output format, the Operational technology mode presents the complete set of details that we can specify. **Figure 18** displays the common elements shared in both the BPEL technology mode and the Operational technology mode. To the right and left of the common elements, the concealed (greyed-out) and exposed elements are also listed as a reference point.

The ***MQ Workflow FDL technology mode*** is optimized for output in Flow Definition Language (FDL) format, which we can use in WebSphere MQ Workflow as the basis of an automated workflow solution.

3.2.4 Process modelling

Business Integration Modeler facilitates the creation of business process models. Processes describe a sequence of tasks and processes linked by connectors. A process can contain multiple

branching paths based on decisions made during the process execution. A process can also contain sub-processes.



Source: Adapted from [80].

Figure 18: Comparing elements in BPEL and Operational mode

3.2.5 Business item modelling

Our process models can include any business document, work product, or commodity that is used for a particular business operation. We can model as a business item anything that is created, assembled, inspected, tested, modified, or worked upon. Business items can also undergo changes as they are passed from one step to the next in our process models.

3.2.6 Resource modelling

Using Business Integration Modeler, we can model each of our organization's resources, such as employees, computers, vehicles, or electricity. Depending on the level of complexity we require in our process models, we can also specify roles, costs, and timetables for our resources.

3.2.7 Organization modelling

An organization is an entity where people cooperate to accomplish specified objectives. A typical organization consists of one or more departments. We can save our organization definitions within a project in order to reuse and revise them as our organizations evolve.

3.2.8 Structure modelling

Structures define the relationships between different entities in an organization. Using Business Integration Modeler, we can build structures to show how different types of business entities interact with one another in relationships of varying complexity, and allow for different relationships among the same divisions within the same company. By modelling structures, we can define and illustrate these multiple and varied relationships within our organization.

3.2.9 Analysis

Business Integration Modeler provides a variety of analysis functions that we can use to extract targeted information from one or more elements within the modelling project. There are two main categories of analysis that we can perform:

- ***Static analysis*** provides information on models in their static form.
- ***Dynamic analysis*** provides information on the results of one or more process simulations. Dynamic analysis therefore reflects not only the underlying process model and other model elements that are used in simulations, but also the simulation results based on attributes that we specify for a particular simulation profile. When processes are executed, each execution of the process is a process instance. We can use dynamic analysis to extract information on specific process instances or on all process instances together. We can also perform comparative analysis on the results of two different simulations.

3.2.10 Process simulation

Process simulation provides a powerful method for analyzing a process. Whereas weighted average analysis provides a static, long-term view of the process, process simulation captures the dynamics of a shorter horizon. Process simulation enables the simultaneous viewing and examination of all cases in a virtual work environment. Process simulation also provides the ability to vary process input volume over time by adjusting resources and current allocations. Simulation output provides detailed information regarding resource utilization levels, as well as cost and cycle time calculations. Results change according to the simulation session length or the number of entries completed by the

process. We can set the conditions that control a simulation. During a simulation, the tool dynamically generates a number of inputs. These inputs travel through one of the possible paths (cases) of the process. A job is defined as the performance of the process based on one input. The number of jobs is equal to the number of inputs. Throughout the process simulation, resources are assigned to tasks as needed. If inputs arrive at a task and the required resources are not available; the inputs may accumulate to form queues. The detection of a large number of items in the queues helps determine potential bottlenecks and their causes.

To help us visualize our analysis, simulation animates events as they occur in our process model. Various resources can be shared among tasks, just as in real life, where one task may have to wait for a particular resource to complete another task before it can begin work on the first task. We can simulate scenarios in which a particular task, or a sequence of tasks, must be performed several times in sequence, or in parallel, before moving further in the process. These scenarios offer us the flexibility to simulate real-life situations, as well as alternatives, that lead to faster and better performance without the need to remodel the process.

3.2.11 Reporting

Business Integration Modeler enables us to generate reports on a wide range of process data. By generating reports, we can summarize different aspects of our business processes, using a variety of predefined report templates. We can then export the reports to different file formats so that we can quickly and easily include our data in spreadsheets, presentations, or print-outs.

If we need additional reports, Business Integration Modeler provides a report template designer that lets us decide what information to include. Build our own customized reports to further leverage our data and analysis.

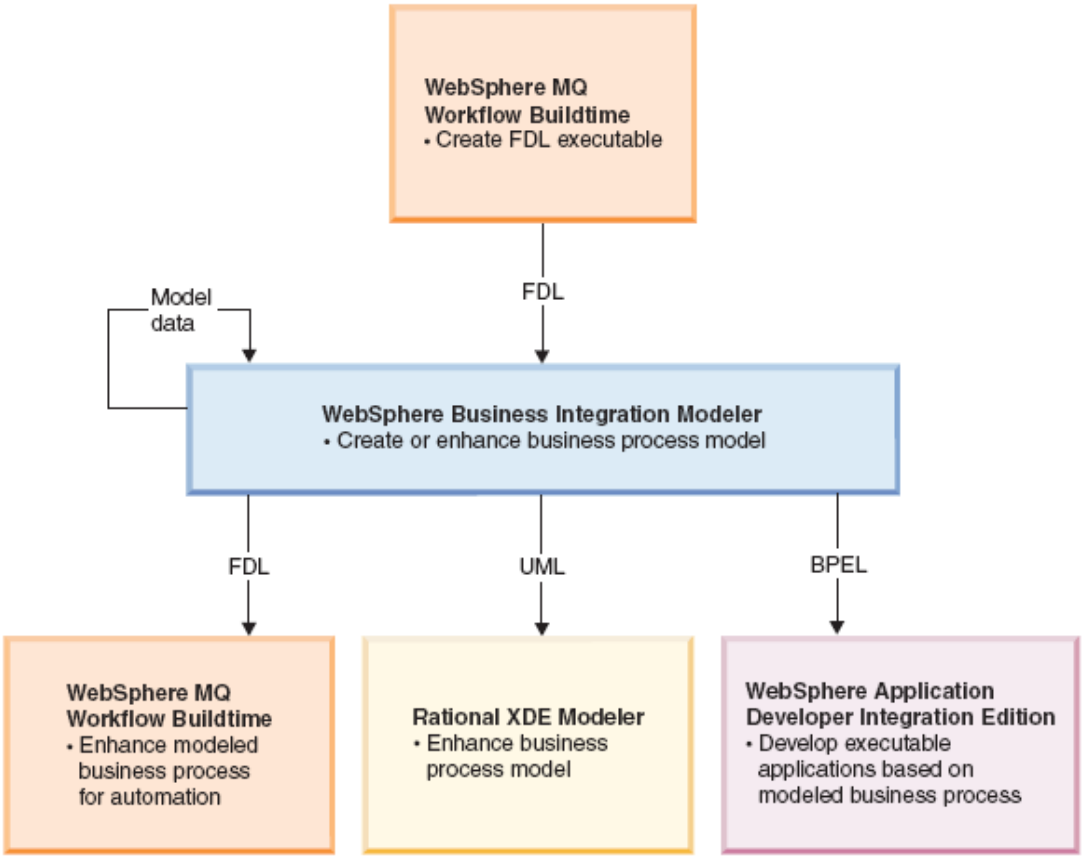
3.2.12 WebSphere product family overview

This topic describes how IBM WebSphere Business Integration Modeler Advanced Edition relates to other tools in the WebSphere product family and Rational XDE Modeler.

After creating our process using Business Integration Modeler or importing it from previous version of Business Integration Modeler, or a model in Flow Definition Language (FDL) format, we can export it to be used in different environments. We can export as a BPEL model and then use WebSphere Studio Application Developer Integration Edition to develop executable based on the model. We can export as a FDL model and then use WebSphere MQ Workflow Buildtime to enhance

the model to add the level of detail required for process automation. We can also export a UML model that can be imported into IBM Rational XDE Modeler.

The following diagram, see Figure 19, shows the relationship of Business Integration Modeler to other WebSphere products and to Rational XDE Modeler:



Source: Adapted from [80].

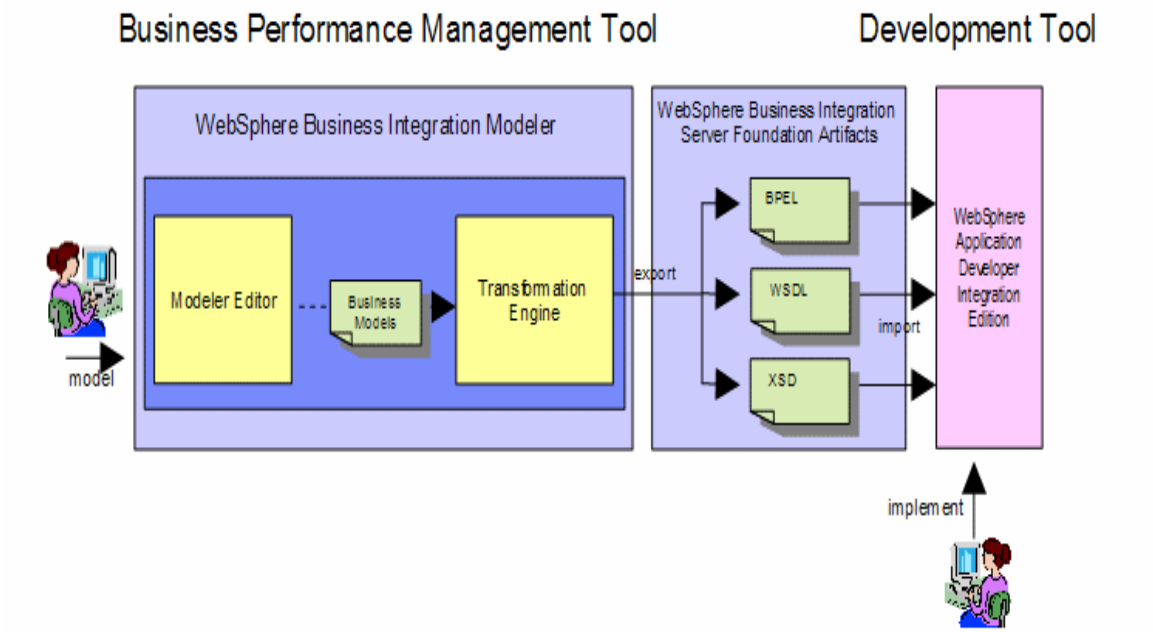
Figure 19: WebSphere product family overview

3.3 Business Process Management & Service-Oriented Architecture

Business process management is the general term for the services and tools that support explicit process management, such as process analysis, process definition, process execution, process monitoring, and process administration.

Modelling BPEL4WS process flows in the WebSphere Business Integration Modeler takes a top-down approach to process modelling. Process flows can be defined that will encapsulate the tasks and other modelling elements that will ultimately translate into specific BPEL4WS, WSDL, and XSD constructs in other development environments, for example WebSphere Studio Application Developer Integration Edition, and target runtimes, like WebSphere Business Integration Server Foundation.

For process modelling purists, who do not get involved in defining coarse-grained components, the BPEL4WS process modelling capabilities in WebSphere Business Integration Modeler provide an environment that is conducive to mapping out task sequences and flow control, modelling data as business items, and creating a visual representation of a business process. The visual model can be shared with others that have a vested interest in learning or reviewing a particular process or processes. By modelling the process in a certain profile and technology mode, models can be handed off to more technical resources for additional modification. **Figure 20** illustrates this concept.



Source: Adapted from [80].

Figure 20: Process model transformation

The sequence in the diagram can be described as follows:

- A business analyst uses WebSphere Business Integration Modeler to capture, communicate, analyze, and simulate business processes.
- An IT specialist is interested in implementing the business processes using WebSphere Business Integration Server Foundation technologies.
- The business analyst exports the business models from WebSphere Business Integration Modeler to WebSphere Business Integration Server Foundation artifacts. The business models are transformed into BPEL, WSDL, and XSD files.
- The IT specialist imports the exported WebSphere Business Integration Server Foundation artifacts into WebSphere Studio Application Developer Integration Edition as a project.

3.4 Other Business Process Management Tools

There are many Business Process Management tools, other open source and other commercial. The open source tools are immature but improving, developer-centric and not "analyst" friendly. The commercial are divided in three categories Business Process Management Integrated into Middleware, Document Management and Pure Play Business Process Management.

- **Open Source Business Process Management Tools**
  - ***JBoss jBPM***: workflow system for JBoss app server. Visual process editor based on Eclipse IDE, uses proprietary jPdl process definition language
  - ***OpenWeb Enhydra Shark***: XPDL-based workflow editor, workflow engine
  - ***Open For Business Workflow Engine (OfBiz)***: XPDL based workflow
  - ***Twister***: Apache project based on WS-BPEL, no visual process editor
  - ***Drools***: A powerful rules engine and rules management system uses an XML rules declaration language. Very developer-centric, but is "embeddable" and is used frequently for workflow applications
- **Commercial Business Process Management Tools**
  - **Business Process Management Integrated into Middleware**
    - **ADONIS -** is the toolkit for holistic Business Process Management. Simple in handling yet extensive in features, it helps you streamline your business processes and restructure your corporation, and reduces efforts and costs drastically.
    - ***Oracle BPEL Process Manager*** – technology incorporated from Collaxa acquisition – replaces Oracle Workflow, which is recommended only for legacy installations
    - ***SAP Webflow (aka SAP Business Workflow)*** – supports Wf-XML, BPML
    - ***Tibco BusinessWorks Workflow***: Integrates object-oriented technology, document management, and a process model enabling users to quickly build and tailor workflow.
- **Document Management**
  - ***Documentum***: Specialized workflow capabilities for document review, correspondences.
  - ***FileNet***: FileNET P8 BPM Suite is the J2EE evolution of the first workflow ever developed: It leverages the scalability of the P8 platforms' distributed architecture, its

EAI capabilities through CrossWorlds, and a Java/COM API for tailored developments and integration.

- ***StaffWare***: Offers a good balance between production and administrative workflow requirements while delivering very high production and path through throughput. Interactive activities implementation uses form definition and a scripting language.

- **Pure Play Business Process Management**
  - ***Verity LiquidBPM*** (formerly Dralasoft Workflow) – Java-based BPEL
  - ***Fujitsu Interstage Business Process Manager*** (formerly iFlow): i-Flow from Fujitsu offers a clean and simple to use user interface and a process definition than can be completed and changed at run time.
  - ***Savvion***: BPM pure play, uses BPMN process notation
  - ***Ultimus Workflow Suite***: .NET / Microsoft Friendly

4 Case Study

With the present thesis, we will try to use Business Process Management techniques, in order to examine and analyze the processes of the General Assembly of Computer Science Department at the University of Crete. Our study aims to detect dis-operations and problems of fragmentation, which exist, in order to suggest solutions, in the borders of a Service Oriented Architecture, solutions which will lead to the de-fragmentation, automation and the communication of these processes with other processes in different systems. In order to implement the above, we will use the IBM WebSphere Business Integration Modeler tool.

4.1 Legislation – Act 1286/82

The Act 1268/82 (Published in the Official Government Journal numbered A87) regulates the operation, as well as the structure, of the Highest Education Institutions. According to the Article 3 of the above law;

> "*The **Highest Education Institutions** are Legal Persons of Public Interest completely self-administered. The State Supervision is exercised by the Minister of National Education and Religions*".

In the Article 6 of A. 1268/82 the general provisions of the Highest Education Institutions organisation and structure are defined. The Highest Education Institutions are constituted of Faculties, which cover a total of relating sciences so that the required interaction for their scientific development as well as the necessary coordination for the research and their teaching are guaranteed. The Faculties are divided into Departments. The ***Department*** consists the basic functional academic unity and covers the cognitive content of a science.

Furthermore, according to the Article 4 of A. 1268/82, a Legal Person of Public Interest is founded, which is supervised by the Ministry of National Education and Religions, which is named

National Academy of Letters and Sciences (N.A.L.S.) and it has its legal home in Athens. The National Academy of Letters and Sciences is the main advisory body for the Highest Education Institutions regarding teaching, postgraduate studies and the evaluation and judgement procedures of the Faculty.

4.2 Department Administration Units

The Article 8 of A. 1268/82 defines the following Administration Units and their structure;

The ***Department General Assembly***, where the following members participate; the Department Chairman, who is a professor or an associate professor, having a biennial service, the Faculty, the Students' Representatives, equal to the 50% of the Faculty and finally the Postgraduate Students Representatives, equal to the 15% of the Faculty. The Secretary of the Department is the Head of the Secretarial Personnel and he is responsible and liable to its Chairman, regarding the successful operation of his Secretariat. Besides, he notifies the General Assembly Members of the current legislation, as well as of each legal and general administrative subject, which occurs. The Department General Assembly is the sovereign unit determining its instructive and search policy. Finally, the Department General Assembly is held in four regular meetings annually.

The ***Department Board of Directors*** functions in cases where the Department includes at least three Sectors (otherwise the General Assembly exercises its responsibilities) and it is composed of the Department Chairman and the Assistant Chairman, the Directors of Sectors, two undergraduate students and a representative of the postgraduate students.

The **Chairman**, who directs the Department Services, and the Assistant Chairman, who replaces him when he (the Chairman) is absent or hindered or disappears. The Chairman's and the Assistant Chairman's duty is biennial. The Department Chairman's responsibilities are; to convoke the General Assembly and the Board of Directors, to work out its daily agenda and to preside their occupations, to submit proposals to the General Assembly regarding the responsibilities of the Faculty, to take care of the application of the General Assembly decisions, to constitute committees in order to study and complete specific subjects and to direct the Department Services.

4.3 Definition of General Assembly Processes

In this section we will define the below mentioned four processes of Department's General Assembly:

1. ***Announcement of a Faculty Vacancy***
2. ***The Chairman's Election***
3. ***Extraordinary General Meetings***
4. ***A Professor's Engagement***

4.3.1 Announcement of a Faculty Vacancy

In the Article 15 of A. 1268/82 the process of the announcement and engagement of a Faculty Vacancy consists of the following stages;

1. The Department General Assembly announces the Faculty vacancies. The Rank and the Sector of the vacancy is mentioned on the announcement.
2. The announcement is notified to the Ministry of National Education and Religions, who decides to accept or reject it.
3. The announcement is published;
    a. In The Official Government's Paper and
    b. In three daily Athens located newspapers at least twice, in two Thessalonica located newspapers an in two newspapers located at the legal home of the Highest Education Institution, if there are.
4. The announcement is notified to the National Academy of Letters and Sciences.
5. After the day of the latest publication in the daily press, and in the deadline of thirty days;
    a. All the candidates' applications with the necessary documentation for the judgement are submitted to the Department Secretariat.
    b. A candidate's application can also be submitted further to a request made by at least five members of the Department General Assembly (the students-members are excluded).
6. In the exclusive deadline of 15 days after the application submittance or the date of compulsory judgement for promotion or after the 30 days' deadline, in case of a vacancy announcement, due to a resolution of the Department General Assembly, a three-membered Recommendation committee is constituted of Faculty, who are of the same or relating scientific cognitive, who can be electors.
7. The Recommendation committee, in the exclusive deadline of 40 days after its constitution, submits to the Department General Assembly a specifically justified report, which includes;

a. Detailed presentation and evaluation of the candidates' work and the personality of the candidates as well as the judgement regarding their offer to the science progress.
b. Position of the Candidates' correspondence degree to the required legal qualifications and
c. The Candidates' Classification due to their evaluation.

8. The report is notified to the candidates, who are entitled to submit a relating memorandum.
9. All the members of the Faculty belonging to the Rank, which the judgement is made for and of their superior Rank, who constitute the electors' body, if their number does not exceed the number 30, have a right to vote for the election or promotion of the Faculty. The mission of the electors' bodies is completed as soon as the specific process is complete.
10. If the members of the Faculty, who have a right of vote, are less than five, the electors' body is composed of five members. By its decision, the Department General Assembly supplements the electors' body with other members of the Faculty of relating Sectors of the same or other Highest Education Institutions, who have a right to vote for this judgement.
11. In the exclusive deadline of 10 days after the recommendation report is submitted or after the relating deadline has expired without result, the Department General Assembly and the electors' body assemble under the Department Chairman' s presidency.
12. At the beginning of the meeting, a representative of the students - members of the Department General Assembly analyzes the judgement conclusions regarding the candidates' instructive ability.
13. The General Assembly students' –members' representative reminds the electors of the evaluation of the candidates' instructive work.
14. At the beginning of the meeting the candidates can express orally their points of view regarding the content of the report, they answer the questions asked by the members of the two bodies and then they leave.
15. The evaluation of the Faculty's instructive ability is also considered in the process of judgement for the election or the promotion of the Faculty.
16. Further to the electors' relative discussion, the voting for election takes place:
    a. The Candidate, who gathered the 2/3 of the total electors in his favour, is considered to have been elected.
    b. If the candidate gathered the absolute majority, but less than the 2/3, the review of the subject is potential by the Department General Assembly, if the 1/5 of its members submit the relating request in the exclusive deadline of 10 days.

c. The Department General Assembly is held ex officio in 10 days after the request is submitted and it makes its decisions at the absolute majority of its present members either by accepting the electors' decision or by transferring it to the National Academy of Letters and Sciences.

d. In case of transferring the request to the National Academy of Letters and Sciences;

   i. The National Academy of Letters and Sciences, according to its domestic regulation, forms its opinion and notifies it to the Department General Assembly in the exclusive deadline of 15 days.

   ii. The Department General Assembly is held ex officio and makes its decision at the absolute majority of its present members by either accepting or rejecting the electors' body suggestion based on the opinion formed by the National Academy of Letters and Sciences and in the deadline of 10 days after it has been received.

   iii. In case of acceptance, the member, who is recommended, is considered to have been elected, while in case of rejection, the election is considered unsuccessful.

17. The decision and the process are transferred from the Highest Education Institution to the competent Minister, who, further the examination of its legality, publishes the relative action of appointment, which is notified to all candidates.
18. The proceedings regarding the election or the promotion of the Faculty are published annually in a particular volume further to the corresponding Department liability and each interested person can have access to it.

4.3.2 The Chairman's Election

According to the article 8 paragraph 4 section a, b, g, d of the Act 1268/82 the ***Chairman*** of Department is elected by;

1. The special electors' body, constituted by :
   a. The total Faculty.
   b. The Postgraduate Students' Representatives equal to the 15% of the Faculty.
   c. The Representatives of Special Instructive Technician Personnel, equal to the 5% of the Faculty.
   d. The Undergraduate Students' Representatives equal to the 50% of the Faculty.

2. The electors are convened by the Dean one month before the expiry of the Chairman's service or the latest in 15 days after the post evacuation however it takes place.
3. The candidatures are submitted further to a proposal made by;
    a. Any member of electors' body or
    b. Anyone who is interested.
4. The Dean chairs the electors' body, without having the right to vote provided that he is not also an elector.
5. The voting is secret:
    a. The only one candidate chairman can not be elected, if he does not assemble at least the 1/3 of the electors' body votes.
    b. The Candidate is elected if he assembles the absolute majority of the present electors.
    c. If no candidate assembles the required majority, the voting is repeated between the first in votes. In this case the person who assembles the most votes is considered to have been elected.

4.3.3 Extraordinary General Meetings

According to the Article 8 paragraph 2 section of A. 1268/82 the **Extraordinary General Meetings** of the Department are held by;

1. The Chairman of the Department regarding the election judgements or promotions or other specific subject.
2. Furthermore, Extraordinary General Meetings of the Department can be held further to a request by the 1/3 of the total members of the Department General Assembly.
3. In case of the Department Chairman's inactivity, the above members submit the request to the Dean.
4. The Dean convokes the Department General Assembly and performs the Department Chairman's duties.

4.3.4 Professors' Engagement

According to the Article 16 of A. 1268/82, where the process of **Professors' Engagement** is defined, the engagement of scientists in Faculty vacancies at the Rank of Professor is possible;

1. The Engagement Proposal is submitted by at least the 1/4 of the Department Faculty.

2. The Proposal is submitted to the General Assembly, which decides regarding the activation or not of the engagement proposal.
3. In case where the electors - professors are less than seven ;
    a. The Department General Assembly draws up a table, which includes all the Greek Higher Education Institutions Professors, who possess posts of the same or the most related cognitive object to that of the post which the engagement is for.
    b. Out of the above table, the Minister of National Education and Religions fixes the electors, who are required to complete the seven-membered elector's body.
4. The relating decision is taken by all the Professors at the majority of the 2/3 of their whole number. The Professors are gathered in common meetings with the Department General Assembly.
5. If the proposal assembles the absolute majority, the review of the subject by the Department General Assembly is possible, provided that the relating request is submitted in the exclusive deadline of 20 days by the 1/5 of its members.
6. The General Assembly votes and the relating decision is taken at the absolute majority of the General Assembly total members.
7. If the absolute majority is not achieved, the National Academy of Letters and Sciences expresses its point of view regarding the post engagement.
8. After the above stage, the General Assembly votes again and the relative decision is taken at the absolute majority of all General Assembly members.

5 Implementation and Results

WebSphere Business Integration Modeler provides an environment for modelling organization business processes. The environment not only provides robust simulation/analysis capabilities and reporting capabilities, but also provides the ability to generate BPEL4WS processes.

Capturing a business process in the form of a model helps organizations to visually see how data, information, and tasks flow through a particular process or across various interconnected processes. With the ability to interact with both internal as well as external service partners, processes can easily transcend corporate boundaries to provide greater interoperability and enhanced visibility of an end-to-end process or service.

Visual models provide a platform for discussion, documentation to satisfy regulatory requirements, and ultimately the benefit of being transformed into an executable processes. Executable processes translate visual models into tangible benefits by consolidating or eliminating manual activities in order to streamline operations, integrating with business partners, providing visibility into workloads, and distribution. Creating BPEL4WS processes in WebSphere Business Integration Modeler allows organization to re-use existing definitions of resources, data, and processes.

5.1 Creating workspace, project and catalogues

Modelling any type of artifact requires setting up a workspace, project, and several different catalogues.

5.1.1 Define the Workspace

A workspace contains all of the modelling artifacts that are required to model a process. The workspace consists of one or more top-level projects. Each project maps to a corresponding user-defined directory on the target file system.

Workspaces allow for modelling artifacts to be saved to a specific location on the file system and given a name based on a particular project, date/time, version, and so on. **Figure 21** displays the workspace dialogue that will be launched when WebSphere Business Integration Modeler is launched. This assumes we are using WebSphere Business Integration Modeler in stand-alone mode rather than as a plug-in to WebSphere Studio Application Developer Integration Edition.

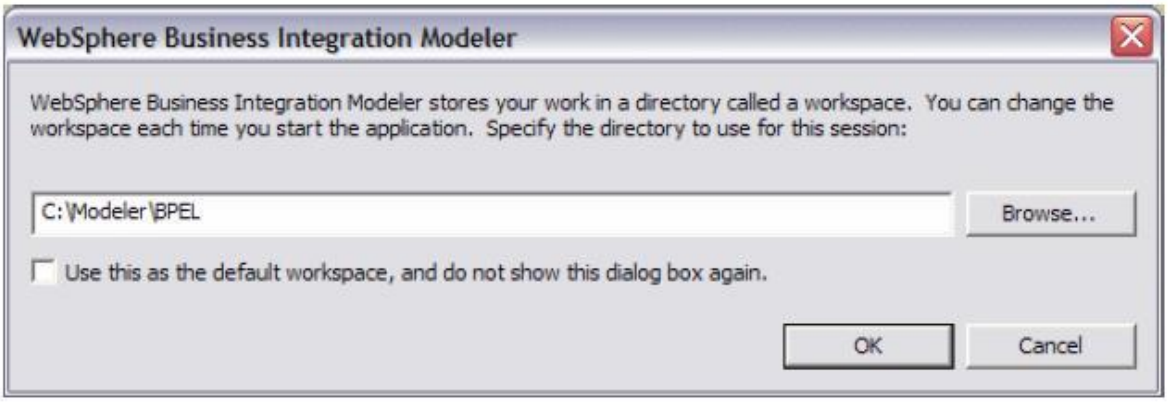


Figure 21: WebSphere Business Integration Modeler workspace dialog

5.1.2 Create Project

Projects contain process models and other modelling artifacts. When a project is created, the modelling artifacts that belong to the project can be viewed as common, shareable resources. Projects are stored in project catalogues.

The first thing to do when we start to model a new process is to create a new project to contain our work. Projects provide a way of organizing our data, processes, and resources, see **Figure 22**.

Our project, with the name Thesis, appears in the Project Tree. Placeholders have been created for business items, processes, resources, and organizations. Now we can start creating the elements required to model the process

5.1.3 Create Catalogues

Catalogues function as categories where different modelling artifacts can be logically defined and organized. Several catalogues exist where artifacts such as processes, data, resources, organizations and reports are defined and referenced. Separating artifacts into separate catalogues not only allows for extensive querying capabilities for reporting, but also greatly enhances the granularity of exporting entire projects to specific modelling artifacts, such as exporting only the data for a particular project. Entire projects or individual artifacts may be selected for export, depending on the requirement.

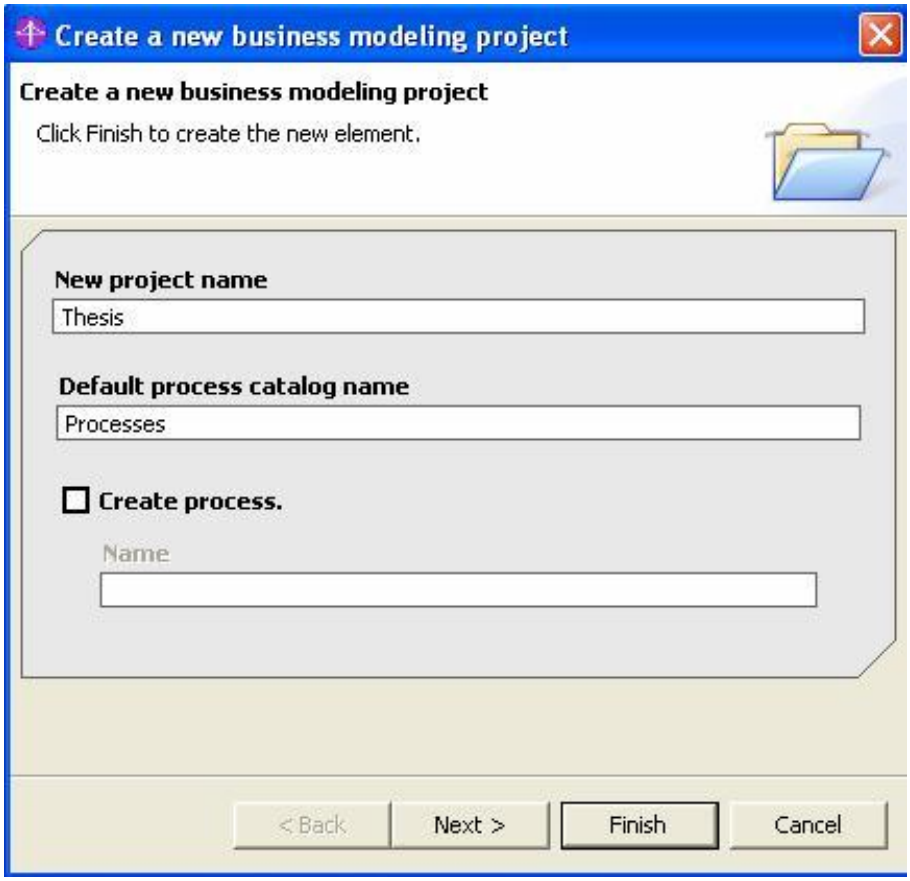


Figure 22: New Project workspace dialog

A catalogue performs the function of a folder, allowing us to group a related set of artifacts that we create to model our business operations. A catalogue can also contain other catalogues, enabling us to create a multilevel structure to contain our process artefacts, see **Figure 23**

Process catalogs help us to organize our processes, tasks, repositories, and services, enabling us to keep them in folders that correspond to the way they are organized in the business. The ***Processes*** catalogue also contains other catalogues, one for each process we are modelling:

- ***As_Is*** catalogue contained all the artifacts that are used to describe the current situation.
- ***To_Be*** catalogue contained all the artifacts that are used to describe the future situation.

Data catalogs help us to organize the model elements that we create to represent business data, including business item templates, business items, business item instances, notification templates, and notifications, enabling us to keep them in folders that correspond to the way they are organized in the business. We create the ***Business Items*** catalogue**.** We also created the following Data Catalogues into ***Business Items*** catalogue:

- ***General Data*** catalogue contained all the Business Items that are used in all the processes.
- ***Proclamation*** catalogue contained all the Business Items that are used in Proclamation process.

Resource catalogs help us to organize our model elements relating to resources, including resource definition templates, resource definitions, resources, roles, and timetables, enabling us to keep them in folders that correspond to different projects or to the way the resources are used in the business. We create the ***Resources*** catalogue.

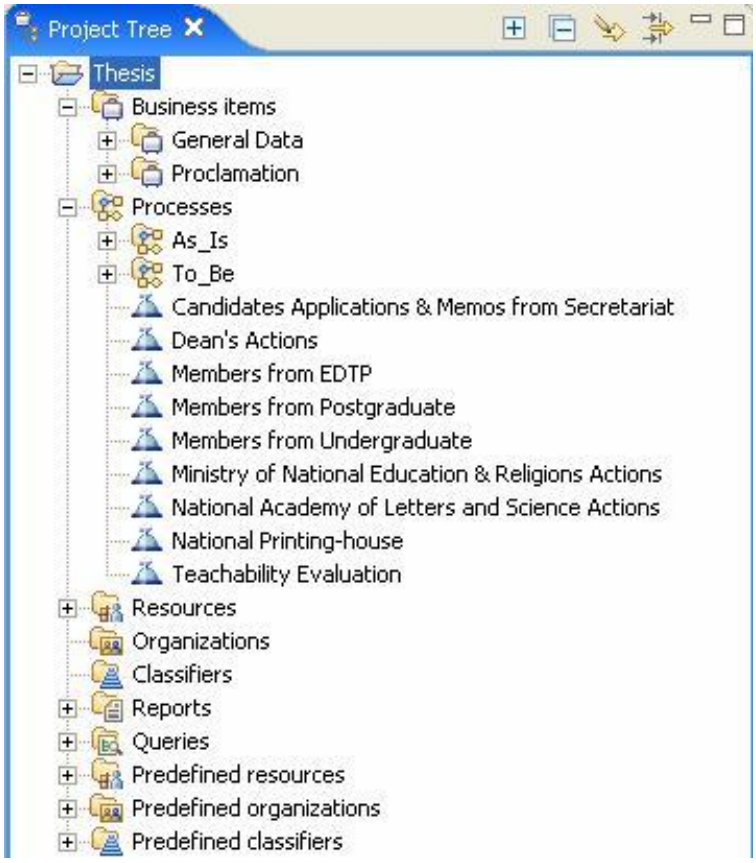


Figure 23: Project catalogue

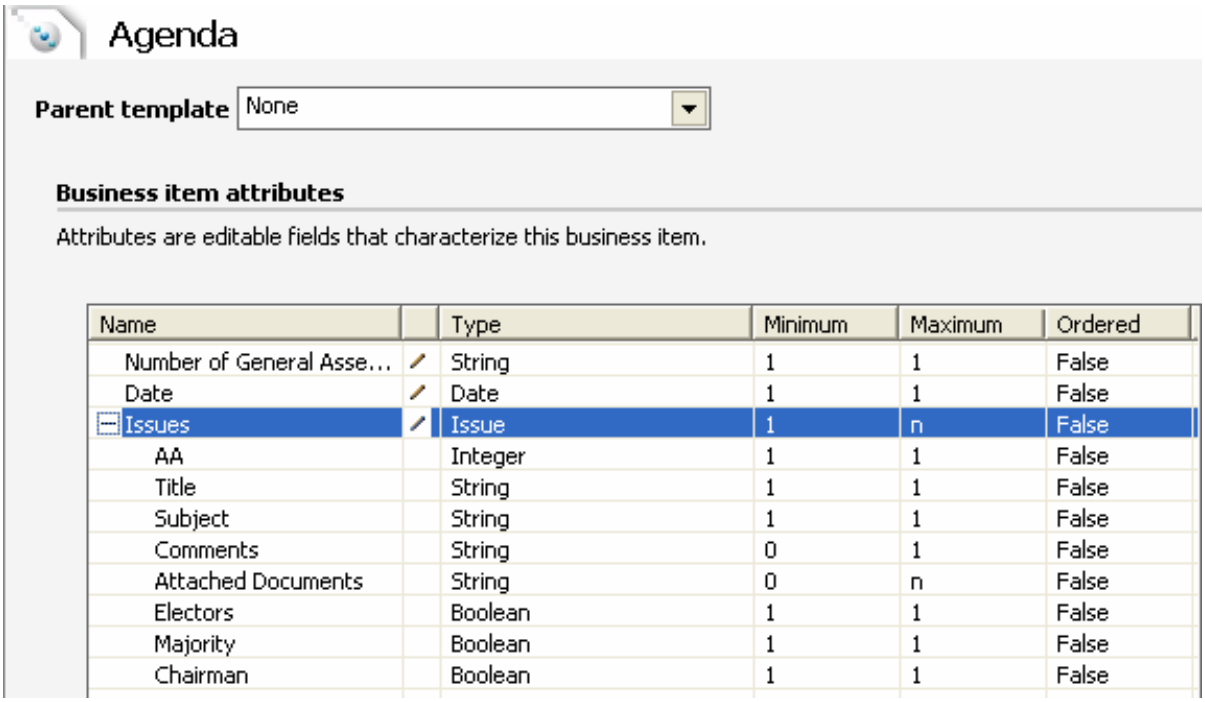
5.2 Modelling Business Items

A business item represents one or more pieces of data that might be produced or consumed within a process. Each of the items used in the business (such as documents, work products, or commodities) can be modeled and placed in the Project Tree for use in process diagrams.

Business items can be either Basic or Complex. Basic types are: boolean, long, integer, double, date, string, time, dateTime, duration, short, byte, and float. If a business item is defined as Complex, then the item usually represents an object that has 1..N associated attributes. The complex business item encapsulates individual pieces of data and promotes a mechanism for passing data between elements in a process, as opposed to mapping each piece of data separately. For elements that only require a few pieces of input data, mapping individual elements might suffice; however, when multiple individual data elements are required by an element, encapsulating the data as part of a complex type

will reduce clutter in the modelling diagram. To add a new business item to a project, we use add new Business Item wizard, see **Figure 24**.

Figure 24: New Business Item workspace dialog



Name	Type	Minimum	Maximum	Ordered
Number of General Asse...	String	1	1	False
Date	Date	1	1	False
Issues	Issue	1	n	False
AA	Integer	1	1	False
Title	String	1	1	False
Subject	String	1	1	False
Comments	String	0	1	False
Attached Documents	String	0	n	False
Electors	Boolean	1	1	False
Majority	Boolean	1	1	False
Chairman	Boolean	1	1	False

Figure 25: Business Item Agenda

We add attributes to the business items which are the fields or properties that defines an element, see **Figure 25**. In the Intermediate Business Modeling or Advanced Business Modeling profile, we can also specify other values, as described in the **Table 4**:

Field	Value
Minimum	Specify the minimum number of values that the attribute can have. If the attribute is optional, specify 0 to indicate that it can be left without a value. If the attribute is mandatory and must have a value, specify 1. If the attribute has more than one required value, specify the number.
Maximum	Specify the maximum number of values that the attribute can have. If the attribute can have only one value, specify 1. If the attribute can have any number of values, enter "n."
Read Only	Select **True** if the attribute cannot change while an instance of the element (such as a business item instance or a resource) is running. Each instance has a different value for this attribute, but the value does not change once it has been entered.
Static	Select **True** if the value for the attribute is the same for all instances of the element. The information is the same for all invoices. However, static does not mean read-only, so all the heading information might be changed during a specific task.
Ordered	Select **True** if the attribute can have more than one value (Maximum is greater than 1) and the order of the values is important.
Unique	Select **True** if the attribute can have more than one value (Maximum is greater than 1) and each value must be different.
Default value	Enter a default value for the attribute. This value is given to the attribute when an instance of the element is first created.

Table 4: Attributes of Business Items

We have defined business items that represent one or more pieces of data that might be produced or consumed within the processes. We also have categorized and have put them in appropriate data catalogues.

In the General Data catalogue included the following Business Items:

- ***Issue*** which contains all the data that are necessary to define the issues of General Assembly; see **Table 5**.

Name	Type	Minimum	Maximum	Ordered	Unique	Default Value
AA	Integer	1	1	False	True	
Title	String	1	1	False	False	
Subject	String	1	1	False	False	
Comments	String	1	1	False	False	
Attached Documents	String	1	N	False	True	
Electors	Boolean	1	1	False	False	
Majority	Boolean	1	1	False	False	
Chairman	Boolean	1	1	False	False	

Table 5: Issue

- ***Agenda*** contains all the General Assembly Issues that will be consider and discussed in a General Assembly Meeting; see **Table 6**.

Name	Type	Minimum	Maximum	Ordered	Unique	Default Value
Number of General Assembly	String	1	1	False	True	
Date	Date	1	1	False	False	
Issues	General Assembly Issue	1	N	False	False	

Table 6: Agenda

- ***Member*** contains all the data that are necessary to define the Member of General Assembly; see **Table 7**.

Name	Type	Minimum	Maximum	Ordered	Unique	Default Value
Last Name	String	1	1	False	False	
First Name	String	1	1	False	False	
Social Number	String	1	1	False	True	
Attribute	String	1	1	False	False	

Table 7: Member

- ***Members*** contain the data of all General Assembly Members; see **Table 8**.

Name	Type	Minimum	Maximum	Ordered	Unique	Default Value
Member	General Assembly Member	1	N	False	False	
Total Number	Integer	1	1	False	False	

Table 8: Members

- ***Decision*** which includes all the data that are necessary to define a decision of General Assembly; see **Table 9**.

Name	Type	Minimum	Maximum	Ordered	Unique	Default Value
Number of Decision	String	1	1	False	True	
Date	Date	1	1	False	False	
Title	String	1	1	False	False	
Rationale	String	1	1	False	False	
Result	Boolean	1	1	False	False	

Table 9: Decision

- ***Request*** contains all the data that should define a document request to any organization; see **Table 10**.

Name	Type	Minimum	Maximum	Ordered	Unique	Default Value
Number of Protocol	String	1	1	False	True	
Date	Date	1	1	False	False	
Title	String	1	1	False	False	
Subject	String	1	1	False	False	
Attached Documents	String	1	N	False	False	

Table 10: Request

- ***Answer*** from organizations contains all the data that should define a document answer to a pre submit request; see **Table 11**.

Name	Type	Minimum	Maximum	Ordered	Unique	Default Value
Number of Protocol	String	1	1	False	True	
Date	Date	1	1	False	False	
Title	String	1	1	False	False	
Subject	String	1	1	False	False	
Result	Boolean	1	1	False	True	

Table 11: Answer

- ***Notification*** from organizations contains all the data that should send to somebody via email; see **Table 12**.

Name	Type	Minimum	Maximum	Ordered	Unique	Default Value
email	String	1	1	False	True	
Title	String	1	1	False	False	
Subject	String	1	1	False	False	

Table 12: Notification

- ***Vote Results*** contains the results of votes; see **Table 13**.

Name	Type	Minimum	Maximum	Ordered	Unique	Default Value
Number of Candidates	Integer	1	1	False	False	
Number of Instructive Scientific Personnel	Integer	1	1	False	False	
Electors Body Members	Integer	1	1	False	False	
First -Votes	Integer	1	1	False	False	
Second-Votes	Integer	1	1	False	True	
Pro-Voted	Integer	1	1	False	False	
Versus-Voted	Integer	1	1	False	True	
White-Voted	Integer	1	1	False	False	
Total	Integer	1	1	False	False	
Absolute Majority	Boolean	1	1	False	False	

Table 13: Vote Results

In the **Proclamation catalogue** included the following Business Items:

- ***Candidate Record*** it contains all the data that submits the candidate in his application and the data that the Candidate submits with regard to the objections that he can have with regard to the decision of committee of evaluation; see **Table 14**.

Name	Type	Minimum	Maximum	Ordered	Unique	Default Value
Last Name	String	1	1	False	False	
First Name	String	1	1	False	False	
Social Number	String	1	1	False	True	
Titles of University	String	1	N	False	False	
Lab our Experience	String	1	1	False	False	
CV	String	1	1	False	False	

Table 14: Candidate Record

- ***Candidate Records*** contains the data of all Candidates; see **Table 15**.

Name	Type	Minimum	Maximum	Ordered	Unique	Default Value
Candidate Record	General Assembly Member	1	N	False	False	

Table 15: Candidates Records

- ***Students Proposal*** contains the data of the students' proposal for the election of a professor; see **Table 16**.

Name	Type	Minimum	Maximum	Ordered	Unique	Default Value
Date	Date	1	1	False	False	
Title	String	1	1	False	False	
Subject	String	1	1	False	False	

Table 16: Student Proposal

- ***Teachability Evaluation*** contains the data from the every year teach ability evaluation of the professors; see **Table 17**.

Name	Type	Minimum	Maximum	Ordered	Unique	Default Value
Number of Protocol	String	1	1	False	True	
Date	Date	1	1	False	False	
Title	String	1	1	False	False	
Rationale	String	1	1	False	False	

Table 17: Teachability Evaluation

5.3 Modelling Timetables & Resources

5.3.1 Timetables

An accurate model must take into account the schedules of the resources or roles involved in the process. In WebSphere Business Modeler, we can define timetables that specify what times certain resources are available. The following timetables are required to indicate the work hours of the key roles in the current order handling process:

- **Day Shift**, define a regular Weekday timetable with a time interval of 9-5, repeated every day.
- **WeekEnd**, define a Weekend timetable with a time interval of 48 hours from 12:00 AM Saturday to 12:00 AM Monday, repeating weekly.
- **Christmas Holidays**, define a timetable with a time interval 15 days starting at 12:00 AM of the 24th December.
- **Easter Holidays**, define a timetable with a time interval 15 days starting at 12:00 AM of the 15th April.
- **Summer Holidays**, define a timetable with a time interval 45 days starting at 12:00 AM of the 15th July.

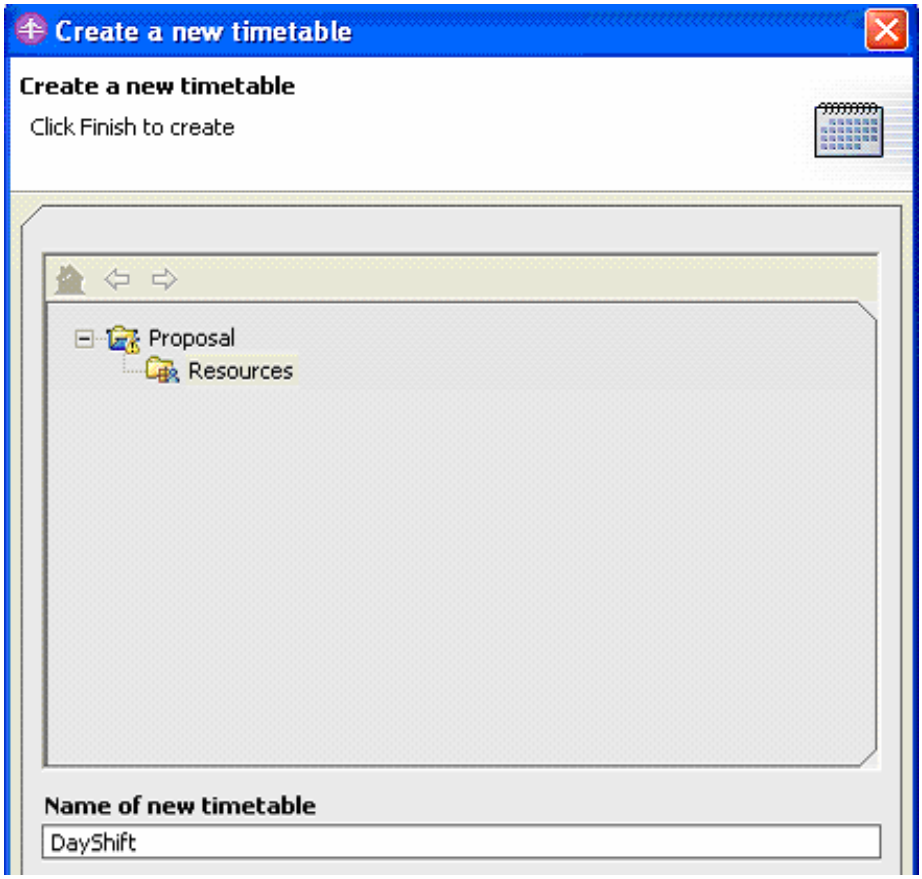


Figure 26: Create Timetable Wizard

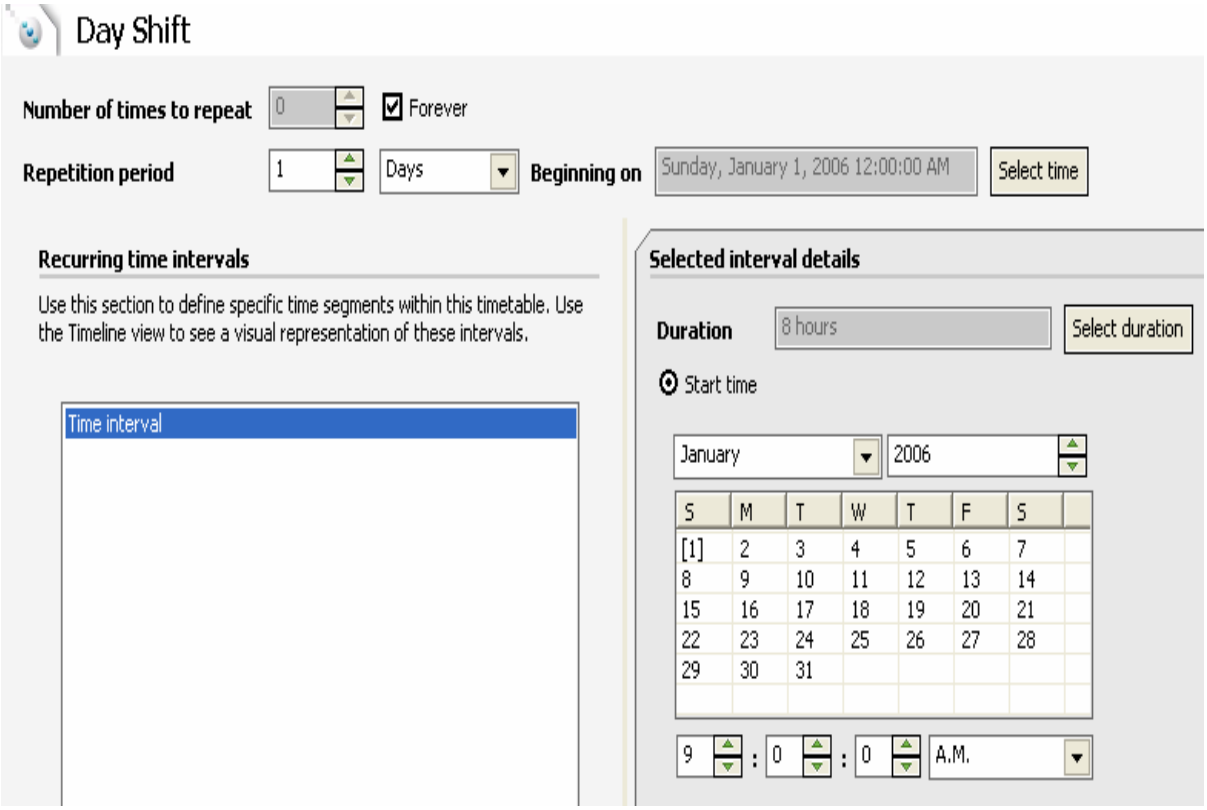


Figure 27: Timetable Attributes

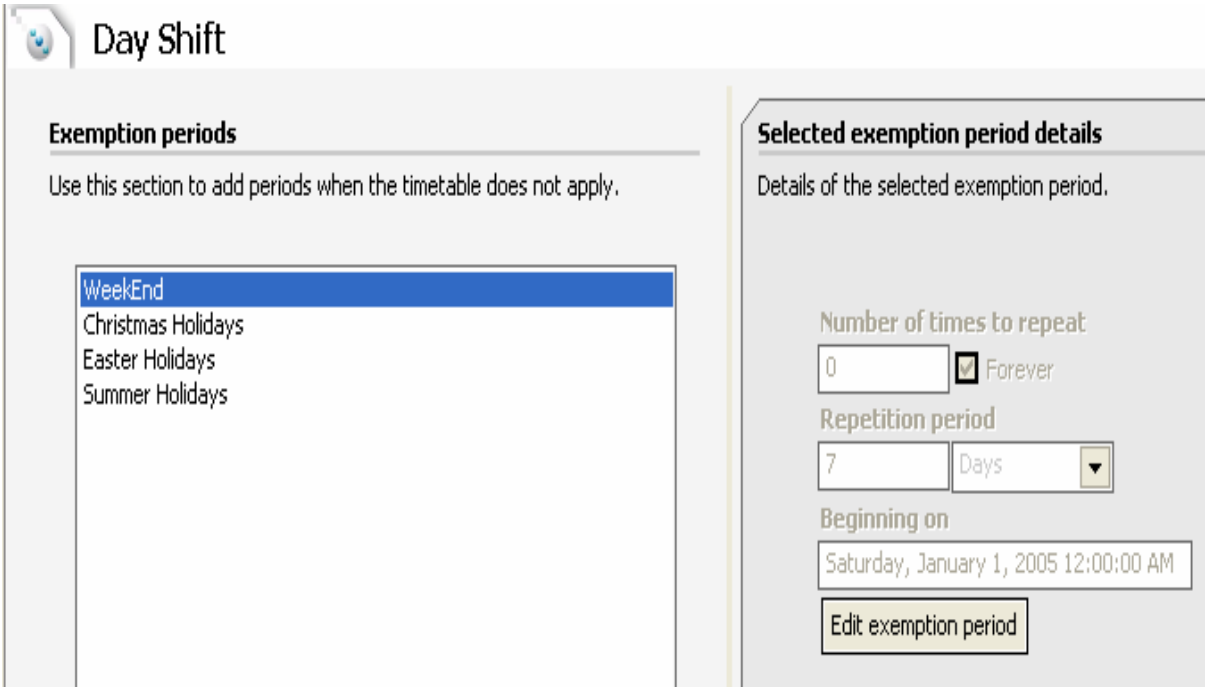


Figure 28: Exemptions Periods

The main timetable is Day Shift which specify the time that role or resources are available. We add exemption periods to a timetable if there are any time periods during which the timetable does not apply. In Day Shift timetable we add WeekEnd, Christmas Holidays, Easter Holidays and Summer

Holidays timetables as exemption periods. To create the above timetables, we use the create Timetable wizard, see **Figure 26**. We define timetables attributes as Recurring time intervals, Number of times to repeat, Repetition period**,** see **Figure 27** and add exemption periods to the timetable Day Shift using other timetables as weekend e.t.c., see **Figure 28**.

5.3.2 Resources

A key to documenting any process is determining the resources and roles required to complete each of the activities. Resources are not the same as business items. The objects that undergo changes and are passed from one process step to the next should be modelled as business items, whereas the things that are performing the work or are required prerequisites for this work should be modelled as resources. We can model two types of resources:

- **Individual resources** are resources where a specific instance is required, such as people and computers.
- **Bulk resources** can represent the material used to perform a project or a task. They can be non-consumable (such as employees or equipment) or consumable (such as fuel or printer paper).

To create a new role or resource, we use the Create new Role wizard see **Figure 29**.

For the purposes of this work we have created resources that are represented by the following people roles and subsystems in the processes:

- **Professor**, belongs in the first rank in the hierarchy and contains the qualifications shown below:
    - General Assembly Member
    - Chairman
    - Electors Body Member
    - Recommendatory Committee Member
- **Associate Professor**, belongs in the second rank in the hierarchy and contains the qualifications shown below:
    - General Assembly Member,
    - Chairman,
    - Electors Body Member,
    - Recommendatory Committee Member,
- **Assistant Professor**, belongs in the third rank in the hierarchy and contains the qualifications shown below:

  - General Assembly Member,
  - Electors Body Member,
  - Recommendatory Committee Member,
- **Lecturer**, belongs in the fourth rank in the hierarchy and contains the qualifications shown below:
  - General Assembly Member,
  - Recommendatory Committee Member,
- **Postgraduate Student**, with the qualifications shown below:
  - General Assembly Member,
- **Undergraduate Student**, with the qualifications shown below:
  - General Assembly Member,
- **Special Administrative - Technical Personnel**, with the qualifications shown below:
  - General Assembly Member,
- **Secretary** writes the minutes of meetings without right of vote.

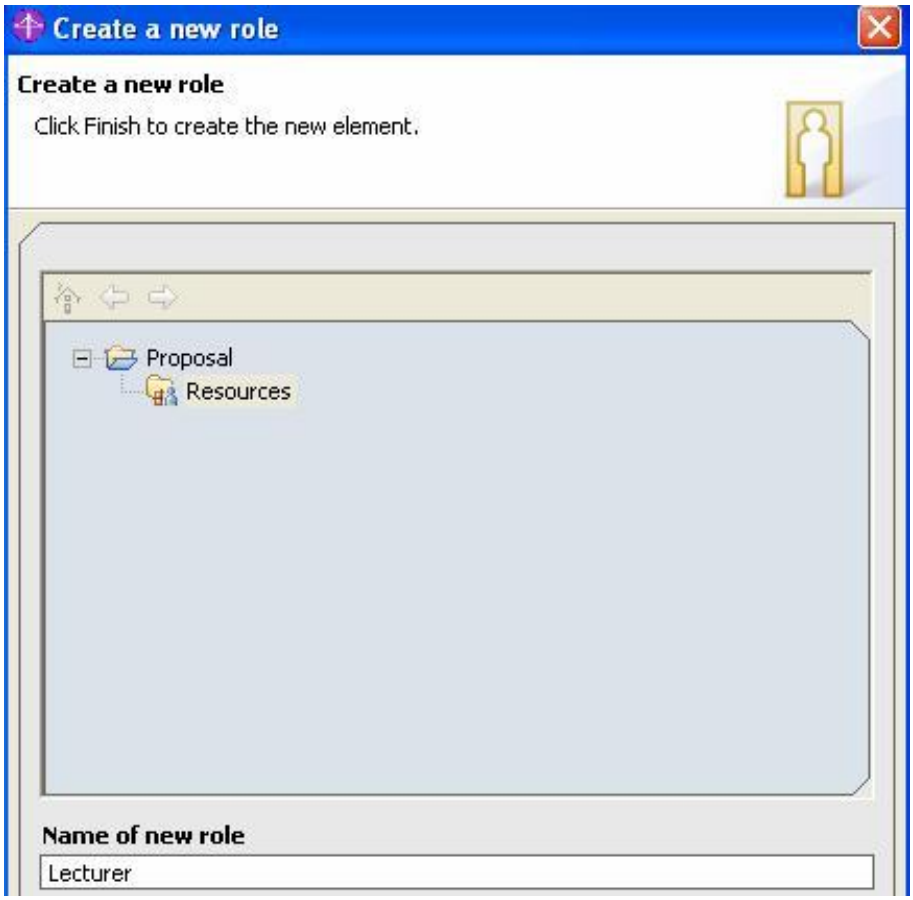


Figure 29: Create Role Wizard

We can specify the details of the role in the Definition editor. Define a role by adding **scope dimensions**, which enable us to add required qualifications to tasks and to specify the qualifications provided by individual resources, see **Figure 29** above.

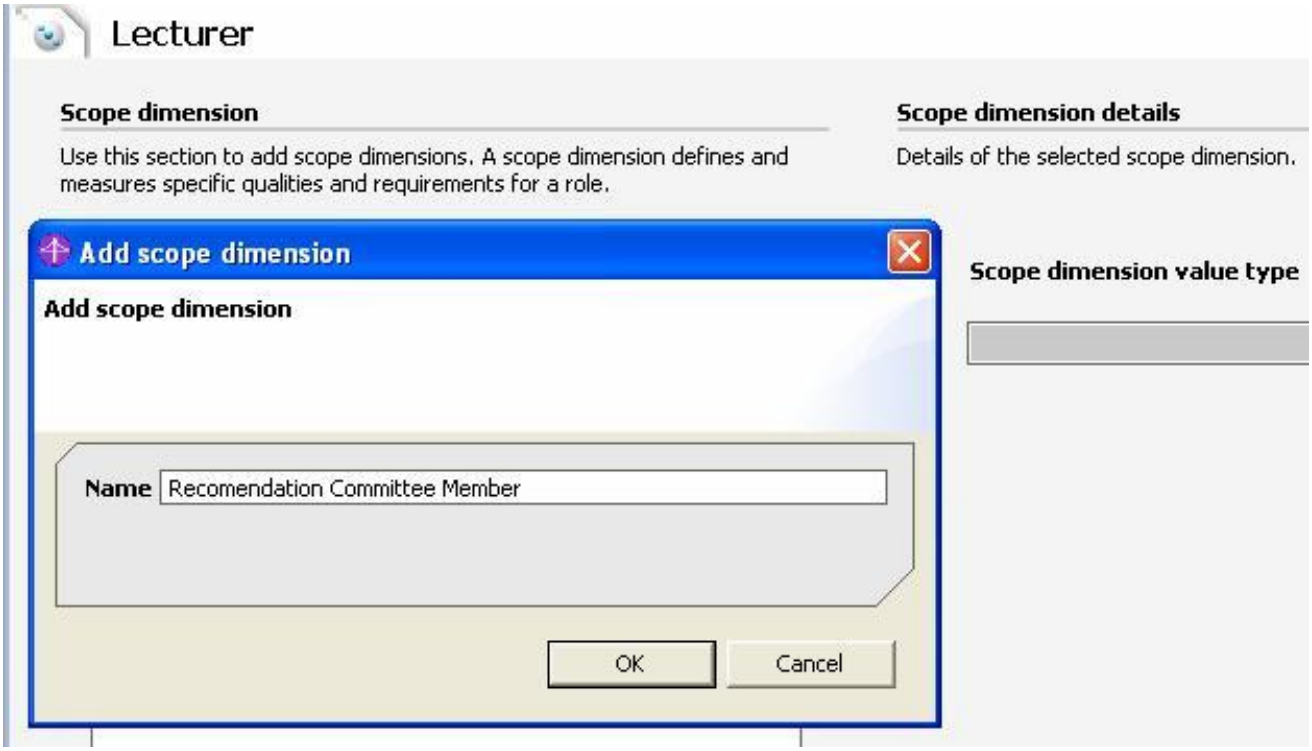


Figure 30: Add Scope dimension

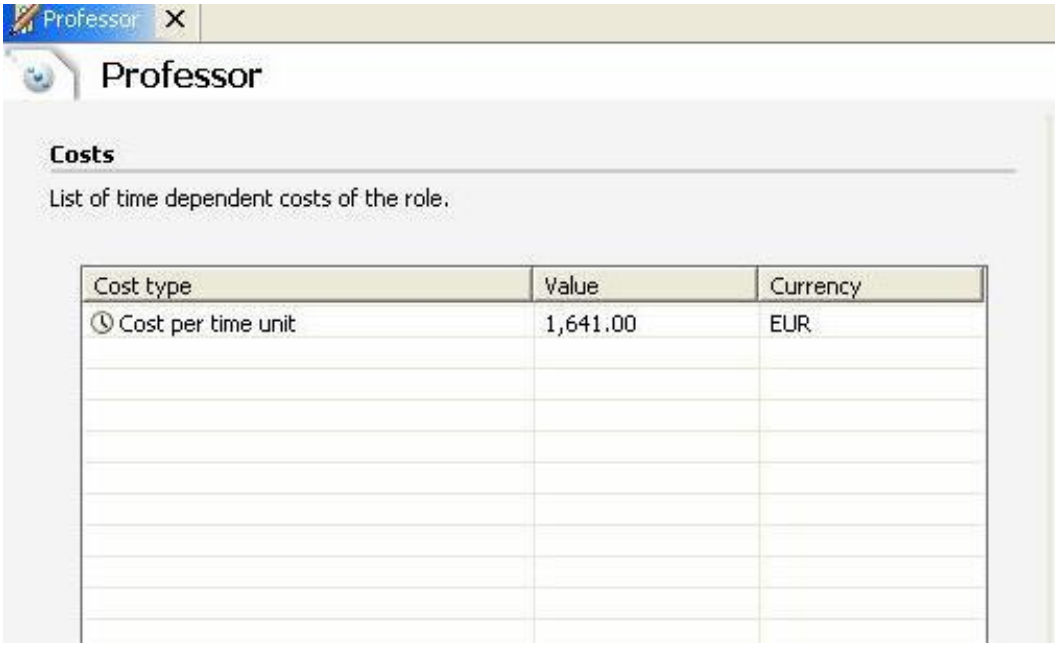


Figure 31: Add Cost

To model the **cost** of using a resource or a role, we specify costs for both, the resource cost takes priority, see **Figure 31**.

We can specify when a resource or role is **available**, or how much of a bulk resource is available, see **Figure 32**. If we do not specify availability, it is assumed that the resource or role is always available.

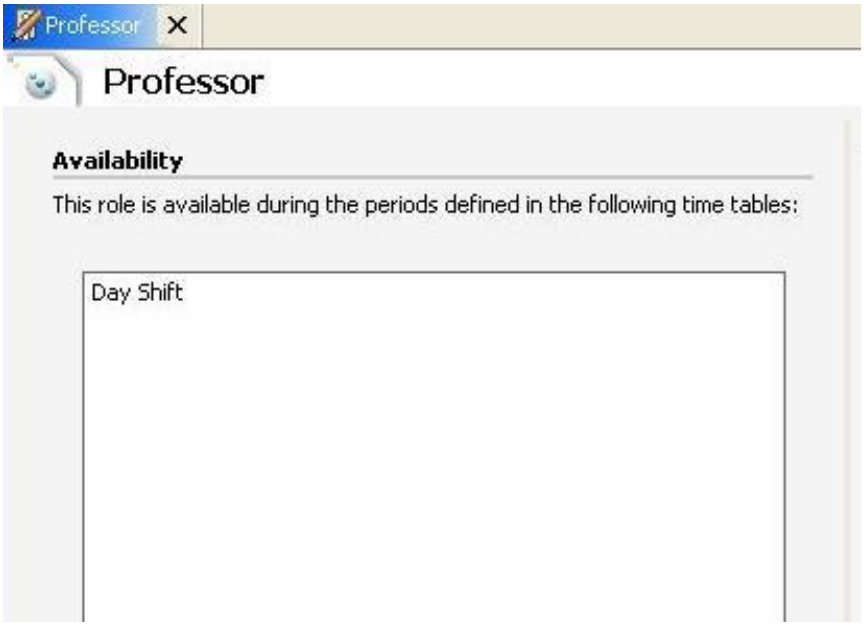


Figure 32: Add Availability

5.4 Modelling Services

Services represent external processes that are provided by a service provider. These services are not internally owned by the organization, the services' actual implementation is hidden from the consumer of the service. This type of underlying implementation is often referred to as *black box*. A service should provide a well-defined interface that details how a service is invoked, what request message or parameters are required, and what response message or output is returned. Services can be exported to BPEL4WS either as stand-alone services or as services embedded within a process.

According to our **Case Study** we have define the following services that are required in our process to represent the external processes that are provide by other organizations:

- **Candidates Applications & Memos from Secretariat:** The secretariat collects the Candidate Applications and Candidates Memos about the Election process and transmits them to General Assembly.

- **Dean's Actions:** The Dean convokes General Assembly of the Department in cases of Chairman Election or Extraordinary General Meetings.
- **National Printing-house:** Publish the announcement of a Faculty vacancy.
- **Members from EDTP:** The Assembly of EDTP defines the members for the Chairman Election.
- **Members from Postgraduate:** The Assembly of Postgraduate Students defines the members for the Chairman Election.
- **Members from Undergraduate:** The Assembly of Undergraduate Students defines the members for the Chairman Election.
- **Ministry of National Education & Religions Actions:** Actions that take place at the Ministry of National Education and Religions. Answers at request that have been submitted by General Assembly of the Department.
- **NLSA Actions:** Actions that take place at the National Academy of Letters and Science. The National Academy of Letters and Science according to her internal regulation, formulates her opinion and send it to General Assembly.
- **Teachability Evaluation:** The teachability evaluation for Candidates that takes place every year came as import to be survey by the Electors.

5.5 Modelling Current Processes

A top level global process defines a process model. It consists of three parts:

- The process diagram, which is a visual representation of the process flow.
- The specification, which includes details on the inputs and outputs of the process, a description, and a list of required resources.

Processes contain modelling elements that are logically linked together to form the control flow that addresses when and where the elements will be executed. Executable processes can perform tasks serially, in parallel, or a combination of both serial and parallel processing. Furthermore, control flow can be based on conditional expressions that will evaluate whether a particular path should or should not be executed.

When a process is global in scope, the process appears as part of a particular Process Catalog in WebSphere Business Integration Modeler. The ***global process*** is a reusable modelling asset, which can be copied into other processes as necessary. ***Local processes***, or ***sub-processes***, have scope that applies

only to the loop or parent process where the local process will be created. Local processes are not re-usable in other modelling projects. Hence, local processes are not a reusable modelling asset.

Both local and global processes contain process-level attributes. Examples of process-level attributes are the input, output, input criteria, and output criteria that will determine both the input and output data required by the process at runtime. Also, resource attributes can be specified at the process level.

Inputs and outputs represent data that is required by a process or activity to start processing, or the result of the process or activity after processing has been completed. Hence, inputs and outputs act as entry points into a process or task as well as several other elements such as maps, decisions, merges, joins, and forks.

Inputs and outputs define the business items that are injected into a process and the business items that are passed between modelling elements in a process flow when the two elements are connected with a connection. Input and output assigned to elements, which are joined by a connection, help to clearly identify when an upstream element produces data for consumption by other downstream elements, see **Figure 33**.

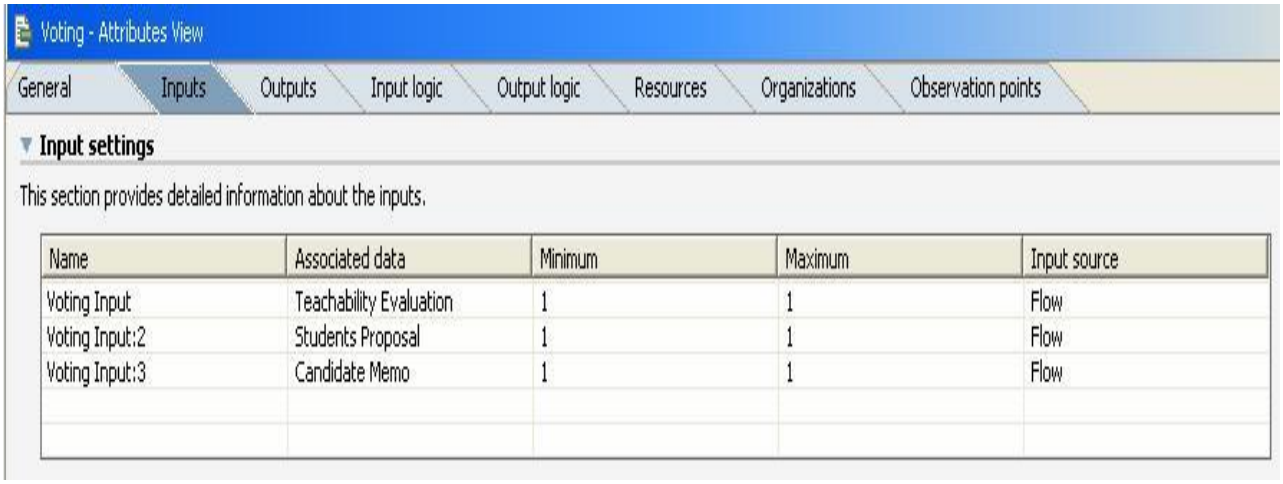


Figure 33: Inputs & Outputs of a Process or a Task

Inputs and outputs can be grouped together to form input and output criteria, see **Figure 34**. The criteria define the inputs and outputs that must be present in order for a process, task, or other element to start or end. An input criterion of a task represents a WSDL operation.

In the following paragraphs we describe the existing situation of General Assembly's four processes. First we create an accurate representation of the process with a model and then study how that process performs under different conditions. We have documented, see **Case Study** Chapter, and

sketch the current processes flows, and list all of the key resources (people, equipment, material), see Section 5.3, business items (documents, records, products), see Section 5.2, and business rules (decision logic), included in the process. After we analyze the current processes so that they can fully understand where the business problems lie and set realistic targets for the process improvement.

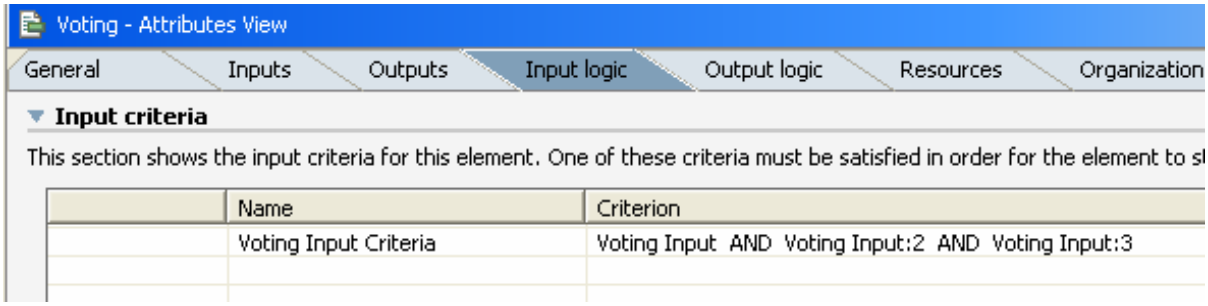


Figure 34: Inputs & Outputs Criteria of a Process or a Task

5.5.1 Announcement of a Faculty Vacancy

The Application_Announcement_as_Is process model is shown in **Figure 35**. The activities in the Application_Announcement_as_Is process are:

- **Proclamation:** This embedded process shows how the Proclamation takes place.
- **Convoke G.A. Session for Election:** Define the agenda for the General Assembly session and convoke the General Assembly for defining the Electors Body and the Recommendation Committee.
- **Define Electors Body:** This embedded process shows how the Electors Body is defined.
- **Recommendation Committee:** This embedded process shows how the Recommendation Committee works.
- **Convoke G.A. Session for Election Voting:** Define the agenda for the General Assembly session and convokes General Assembly for the election.
- **Teachability Evaluation:** The evaluation of the Faculty's instructive ability is also considered in the process of judgement for the election or the promotion of the Faculty. This is an external service.
- **Undergraduate Recommendation:** At the beginning of the meeting, a representative of the students - members of the Department General Assembly analyzes the judgement conclusions regarding the candidates' instructive ability. The General Assembly students' –members' representative reminds the electors of the evaluation of the candidates' instructive work.

- **Candidates Memo from Secretariat:** The candidates can express orally their points of view regarding the content of the evaluation report, sending a memo to Secretariat.
- **Voting**: Electors justify specifically their vote.
- **Election Voting:** This embedded process shows how the Election Voting takes place.
- **Submit Election Decision to Ministry of N. E. & R.:** The decision and the process are transferred from the Highest Education Institution to the competent Minister, who, further the examination of its legality, publishes the relative action of appointment, which is notified to all candidates.
- **Publication Election proceedings:** The proceedings regarding the election or the promotion of the Faculty are published annually in a particular volume further to the corresponding Department liability and each interested person can have access to it.

5.5.1.1 Proclamation Embedded Process

The sequence of the Proclamation process is shown in **Figure 36**. The activities in the Proclamation process are:

- **Define Rank - Sector:** The Department General Assembly announces the Faculty vacancies. The Rank and the Sector of the vacancy is mentioned on the announcement.
- **Send Request to Ministry:** The announcement is notified to the Ministry of National Education and Religions, who decides to accept or reject it.
- **Ministry of National Education & Religions Actions:** The Ministry of National Education and Religions decides to accept or reject the request. This is an external service.
- **Accept the Request Decision:** According to Ministry's answer the process continue or stop.
- **Decision of proclamation the place:** The announcement decision is ready to be published for continuing the process.
- **Decision of not proclamation the place:** The proclamation is not accepted by the Ministry. The process stop with fail.
- **Notification to National Academy of Letters and Sciences:** The announcement is notified to the National Academy of Letters and Sciences.
- **Send Proclamation to Newspapers:** The announcement is send to be published in three daily Athens located newspapers at least twice, in two Thessalonica located newspapers an in two newspapers located at the legal home of the Highest Education Institution, if there are.

- **Send Proclamation to National Printing-house:** The announcement is notified to National Printing-house.
- **National Printing-house:** The announcement is published to the "The Official Government's Paper". This is an external service.

5.5.1.2 Define Electors' Body Embedded Process

The sequence of the Define Electors Body process is shown in **Figure 37**. The activities in the Define Electors Body process are:

- **Are 11 Electors? Decision:** Check if the members of the Faculty, who have a right of vote there are enough.
- **Define Electors:** All the members of the Department's Faculty belonging to the Rank, which the judgement is made for and of their superior Rank, who constitute the electors' body, have a right to vote for the election or promotion of the Faculty.
- **Establish Table of Electors:** The Department General Assembly draws up a table, which includes all the Greek Higher Education Institutions Faculty, who possess posts of the same or the most related cognitive object to that of the post which the Faculty announcement is, who have a right to vote for this judgement.
- **Send Request to Ministry:** The elector's table is notified to the Ministry of National Education and Religions, who decides.
- **Ministry of National Education & Religions Actions:** Out of the above table, the Minister of National Education and Religions fixes the electors, who are required to complete the elector's body. This is an external service.
- **Completion of Electors Body:** The General Assembly completes the Electors' Body.
- **Send G.A. Decision to Electors:** The General Assembly decision is notified to the Electors.

5.5.1.3 Recommendation Committee Embedded Process

The sequence of the Recommendatory Committee process is shown in **Figure 38**. The activities in the Recommendation Committee process are:

- **Composition of three-member recommendation committee:** Due to a resolution of the Department General Assembly, a three-membered Recommendation committee is constituted of Faculty, who are of the same or relating scientific cognitive, who can be electors.

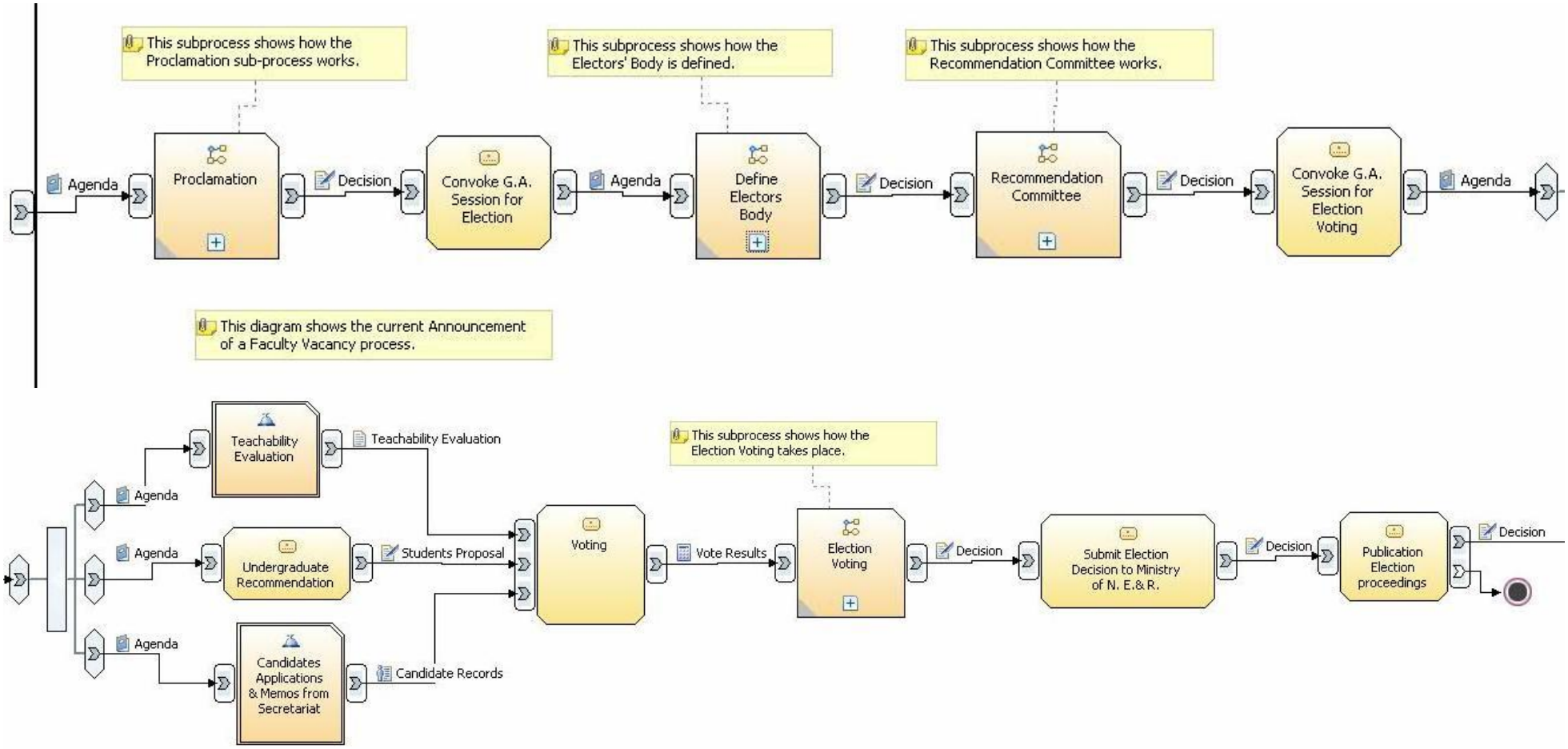


Figure 35: ApplicationAnnouncement_as_Is Process

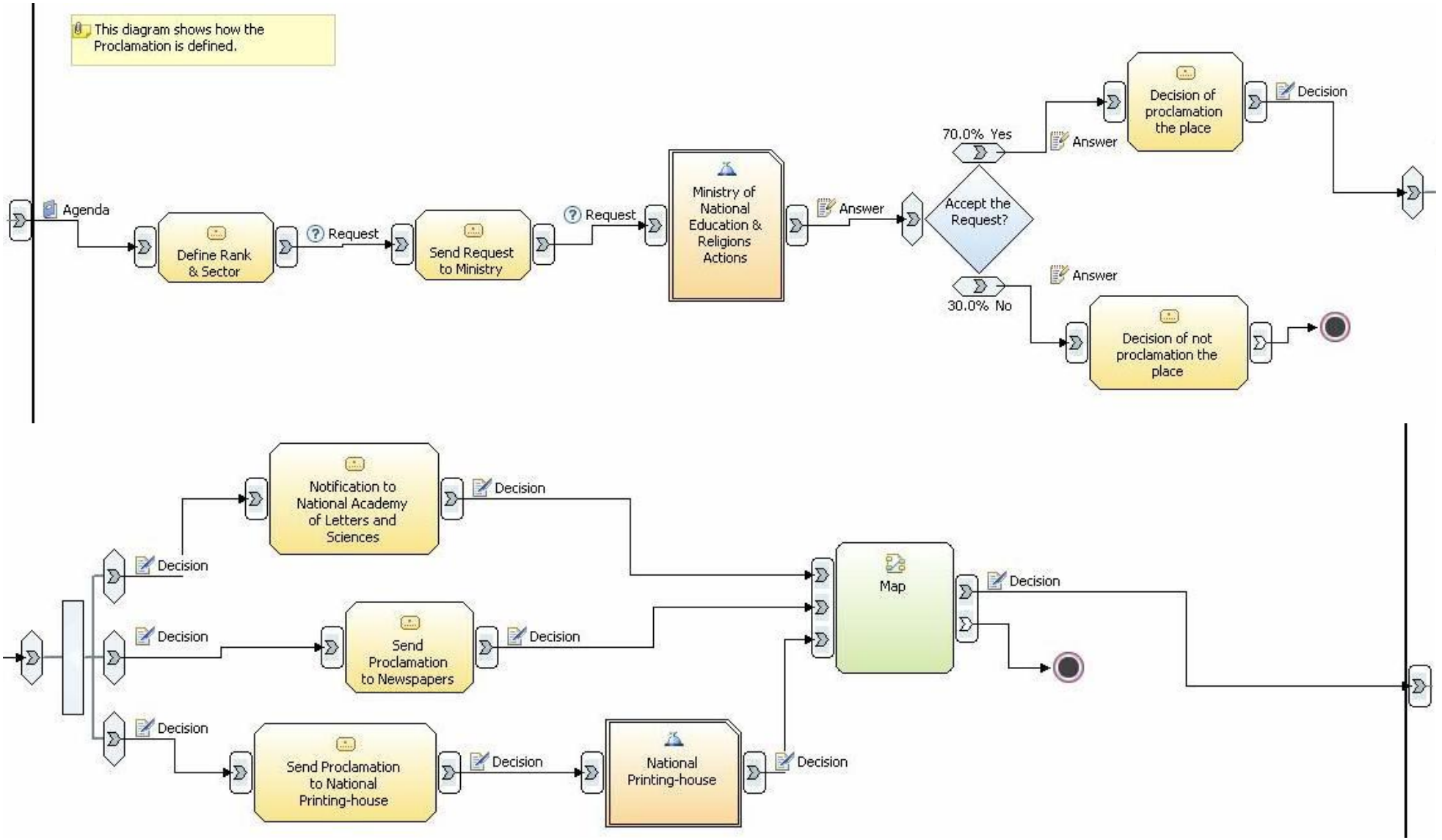


Figure 36: Proclamation Embedded Process

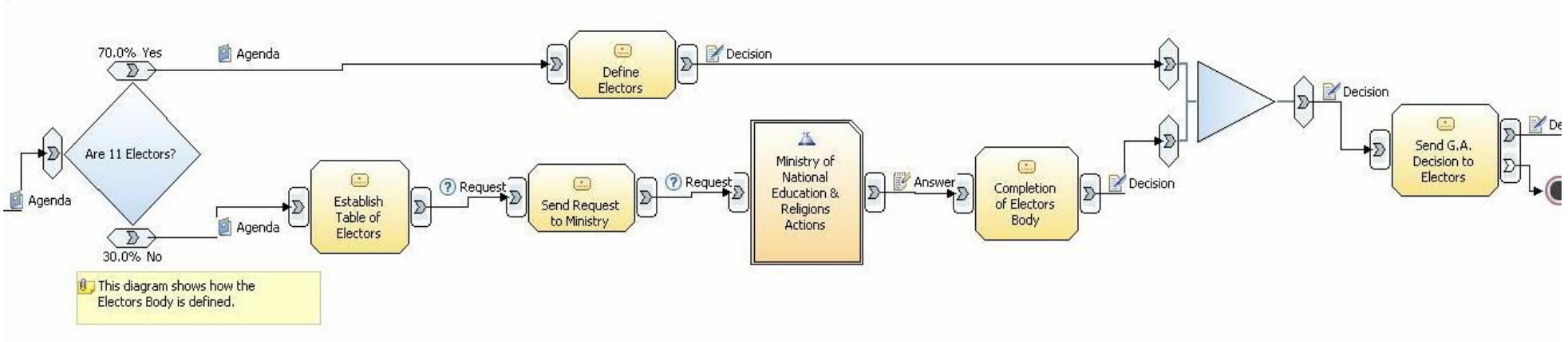


Figure 37: Define Electors' Body Embedded Process

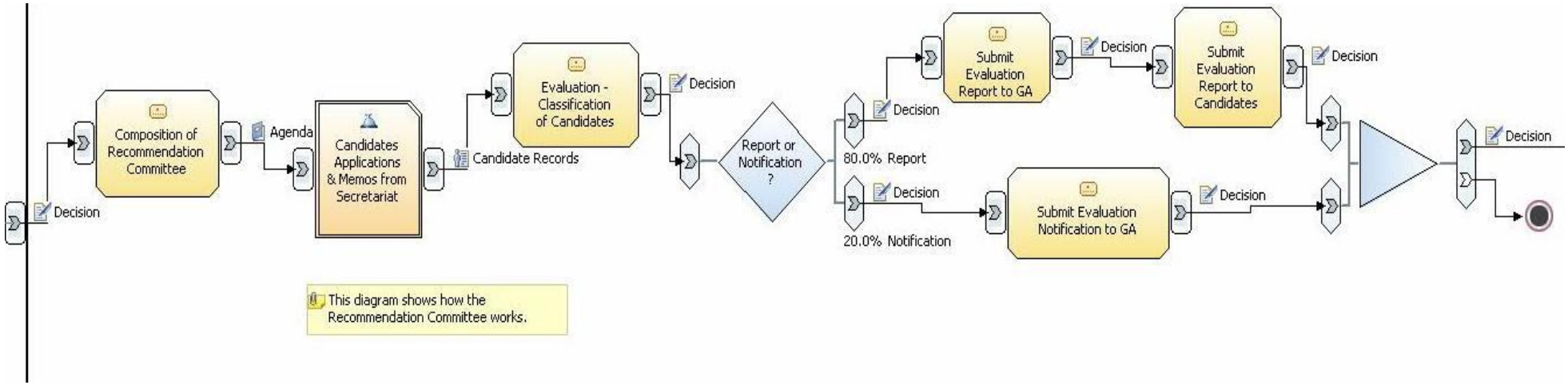


Figure 38: Recommendation Committee Embedded Process

- **Candidates Applications & Memos from Secretariat:** The Recommendation Committee take the Candidate's Applications from Secretariat. This is an external service.
- **Evaluation - Classification of Candidates:** The Recommendation committee submits to the Department General Assembly a specifically justified report, which includes;
    - Detailed presentation and evaluation of the candidates' work and the personality of the candidates as well as the judgement regarding their offer to the science progress.
    - Position of the Candidates' correspondence degree to the required legal qualifications and
    - The Candidates' Classification due to their evaluation.
- **Submit Evaluation Report to GA:** The recommendation report is submitted to the Department General Assembly.
- **Submit Evaluation Report to Candidates:** The recommendation report is notified to the candidates, who are entitled to submit a relating memorandum.
- **Submit Evaluation Notification to GA:** The justified notification is submitted to the Department General Assembly.

5.5.1.4 Election Voting Embedded Process

The sequence of the **Election Voting** process is shown in **Figure 39**. The activities in the **Election Voting** process are:

- **Check 2/3 Majority Decision**: Check if a Candidate gathered the 2/3 of the total electors in his favour.
- **Revision Request:** If the candidate gathered the absolute majority, but less than the 2/3, the review of the subject is potential by the Department General Assembly, if the 1/5 of its members submit the relating request.
- **Check for the 1/5 Majority Decision**: Check if the 1/5 of Department General Assembly members submit the relating request.
- **Reject Revision Request:** The Department General Assembly rejects the relating request.
- **Revision – Voting:** Voting after the relating request**.**
- **Check Absolute Majority Decision**: The Department General Assembly makes its decisions at the absolute majority of its present members either by accepting the electors' decision or by transferring it to the National Academy of Letters and Sciences.

- **Request to and Answer from N.A.L.S.:** This embedded process shows how the request is transferred to the National Academy of Letters and Sciences and how the National Academy of Letters and Sciences forms its opinion and notifies it to the Department General Assembly.
- **Check Absolute Majority:2 Decision**: The Department General Assembly is held ex officio and makes its decision at the absolute majority of its present members by either accepting or rejecting the electors' body suggestion based on the opinion formed by the National Academy of Letters and Sciences.
- **Reject Election:** In case of rejection, the election is considered unsuccessful and the Department General Assembly publishes the Rejection Election Decision.
- **Election Decision:** The Candidate is considered to have been elected and the Department General Assembly publishes the Election Decision.

5.5.1.5 Request and Answer from N.A.L.S. Embedded Process

The sequence of the Request and Answer from N.A.L.S. embedded process is shown in **Figure 40**. The activities in the **Election Voting** process are:

- **Create Request:** The Department General Assembly creates a request asking the opinion of the National Academy of Letters and Science.
- **Send request to National Academy of Letters and Sciences:** The Department General Assembly transferred the request to the National Academy of Letters and Sciences.
- **National Academy of Letters and Science Actions:** The National Academy of Letters and Sciences, according to its domestic regulation, forms its opinion and notifies it to the Department General Assembly. This is an external service.
- **Voting:** The Department General Assembly is held ex officio and after voting makes its decision at the absolute majority of its present members by either accepting or rejecting the electors' body suggestion based on the opinion formed by the National Academy of Letters and Sciences.

5.5.2 The Chairman's Election

The Chairman_Election_as_Is process model is shown in **Figure 41**. The activities in the Chairman_Election_as_Is process are:

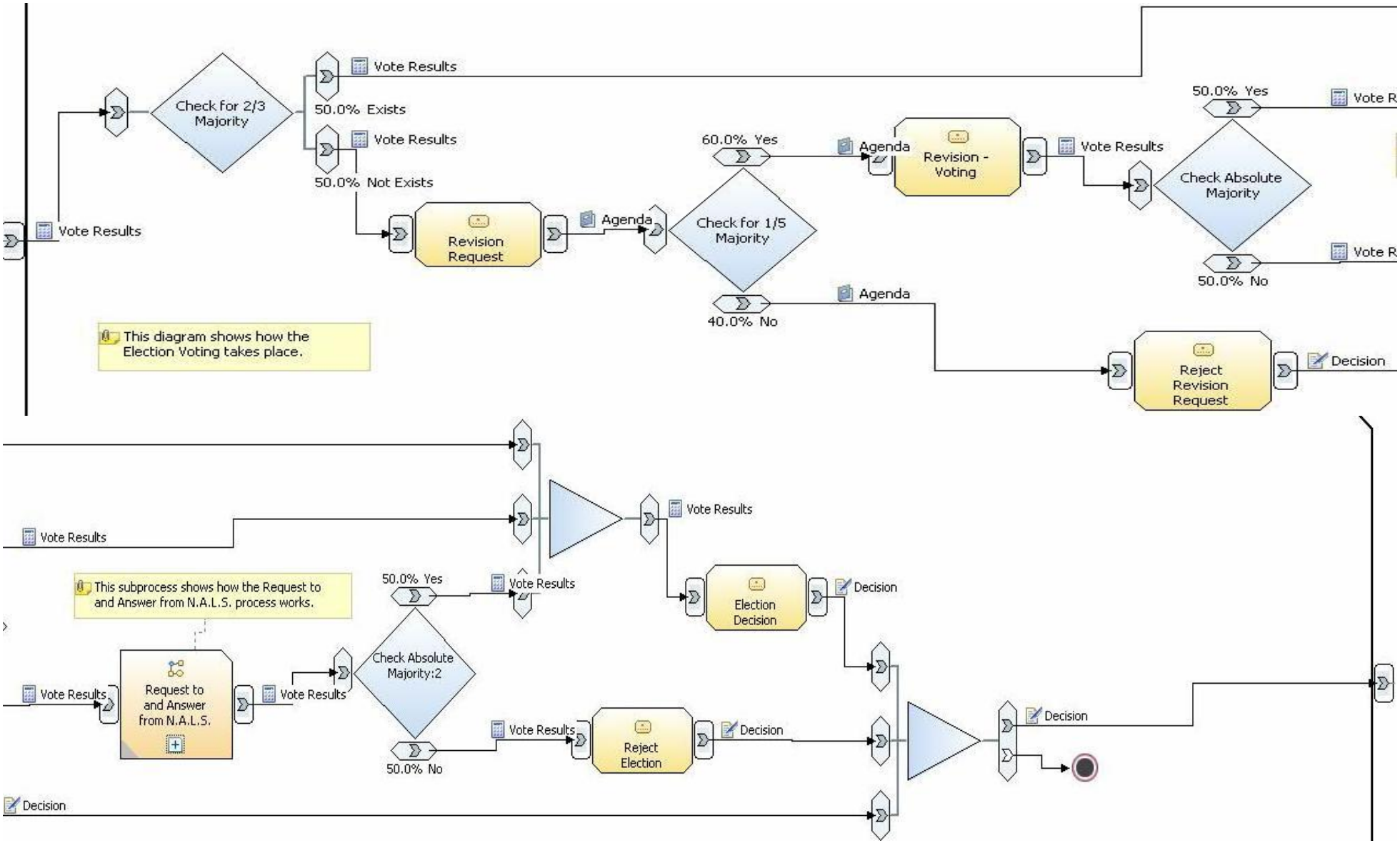


Figure 39: Election Voting Embedded Process

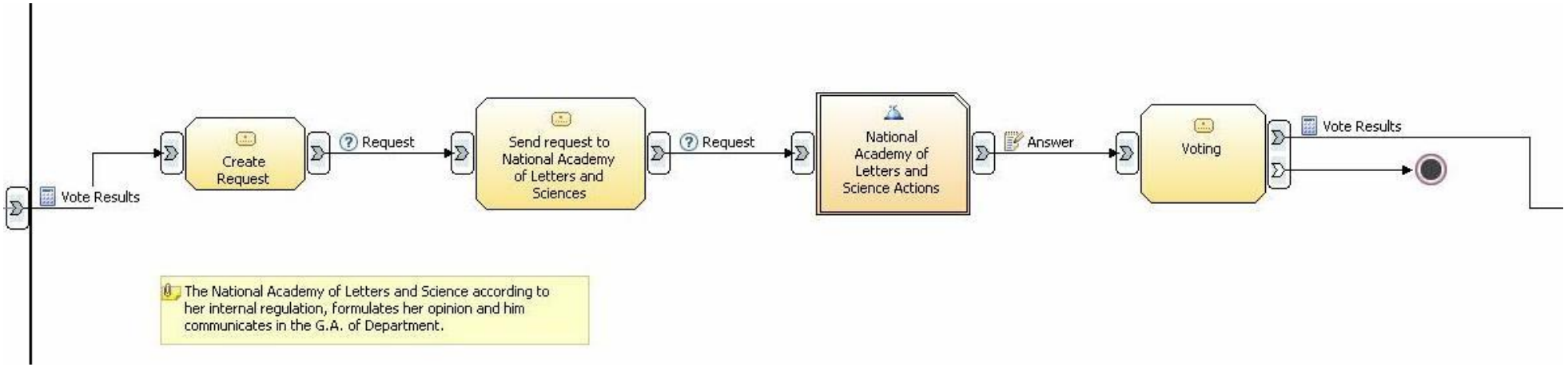


Figure 40: Request to and Answer from N.L.S.A. Embedded Process

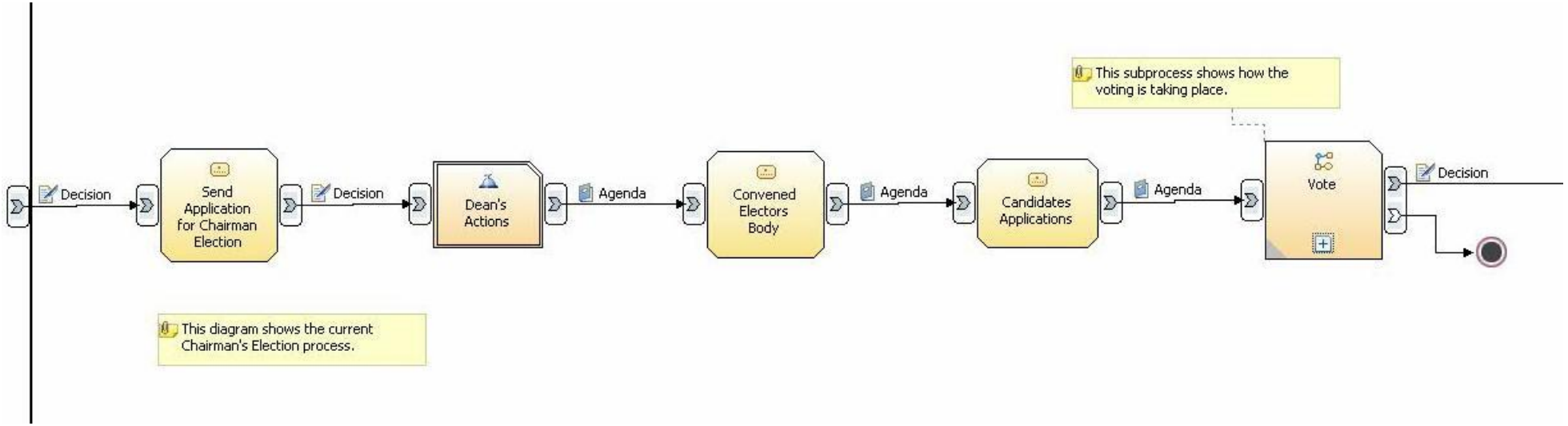


Figure 41: Chairman_Election_as_Is Process

- **Send Application for Chairman Election:** The Chairman of Department sends the decision for the election of the new Chairman to the Dean.
- **Dean's Actions:** The Dean convokes the Department General Assembly and performs the Department Chairman's duties. This is an external service.
- **Convened Electors Body:** Electors they are convened by the Dean of one month before the expiry of service of previous Chairman or at the latest in 15 days afterwards the with any way evacuation of place. In the body electors chairs the Dean, without vote provided that he is not also elector.
- **Candidates Applications:** The candidatures are submitted further to a proposal made by;
    - Any member of electors' body or
    - Anyone who is interested The candidates are submitted with proposal of he interested
- **Vote:** This embedded process shows how the voting is taking place.

5.5.2.1 Vote Embedded Process

The sequence of the Vote process is shown in **Figure 42**. The activities in the Vote process are:

- **Voting:** The General Assembly Members vote for the Chairman's election.
- **Check Number of Candidates Decision:** Check if there are more than one candidates.
- **Check of 1/3 Majority Decision:** The only one candidate chairman can not be elected, if he does not assemble at least the 1/3 of the electors' body votes.
- **Decision of not election:** The Department General Assembly publishes a not election decision.
- **Definition of new date of election:** Define a new date for Chairman's election.
- **Check Absolute Majority Decision:** If there are more then one Candidates, the Candidate who assembles the absolute majority of the present electors, is elected.
- **Repeat Voting:** If no candidate assembles the required majority, the voting is repeated between the first in votes In this case the person who assembles the most votes is considered to have been elected.
- **Chairman Election Decision:** The Department General Assembly publishes the Chairman's Election Decision.

5.5.3 Extraordinary General Meetings

The Extraordinary_G_A_as_Is process model is shown in **Figure 43**. The activities in the Extraordinary_G_A_as_Is process are:

- **Check Majority of 1/3 G.A. Members Decision:** Check if the request has been submitted by the 1/3 of the total members of the Department General Assembly.
- **Reject the Request:** The members of the Department General Assembly reject the Request.
- **Chairman Decision Task:** The Chairman convokes or not the Extraordinary General Meeting.
- **Convoke General Assembly? Decision:** Check if the Chairman convokes the Extraordinary General Meeting.
- **Convoke General Assembly:** The Chairman convokes the Extraordinary General Meeting.
- **Send Chairman Decision to Dean:** In case of the Department Chairman's inactivity, the above members submit the request to the Dean.
- **Dean's Actions:** The Dean convokes the Department General Assembly and performs the Department Chairman's duties.

5.5.4 A Professor's Engagement

The Professor_Engagement_as_Is process model is shown in **Figure 44**. The activities in the Professor_Engagement_as_Is process are:

- **Check for 1/4 Majority? Decision:** Check if the Engagement Proposal is submitted by at least the 1/4 of the Department Faculty.
- **Define Electors Body:** This embedded process shows how the Electors Body is defined.
- **Reject the Engagement:** The Department General Assembly decides regarding not to activate the engagement proposal.
- **Convoke G.A. Session for Engagement:** Define the agenda for the General Assembly session for Professor's Engagement.
- **Engagement Voting:** This embedded process shows how the Professor's Engagement Voting takes place.

5.5.4.1 Define Electors Body Embedded Process

The sequence of the Define Electors Body process is shown in **Figure 45**. The activities are the same as in **Define Electors Body** described in Section 5.5.1.4.

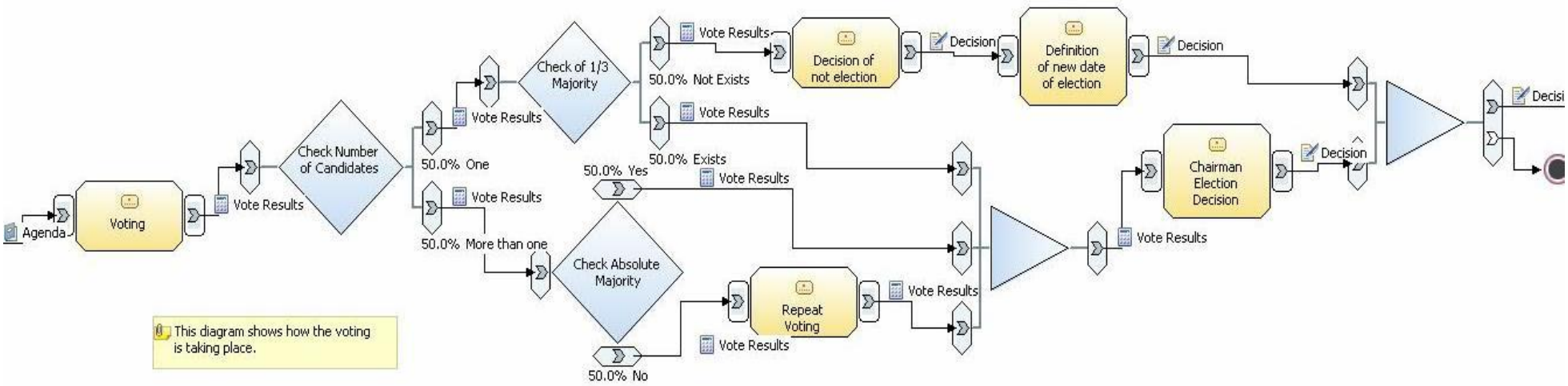


Figure 42: Vote Embedded Process

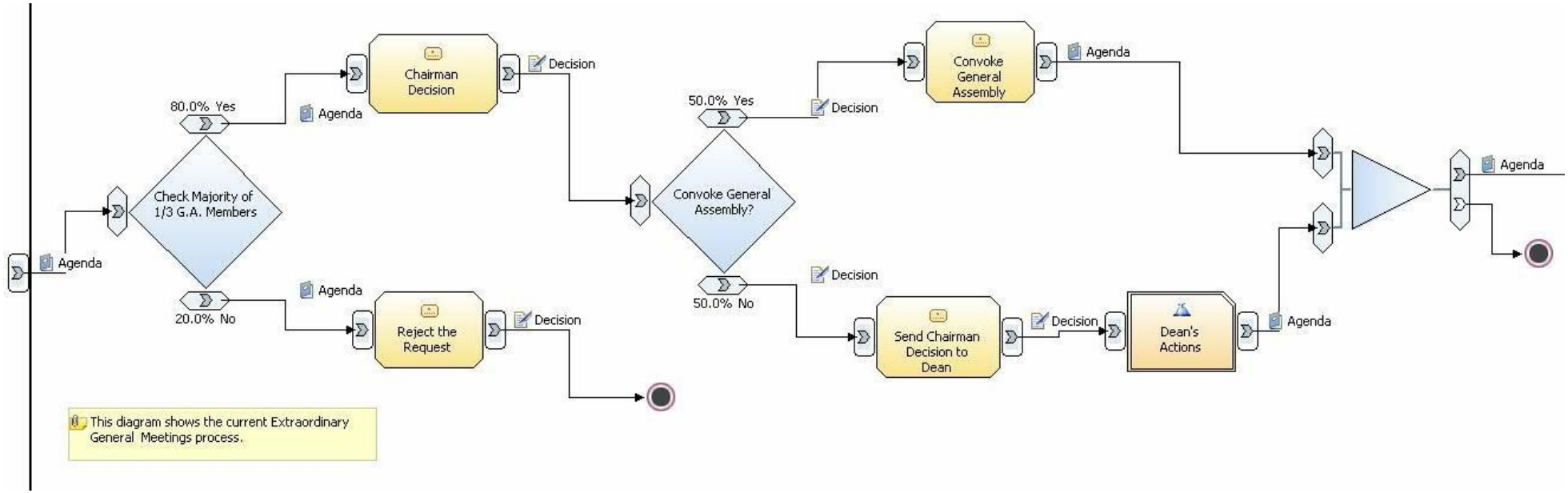


Figure 43: Extraordinary_G_A_as_Is Process

5.5.4.2 Engagement Voting Embedded Process

The sequence of the **Engagement Voting** process is shown in **Figure 46.** The activities in the **Engagement Voting** process are:

- **Voting:** The Electors votes for the Professor's Engagement.
- **Check 2/3 Majority Decision**: The relating decision is taken by all the Professors at the majority of the 2/3 of their whole number.
- **Check Absolute Majority Decision**: If the proposal assembles the absolute majority, the review of the subject by the Department General Assembly is possible.
- **Reject the Engagement:** In case of rejection, the engagement is considered unsuccessful and the Department General Assembly publishes the Rejection Election Decision.
- **Revision Professor Engagement:** The review of the subject by the Department General Assembly is possible, provided that the relating request is submitted by the 1/5 of its members.
- **Check for the 1/5 Majority Decision**: Check if 1/5 majority of its members exists.
- **Reject Revision request**: The Department General Assembly rejects the review request because it doesn't have the 1/5 majority.
- **Revision – Voting:** Voting after the review request**.**
- **Check Absolute Majority:2 Decision**: Check if the absolute majority of the General Assembly Members exists.
- **Request to and Answer from N.A.L.S.:** This embedded process shows how if the absolute majority is not achieved, the National Academy of Letters and Sciences expresses its point of view regarding the post engagement.
- **Check Absolute Majority:3 Decision**: Check if the absolute majority of General Assembly Members exists.
- **Reject Election:** In case of rejection, the engagement is considered unsuccessful and the Rejection Engagement Decision is published.
- **Engagement Decision:** The Candidate is considered to have been engaged and the Engagement Decision is published.

5.5.4.3 Request and Answer from N.A.L.S. Embedded Process

The sequence of the **Request to and Answer from N.L.S.A**. process is shown in **Figure 40**. The activities are the same as described in 5.5.1.5.

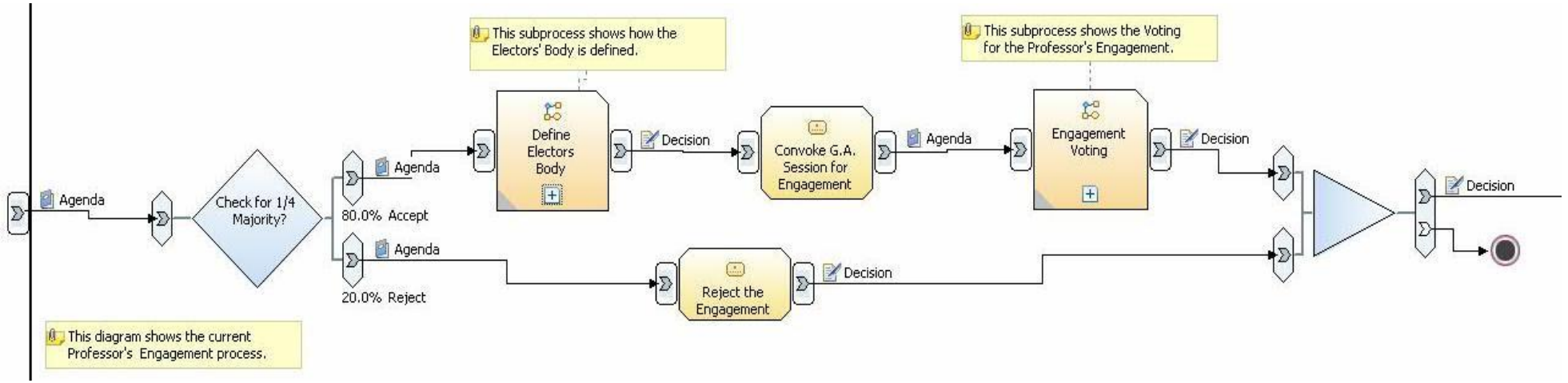


Figure 44:Professor_Engagement_as_Is Process

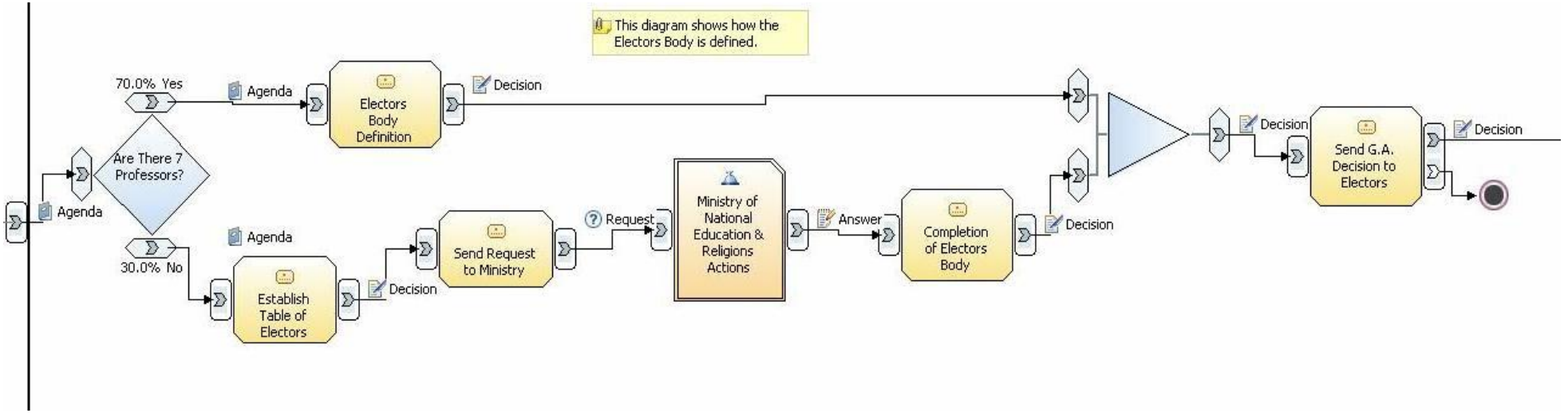


Figure 45: Define Electors Body Embedded Process

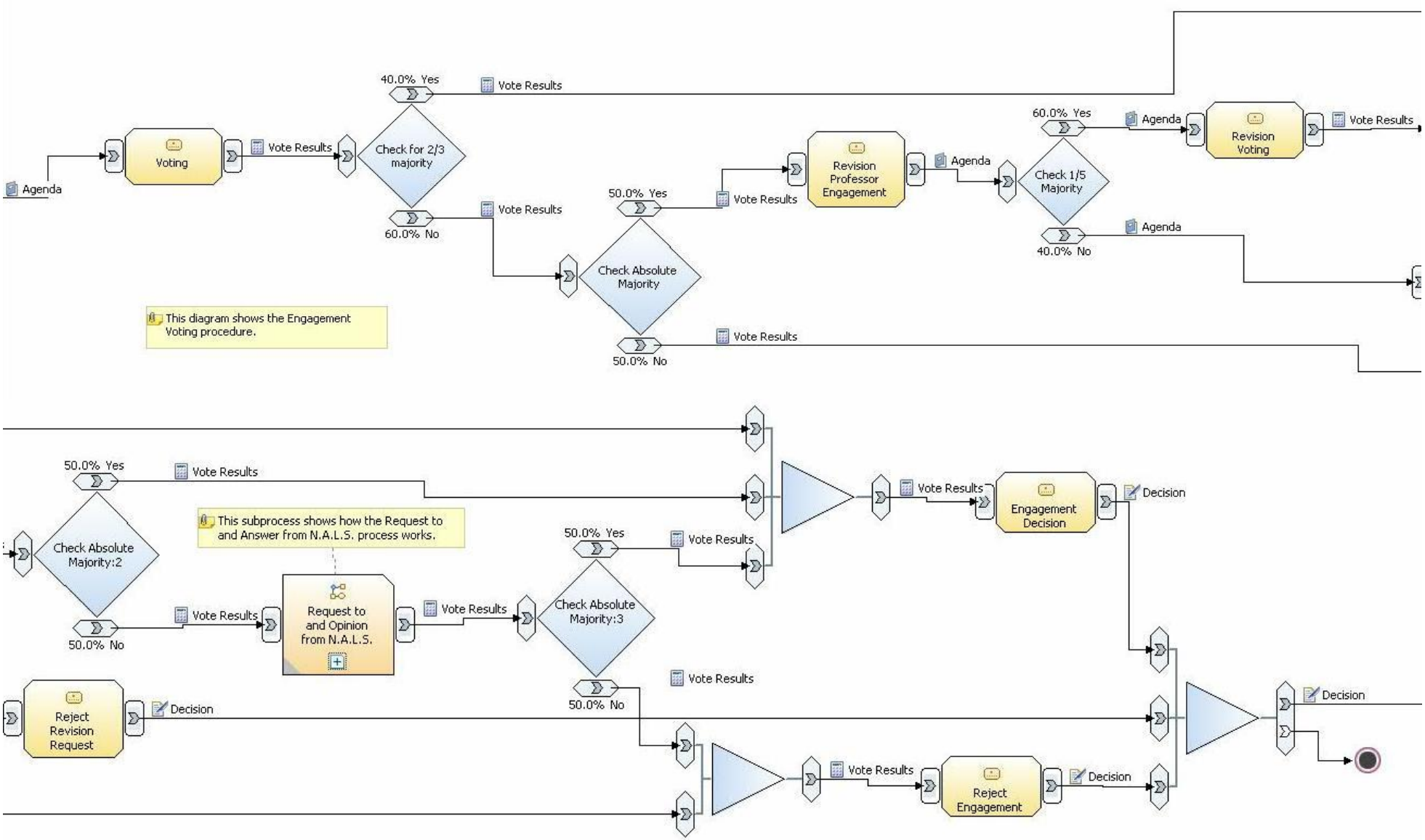


Figure 46: Engagement Voting Embedded Process

5.5.5 Validate the Processes

Creating a valid process is important for simulation and for accurate communication. If there are paths within a model that will never be followed, we have to be aware of this. If the analysis reveals that the input or output criterion of an activity is modelled in such a way that its path is unable to be followed, we can make changes to the model to ensure that the deficiency is corrected.

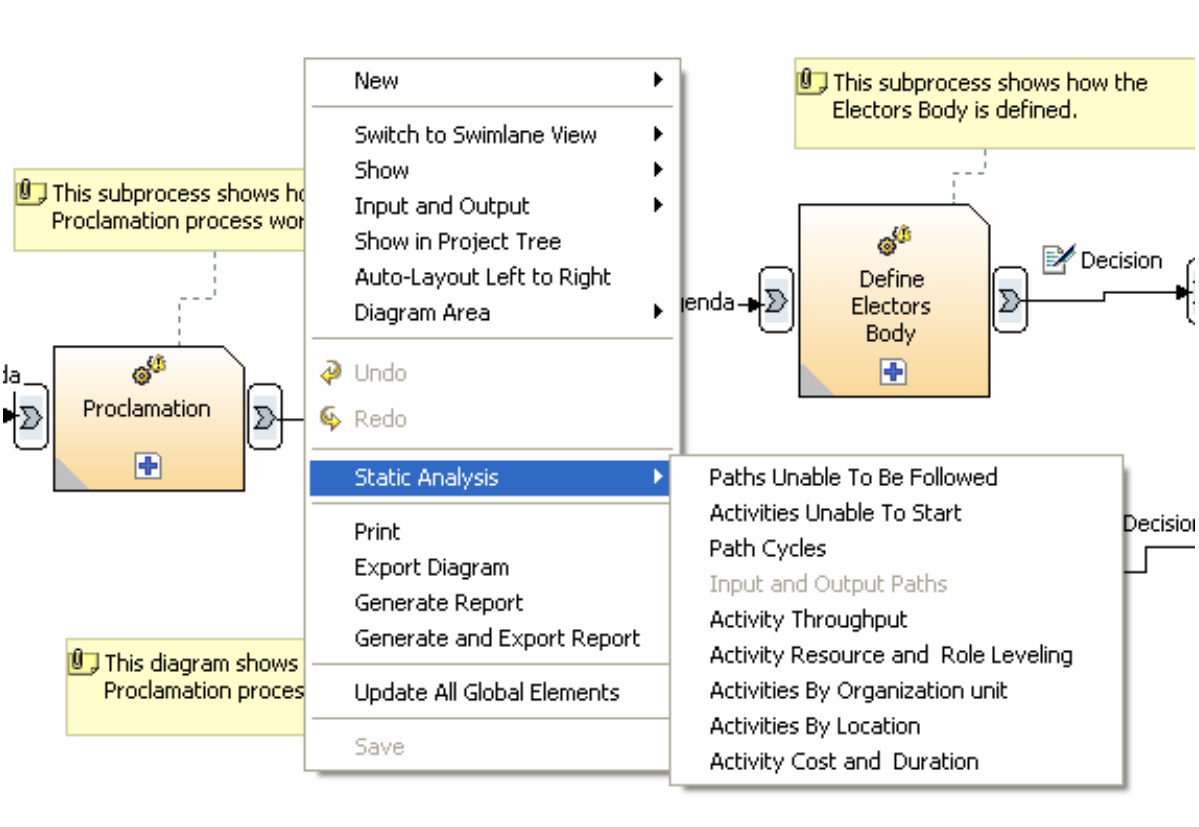


Figure 47: Validate Process

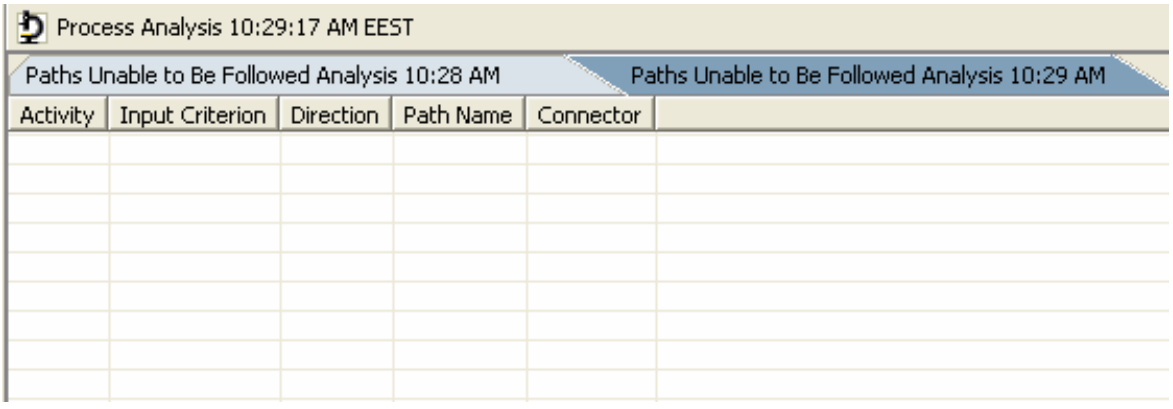


Figure 48: Validate Process Results

The input criterion can be invalid for one of the following reasons:

- No inputs are specified

- One of the inputs of the input criterion does not have an incoming connector.

Now the processes are complete. To validate the process flow, right-click in the diagram area and select *Static Analysis → Paths Unable To Be Followed,* see **Figure 47**. This summary returns a list of the paths within the process that cannot be followed because of an invalid input criterion on an activity in the path. We get an empty summary for every process; see **Figure 48**, so ours processes are fine.

5.6 Simulating and Analysing the Current Processes

This section describes how the current processes are simulated and analyzed in the Modeler. The key to a successful simulation and analyzing of the current process is to describe correctly what information we should gather from the real world business process to simulate a process. These are the major steps to run a simulation of a process:

- Define resources:
  - Corporate strategies or Business objectives.
  - Processes flows, are described at section 5.5.
  - Human resources needs and costs matrix
  - Human resource availability matrix
  - Duration matrix
- Define a simulation profile and attributes related to the simulation runs
- Enter all simulation attributes in the Modeler
- Run a simulation snapshot
- Analyze simulation results

After modelling the business processes, we can use WebSphere Business Modeler to simulate the running of the process. Simulating allows us to assess the performance of the process, generate statistics about its execution, and pinpoint potential areas of improvement. A process simulation is a simulated performance of a real world business process in a virtual environment.

Before simulating the current processes, we have organized workshops with operational officers (Chairman, General Assembly Members and Secretariat Officers) to gather the following information about the real world business process:

5.6.1 Role - Resource Matrix

The role - resource matrix shows the number of people for a specific role and resources assigned to activities. This matrix also shows the cost by roles. Usually the cost is defined by the salary

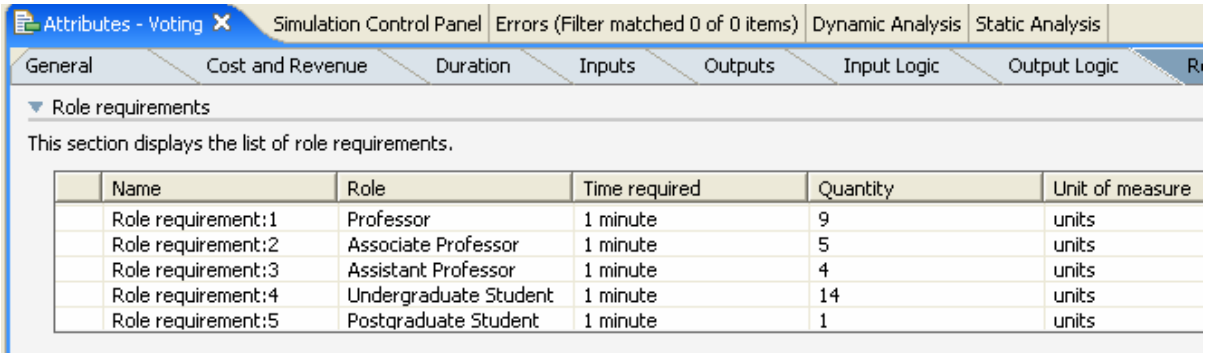
divided by the unit of measure, a month in our case. So we have created the role – resource matrix for every process and subprocess, see Appendix A.

5.6.2 Availability Matrix

The human resources availability matrix shows the timetables assigned to human roles see Appendix A. In our business case, only one timetable named *Day Shift* is used (described as a resource in the 5.3.1).

5.6.3 Duration Matrix

The duration matrix shows the duration of human tasks for a specific role and a specific activity. In this case, there are multiple human roles for one activity, see Appendix A.



Name	Role	Time required	Quantity	Unit of measure
Role requirement:1	Professor	1 minute	9	units
Role requirement:2	Associate Professor	1 minute	5	units
Role requirement:3	Assistant Professor	1 minute	4	units
Role requirement:4	Undergraduate Student	1 minute	14	units
Role requirement:5	Postgraduate Student	1 minute	1	units

Figure 49: Roles Duration and Quantity per Activity

Be careful, the total duration is not equal to the sum of the resources durations, because some resources are used in parallel, see **Figure 49**.

5.6.4 Simulation Profile Information

The assessment of the current processes provides information about the duration of the benchmark to reflect a representative simulation. For ours scenario, we define:

- The number of tokens for the simulation: **10**
  - A token represents a unit of work that is received by a process and transferred between different activities in the process flow. By specifying token creation settings, we define the quantity and rate of inputs that the process handles in a simulation run.
- The maximum duration of the benchmark: **365 days**
  - Specify the maximum duration that a simulation will run. The maximum duration is the real time during which the simulation occurs.

- The start date and time of the simulation: **Monday, September 2, 2006 08:00:00 AM**
    - Specify start and end dates and times to define the virtual time in which the simulation takes place.
- The time measurement unit for results: **Minutes**
    - Select a unit of time that will be used for defining time-related distributions and for recording the results of process simulations.
- The distribution model for requests: **uniform distribution by minutes**
    - Measurements using any variable, even the same variable on the same subject, result in different outcomes. The pattern of different outcomes is called the distribution, which can be described mathematically and graphically. The distribution describes the relative number of times each possible outcome will occur in a number of trials.
- Steady delay for the process: **0 minute**
    - Specify a period which must elapse in the virtual time of a simulation run before statistics gathering begins.
- Method of selecting an output path: **Base on probabilities**
    - Select a method that the process simulator will use to determine which processing path to follow when a process or an activity in a process has more than one set of outputs defined by output criteria.
- Recurring time interval for bundle creation: **15 days**

5.6.5 Populate the simulation environment

Simulation attributes allow us to configure a process so that it behaves in a manner that resembles a real world business process. A simulation environment is divided on four layers:

- The global simulation preferences (select *Windows*® → *Preferences* → *Business modeling* → *Simulation*) hold the default values for the local preferences of any newly created simulation snapshot.
- The local simulation (process default element) preferences are applied as default values for the simulation attributes of any new simulation profiles that we create for the current snapshot.
- The top-level process simulation attributes (process snapshot element) where we define the behaviour of a process as a whole during a simulation.
- The low-level activity simulation attributes (process element or process snapshot element) where we define the behaviour of an activity in a simulation.

5.6.6 Validate the simulation data

We can validate in WebSphere Business Modeler if we have populated all the required information. Select the project and *Static Analysis* → *General Analysis* → *Matrix Analysis* (context) **Figure 50**. This function displays the roles by activities **Figure 51**, **Figure 52**, **Figure 53** and **Figure 54**.

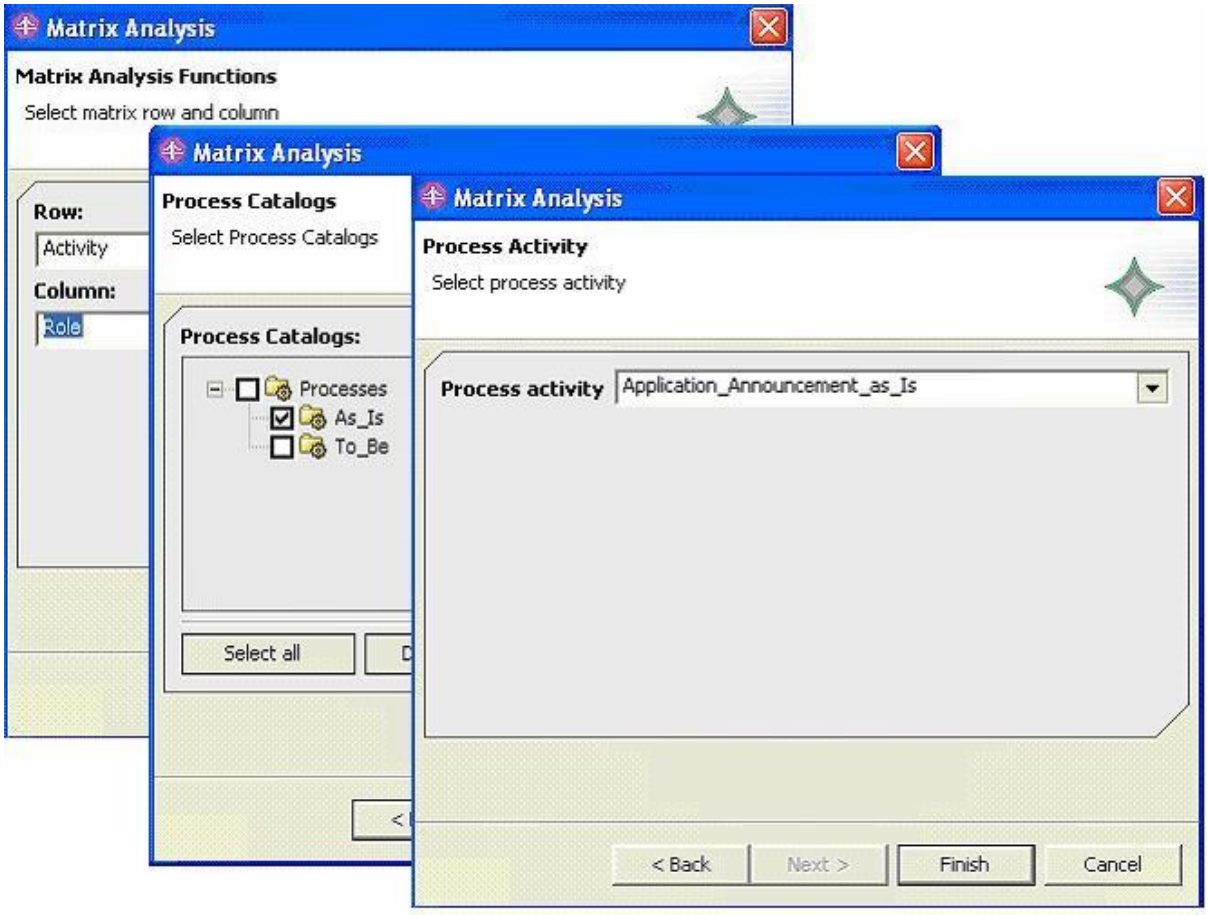


Figure 50: Validate simulation data for Application_Announcement_as_Is Process

Matrix Analysis | Proposal | 10:47 PM | Matrix Analysis | Proposal | 10:49 PM | Matrix A

	Professor	Secretary	Associate Professor	Assistant Professor
Extraordinary_G_A_as_Is				
Convoke General Assembly	1 unit	1 unit		
Reject the Request	9 units	1 unit	5 units	4 units
Chairman Decision	1 unit			
Send Chairman Decision to Dean		1 unit		
Check Majority of 1/3 G.A. Me...				
Convoke General Assembly?				
Dean's Actions				
Merge				

Figure 51: Simulation Data Results for Extraordinary_G_A_as_Is Process

Matrix Analysis | Thesis | 1:00 PM

	Undergraduate Student	Secretary	Professor	Associate Professor	Assistant Professor
Application_Announcement_as_Is					
Undergraduate Recommendation	2 units				
Fork:6					
Submit Election Decision to Ministry of N. E.& R.		1 unit			
Publication Election proceedings		1 unit			
Proclamation					
Define Rang & Sector		1 unit	9 units	5 units	4 units
Notification to National Academy of Letters and Scien...		1 unit			
Send Proclamation to Newspapers		1 unit			
Accept the Request?					
Fork:3					
Send Request to Ministry		1 unit			
Ministry of National Education & Religions Actions					
Decision of proclamation the place		1 unit	9 units	5 units	4 units
National Printing-house					
Decision of not proclamation the place		1 unit	9 units	5 units	4 units
Send Proclamation to National Printing-house		1 unit			
Map					
Recommendation Committee					
Evaluation - Classification of Candidates			3 units		
Submit Evaluation Report to Candidates		1 unit			
Submit Evaluation Report to GA			3 units		
Submit Evaluation Notification to GA			3 units		
Merge					
Report or Notification?					
Candidates Applications & Memos from Secretariat					
Composition of Recommendation Committee		1 unit	9 units	5 units	4 units
Election Voting					
Revision Request			9 units	5 units	4 units
Revision - Voting		1 unit	9 units	5 units	4 units
Merge					
Election Decision		1 unit	9 units	5 units	4 units
Reject Revision Request		1 unit	9 units	5 units	4 units
Check for 1/5 Majority					
Check Absolute Majority					
Check for 2/3 Majority					
Request to and Answer from N.A.L.S.					
Create Request		1 unit	9 units	5 units	4 units
Send request to National Academy of Letters and Sci...		1 unit			
National Academy of Letters and Science Actions					
Voting		1 unit	9 units	5 units	1 unit
Merge:2					
Check Absolute Majority:2					
Reject Election		1 unit	9 units	5 units	4 units
Teachability Evaluation					
Convoke G.A. Session for Election Voting		1 unit	1 unit		
Define Electors Body					
Are 11 Electors?					
Establish Table of Electors		1 unit	9 units	5 units	4 units
Send Request to Ministry		1 unit			
Ministry of National Education & Religions Actions					
Completion of Electors Body		1 unit	9 units	5 units	4 units
Merge					
Define Electors		1 unit	9 units	5 units	4 units
Send G.A. Decision to Electors		1 unit			

Figure 52: Simulation Data Results for Application_Announcement_as_Is Process

Matrix Analysis | Proposal | 10:47 PM | Matrix Analysis | Proposal | 10:49 PM

	Professor	Associate Profe...	Assistant Prof...	Undergraduate S...	Postgraduate S...	Speci...	Secretary	Dean
Chairman_Election_as_Is								
Candidates Applications	2 units							
Vote								
Voting	9 units	5 units	4 units	14 units	1 unit	1 unit	1 unit	
Check Number of Candidates								
Check of 1/3 Majority								
Repeat Voting	9 units	5 units	4 units	14 units	1 unit	1 unit	1 unit	
Check Absolute Majority								
Chairman Election Decision							1 unit	1 unit
Decision of not election							1 unit	1 unit
Merge:2								
Merge:3								
Definition of new date of election							1 unit	1 unit
Send Application for Chairman El...							1 unit	
Dean's Actions								
Convened Electors Body							1 unit	1 unit

Figure 53: Simulation Data Results for Chairman_Election_as_Is Process

Matrix Analysis | Proposal | 10:47 PM | Matrix Analysis | Proposal | 10:49 PM | Matrix Analysis | Proposal | 10

	Professor	Associate Professor	Assistant Professor	Secretary
Professor_Engagement_as_Is				
Check for 1/4 Majority?				
Engagement Voting				
Revision Professor Engagement	9 units	5 units	4 units	
Revision Voting	9 units	5 units	4 units	1 unit
Check Absolute Majority:2				
Merge				
Reject Revision Request	9 units	5 units	4 units	1 unit
Engagement Decision	9 units	5 units	4 units	1 unit
Voting	9 units			1 unit
Check Absolute Majority				
Request to and Opinion from N.A.L.S.				
Create Request	9 units	5 units	4 units	1 unit
Send Request to National Academy of Letters and Sci...				1 unit
National Academy of Letters and Science Actions				
Voting:2	9 units	5 units	4 units	1 unit
Check Absolute Majority:3				
Check for 2/3 majority				
Check 1/5 Majority				
Reject Engagement	9 units	5 units	4 units	1 unit
Merge:3				
Merge:4				
Reject the Engagement	9 units	5 units	4 units	1 unit
Define Electors Body				
Establish Table of Electors	9 units	5 units	4 units	1 unit
Send Request to Ministry				1 unit
Electors Body Definition	9 units	5 units	4 units	1 unit
Completion of Electors Body	9 units	5 units	4 units	1 unit
Merge:3				
Ministry of National Education & Religions Actions				
Are There 7 Professors?				
Send G.A. Decision to Electors				1 unit
Convoke G.A. Session for Engagement	1 unit			1 unit
Merge				

Figure 54: Simulation Data Results for Professor_Engagement_as_Is Process

5.6.7 Simulating the Current Processes

In this section we simulate the current processes and analyze the results. Before running the simulation on our processes, it is necessary to build a simulation snapshot and add information to get an accurate simulation, as described earlier at section 5.6.4.

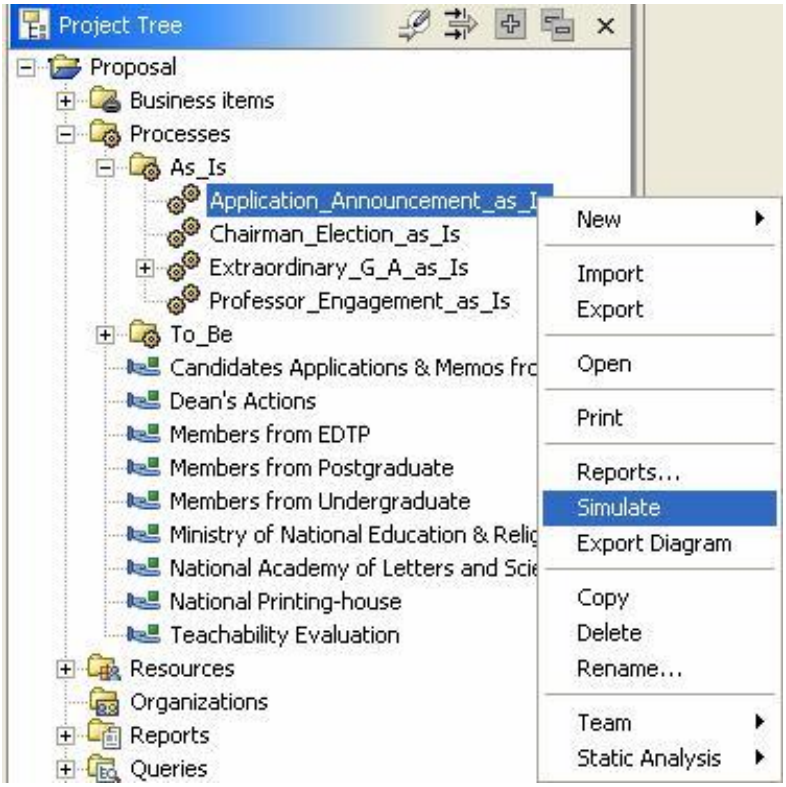


Figure 55: Create Simulation Snapshot

When we simulate a process, the tool adds a simulation snapshot as a child element of the process in the project tree. A simulation snapshot is a record of the complete process model at the moment when we simulated the process.

This record contains a copy of all the elements of our project that the process may use, such as business items, resources, and global tasks. We can create multiple simulation snapshots for the same process after making changes to the project or to the process itself, so that we can compare the effect of these changes. To create a simulation snapshot, select the *Simulate,* see **Figure 55**.

Within the simulation snapshot, the tool also creates two folders:

- **Defaults**: The defaults folder contains a set of local preferences for simulation attributes. When we create a new simulation profile for a simulation snapshot, the values specified in the local preferences are used for the simulation attributes of the process and activities within the process. The initial values of the local preferences are inherited from the global simulation preferences (*Windows → Preferences → Business Modeling → Simulation*).

- **Profile**: Each simulation snapshot contains an initial simulation profile. The simulation profile contains a copy of the process model at the time that we created the simulation snapshot. We customize the process contained in this simulation profile, and we create additional simulation profiles within the same simulation snapshot. Typically, we would create multiple simulation profiles for a simulation snapshot when we are experimenting with changes to the fields in the simulation profile, to determine the effect on process results.

After we create snapshot we have to populate the system with our simulation data. We open the Defaults and specify the values for our simulation as shown in **Figure 56** and **Figure 57**.

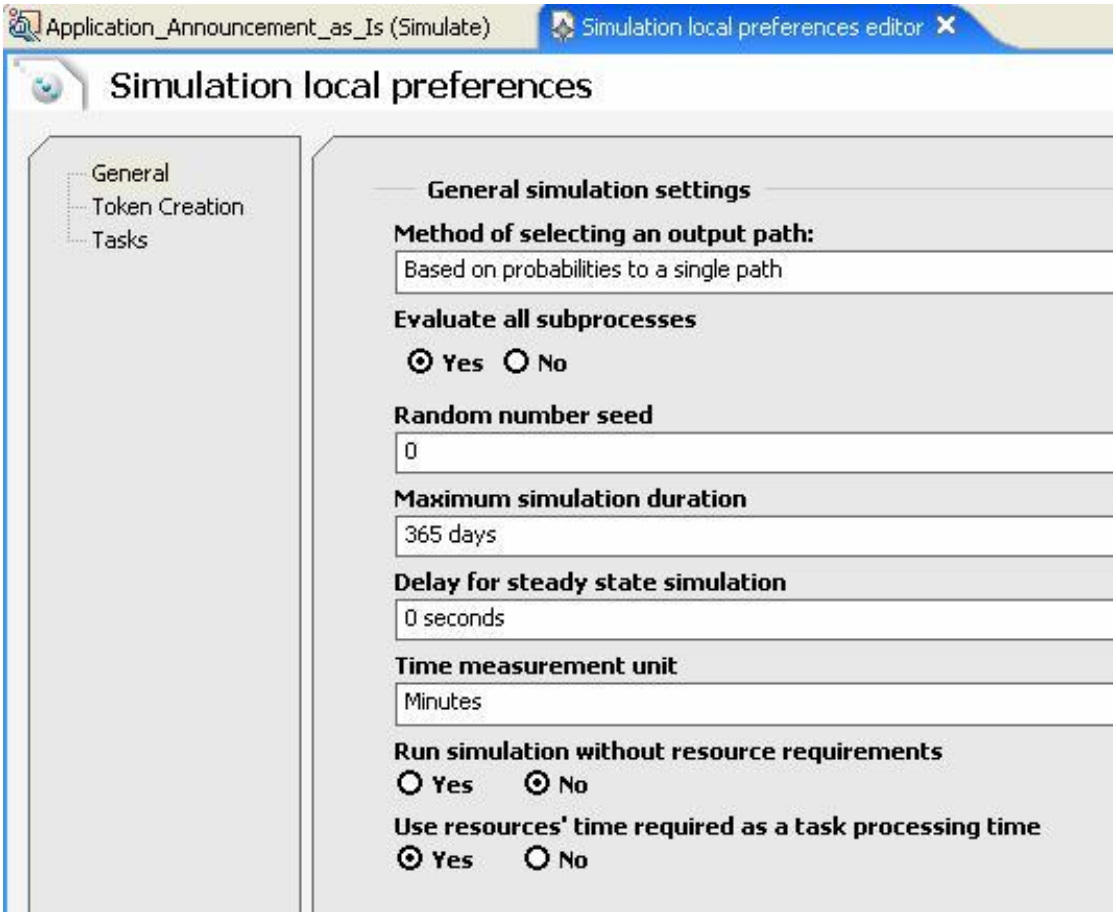


Figure 56: Default simulation Preferences General

- In the *General* tab select:
  - Resource always available: *False*
  - Disable resource allocation: *False*
  - Use resource time: *True*
- In the *Token* tab select:
  - Total number of tokens: **10**
  - Random time trigger: *Uniform distribution* and *Minutes*

- Recurring time interval for bundle creation: **15 days**

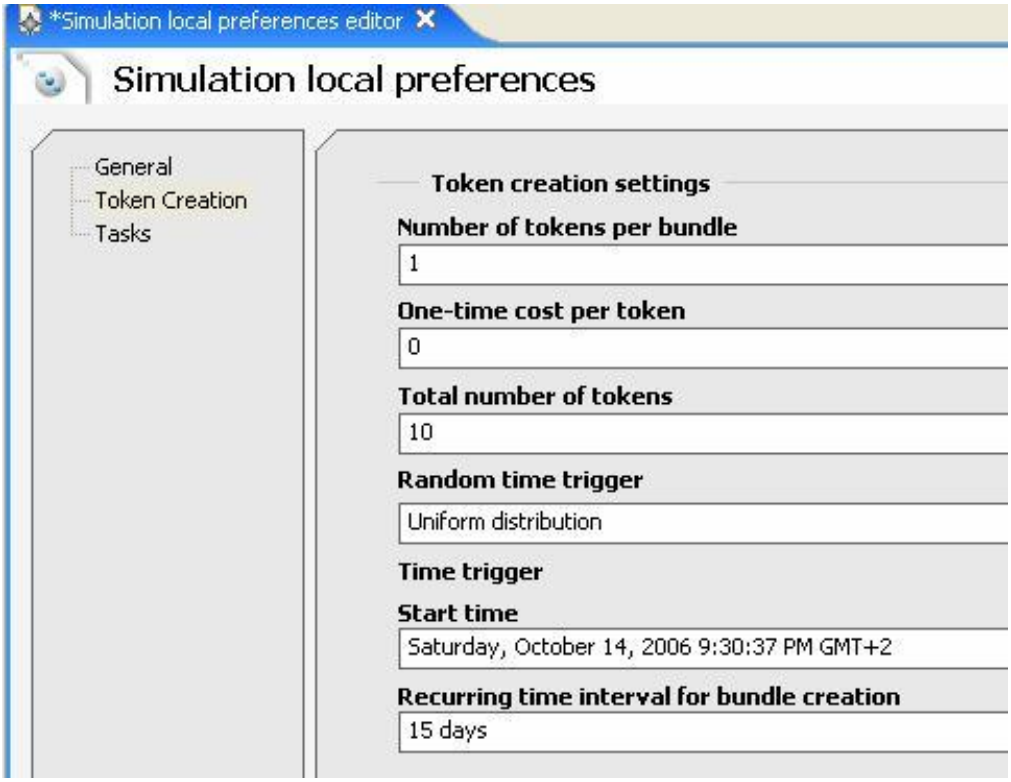


Figure 57: Default simulation Preferences Token Creation

The simulation profile should be open (after creation), but we can also open it from the Project Tree.

- Populate the *General* tab (**Figure 58**):
  - Starting date (GMT-5), and ending date (GMT-5)
  - Evaluate all subprocesses: *Yes*
  - Time measurement unit: *Minutes*
  - Maximum simulation duration: **365 days**
  - Random number seed: **1**
  - Delay of steady state simulation: **0 second**
  - Method of selecting an output path: *Based on probabilities*
  - Resources' time required: *Yes*
- To Populate the *Inputs* tab with the number of tokens, the start time, and interval (**Figure 59**):
  - Total number of tokens: **10**
  - Select the *Time trigger*
  - Start time: same as the process starting date and time zone
  - Recurring time interval: **15 days**

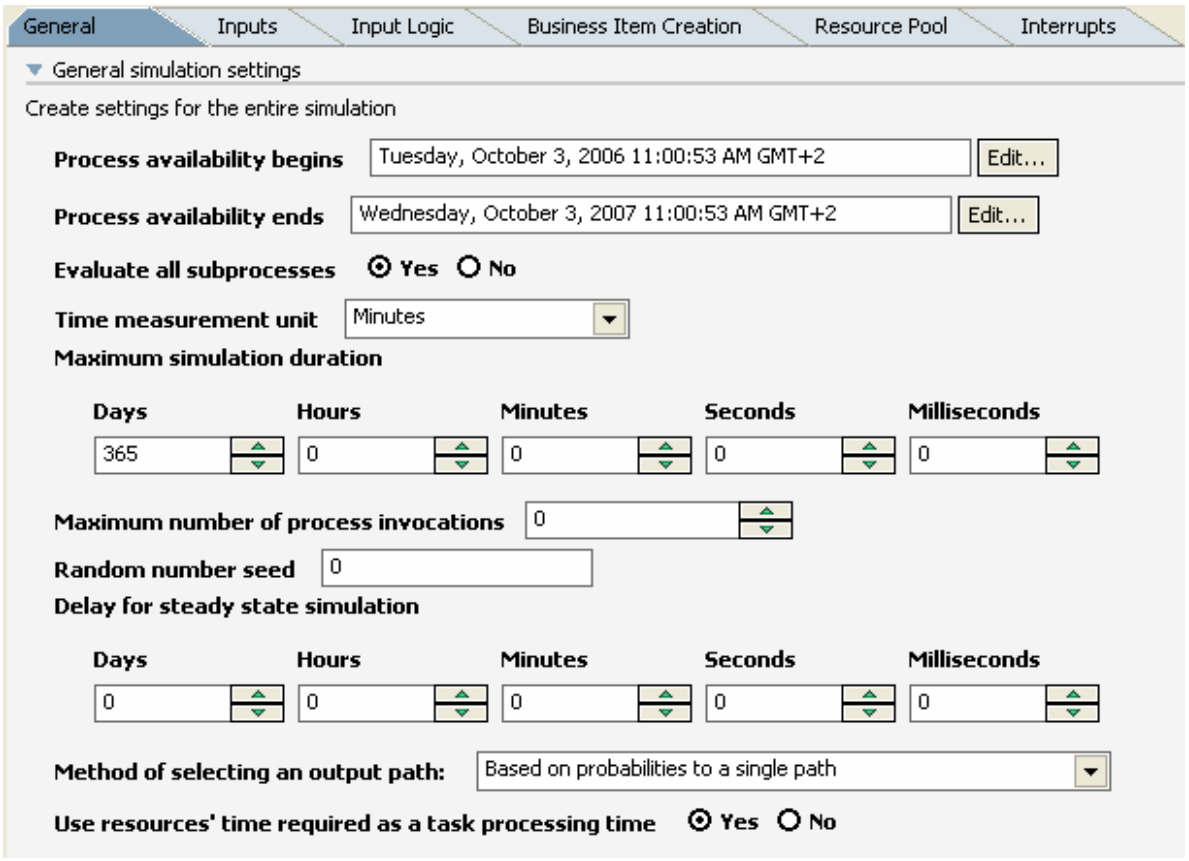


Figure 58: Local simulation Preferences General

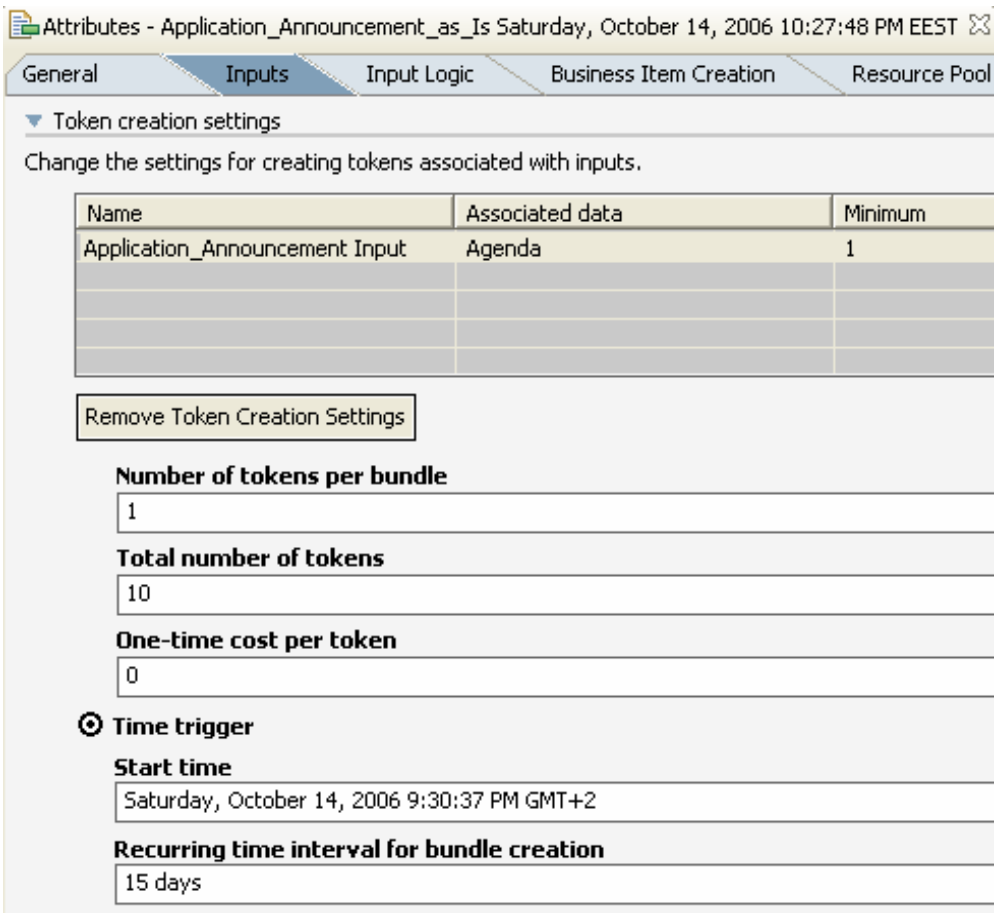


Figure 59: Local simulation Preferences Input

Finally, we populate the number of human resource available in the *Resource pool* tab **(Figure 60)**, for each role or resource we deselect Unlimited and enter the appropriate quantity in the quantity box.

We verify the profile specification by selecting the (Current) Profile and *Profile Analysis → Profile Specification.* Select all processes when prompted. The profile specification (**Figure 61** and **Figure 62**) lists all the processes with the resources that are used and the duration of each resource.

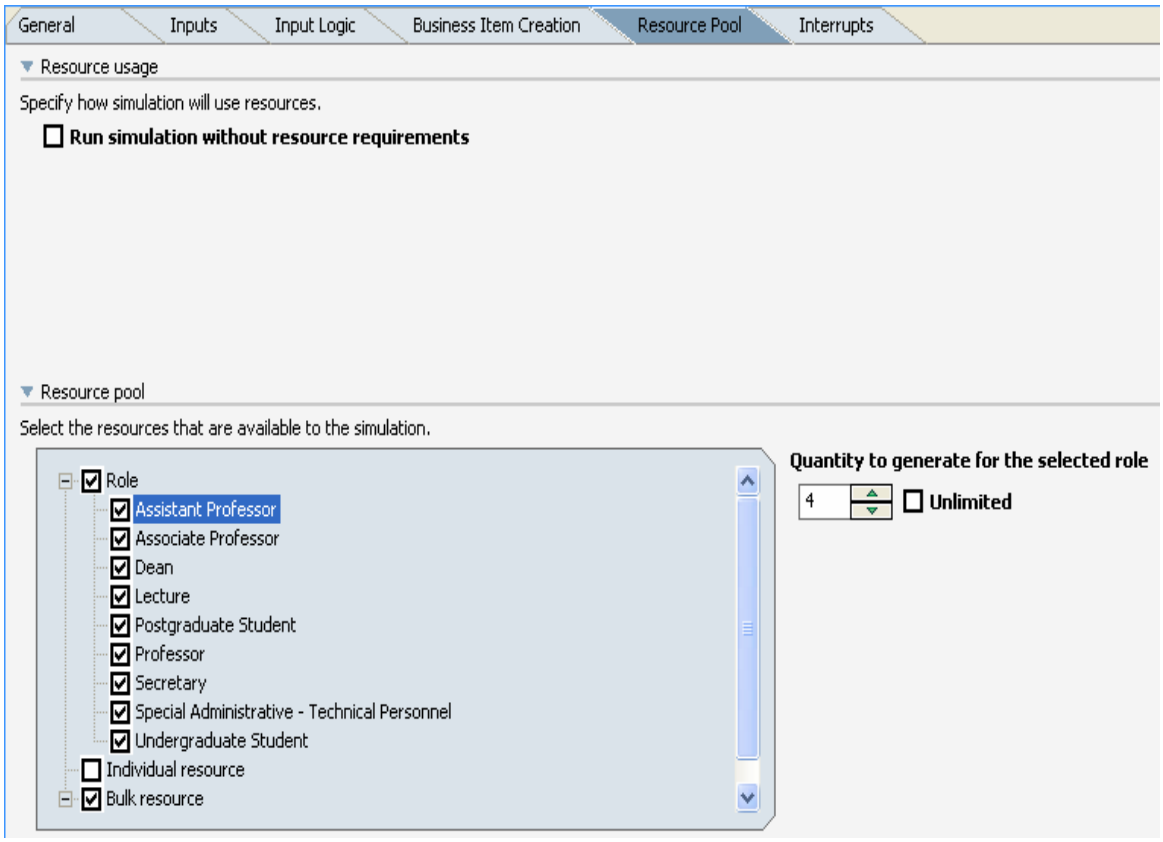


Figure 60: Local simulation Preferences Resource Poll

Profile Specification | Chairman_Election_as_Is Saturday, October 14, 2006 10:26:32 PM EEST | 11:06 PM — Profile Specification | Extraordi

Activity Name	Activity Duration	Requirement Type	Resource or Role Name	Requirement Duration	Quantity	Quant
Chairman Decision	1 second					
		Role	Professor	20 minutes	1	unit
Check Majority of 1/3 G.A. Members						
Convoke General Assembly	1 second					
		Role	Professor	1 hour	1	unit
		Role	Secretary	1 hour	1	unit
Convoke General Assembly?						
Dean's Actions	1 second					
Reject the Request	1 second					
		Role	Professor	15 minutes	9	unit
		Role	Associate Professor	15 minutes	5	unit
		Role	Assistant Professor	15 minutes	4	unit
		Role	Secretary	15 minutes	1	unit
Send Chairman Decision to Dean	1 second					
		Role	Secretary	30 minutes	1	unit

Figure 61: Verify the Profile Specification for Extraordinary_G_A_as_Is Process

Profile Specification | Chairman_Election_as_Is Saturday, October 14, 2006 10:26:32 PM EEST | 11:06:56 PM EEST

Profile Specification | Chairman_Election_as_Is Saturday, October 14, 2006 10:26:32 PM EEST | 11:06 PM

Activity Name	Activity Duration	Requirement Type	Resource or Role Name	Requirement Duration	Quantity	Quanl
Candidates Applications	1 second					
		Role	Professor	15 minutes	2	unit
Convened Electors Body	1 second					
		Role	Dean	30 minutes	1	unit
		Role	Secretary	30 minutes	1	unit
Dean's Actions	1 second					
Send Application for Chairman Election	1 second					
		Role	Secretary	30 minutes	1	unit
Vote						
Vote/Chairman Election Decision	1 second					
		Role	Dean	30 minutes	1	unit
		Role	Secretary	30 minutes	1	unit
Vote/Check Absolute Majority						
Vote/Check Number of Candidates						
Vote/Check of 1/3 Majority						
Vote/Decision of not election	1 second					
		Role	Dean	30 minutes	1	unit
		Role	Secretary	30 minutes	1	unit
Vote/Definition of new date of election	1 second					
		Role	Dean	30 minutes	1	unit
		Role	Secretary	30 minutes	1	unit
Vote/Repeat Voting	1 second					
		Role	Professor	1 minute	9	unit
		Role	Associate Professor	1 minute	5	unit
		Role	Assistant Professor	1 minute	4	unit
		Role	Undergraduate Student	1 minute	14	unit
		Role	Postgraduate Student	1 minute	1	unit
		Role	Special Administrative - Technical Personnel	1 minute	1	unit
		Role	Secretary	5 minutes	1	unit
Vote/Voting	1 second					
		Role	Professor	1 minute	9	unit
		Role	Associate Professor	1 minute	5	unit
		Role	Assistant Professor	1 minute	4	unit
		Role	Undergraduate Student	1 minute	14	unit
		Role	Postgraduate Student	1 minute	1	unit
		Role	Special Administrative - Technical Personnel	1 minute	1	unit
		Role	Secretary	5 minutes	1	unit

Figure 62: Verify the Profile Specification for Chairman_Election_as_Is Process

We are now ready to run the simulation. Open the *Simulation Control Panel* view (**Figure 63**) behind the Attributes area, and click the green arrow icon to start the simulation. The system shows the token moving in the flow and the list of process instances (**Figure 64**). At this point, we might pause, stop, or step through the simulation.

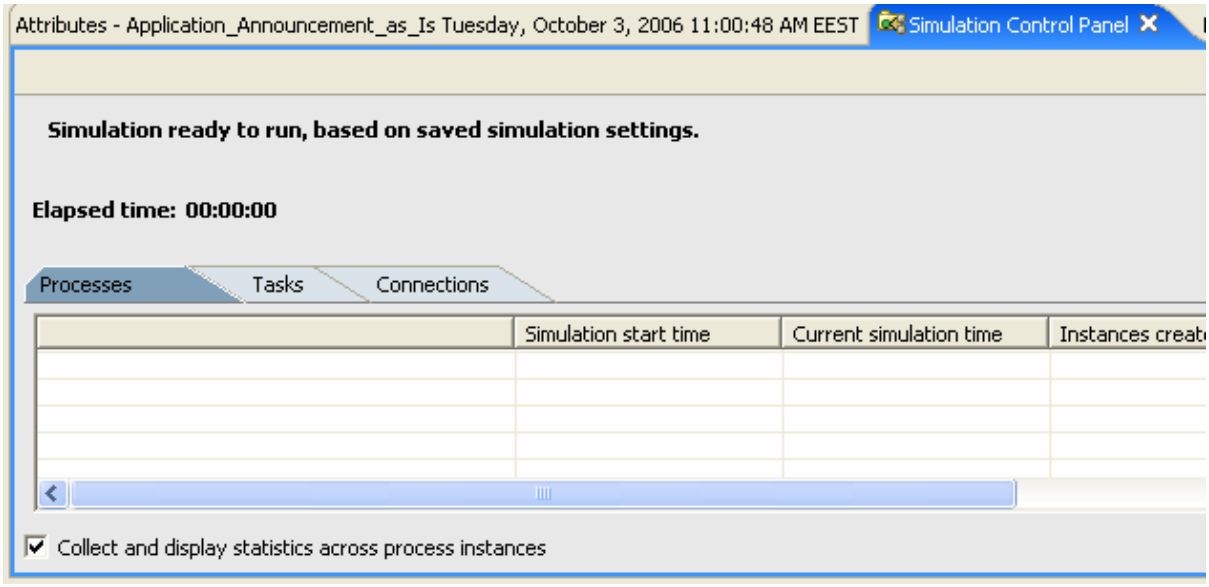


Figure 63: Simulation Control Panel

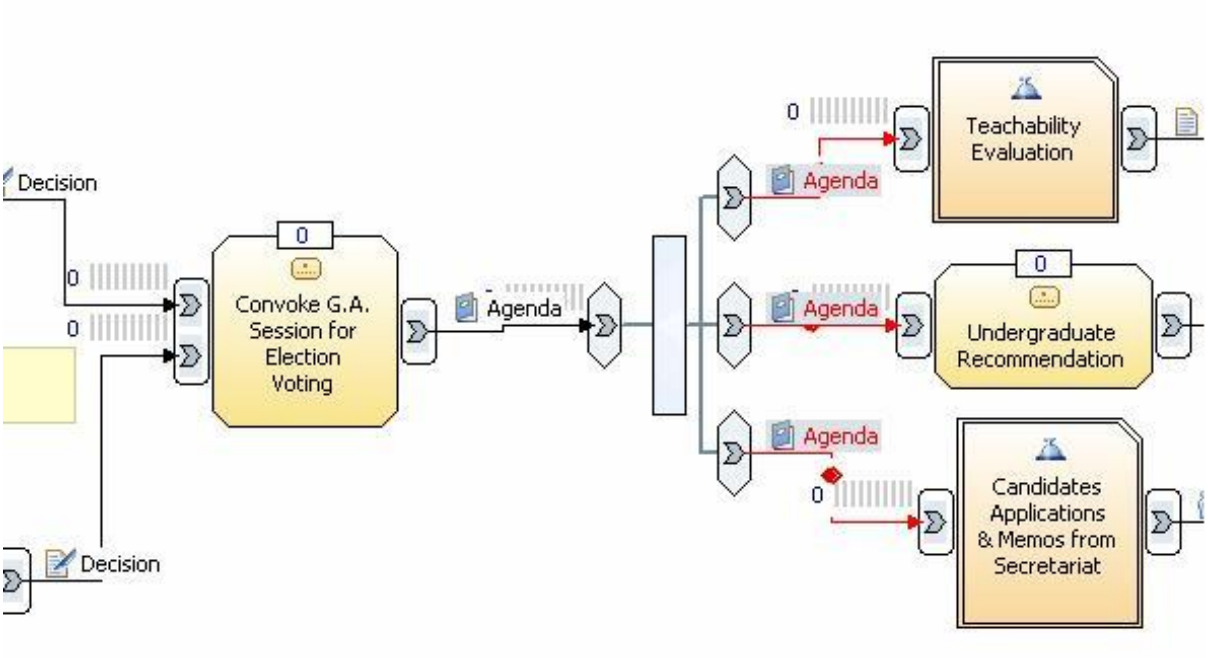


Figure 64: Simulation Running

5.6.8 Analysing the simulation results

Once the simulation is complete, we use the dynamic analysis function on the simulation result element (**Figure 65**). For the current case, we need four categories of the process:

- Process duration
- Process cases summary
- Resource usage

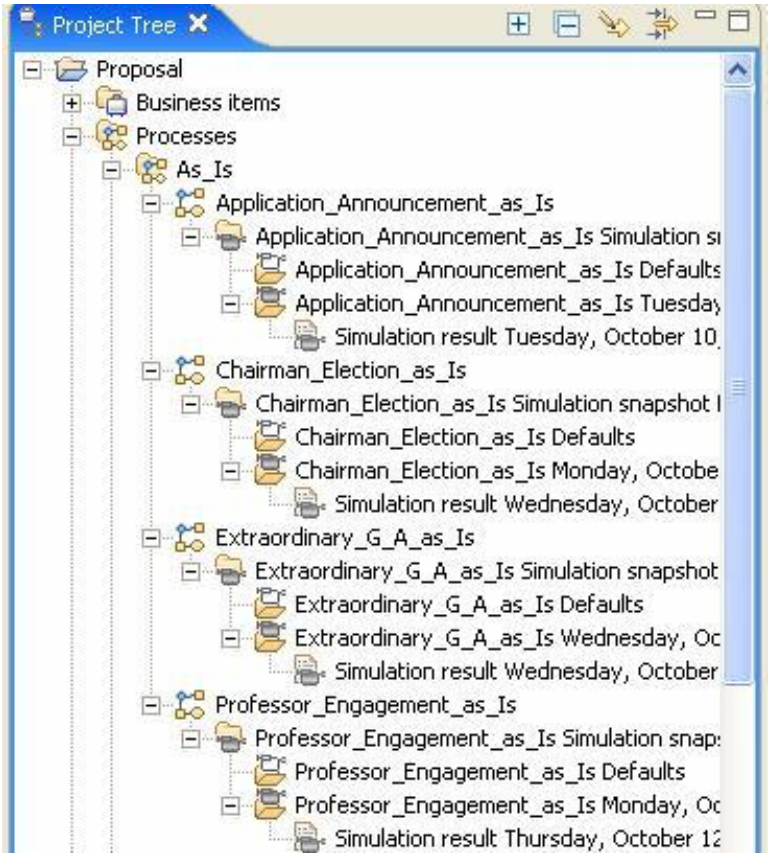


Figure 65: Simulation Snapshots results

5.6.8.1 Process duration

To get the process duration information, select the simulation result element and *Dynamic Analysis → Process Cases Analysis → Process Duration*. This analysis shows process elapsed duration and throughput details for each process case in a simulation.

Process elapsed duration is the duration that a process case takes if started at a specific time and date. Process elapsed duration includes transfer times between activities and the elapsed durations of all activities on the critical path. The critical path is defined as the processing path that has the longest duration of all parallel paths in the process case. Calculations are performed per case by getting the simple average of the process instances duration records in a case.

We use this analysis to examine process level processing durations and throughputs for each generated process case. We have determined that the **average throughput** in particular processes cases is unacceptably low. In the summaries of the processes instances analysis shows:

- Eight cases that reflect eight different ways of processing in ***Application_Announcement_as_Is*** process (**Figure 66**) also Case 2 and 4 have low average throughput.

- Four cases that reflect four different ways of processing in ***Chairman_Election_as_Is*** process (**Figure 67**) also Case 2 and 4 have low average throughput.
- Three cases that reflect three different ways of processing in ***Extraordinary_G_A_as_Is*** process (**Figure 68**) also Case 1 and 3 have low average throughput.
- Seven cases that reflect seven different ways of processing in ***Professor_Engagement_as_Is*** process (**Figure 69**) also Case 1 and 3 have low average throughput.

As a result of reviewing the information that this analysis presents, we may decide the **need of modifying the process model** or **reset resource levels**, or to investigate further with another type of process case analysis such as process resource analysis.

One of the goals of the improvement will be to increase the average throughput and the decrease the average elapse duration.

After detecting abnormal behaviours and bottlenecks in these results, we should have to analyze the worst cases to figure out the resource problem. Now we know that we cannot sustain the current process in the long run.

Process Duration | Simulation result... Resource Usage | Simulation result ... Process Cost | Simulation result Mo... Process C

Case Name	Distribution	Success Status	Average Elapsed Duration	Average Throughput
Case 1	10.00%	Succeeded	4 days 20 hours 4 minutes 27 seconds	0.008615 work items / hour
Case 2	20.00%	Failed	60 days 13 hours 49 minutes 24 seconds	0.000688 work items / hour
Case 3	10.00%	Succeeded	6 days 12 hours 59 minutes 28 seconds	0.006370 work items / hour
Case 4	20.00%	Succeeded	9 days 19 hours 49 minutes 27 seconds	0.004240 work items / hour
Case 5	20.00%	Succeeded	5 days 20 hours 44 minutes 28 seconds	0.007105 work items / hour
Case 6	10.00%	Succeeded	4 days 19 hours 49 minutes 27 seconds	0.008634 work items / hour
Case 7	10.00%	Succeeded	4 days 13 hours 4 minutes 28 seconds	0.009168 work items / hour
Weighted Average			17 days 7 hours 52 minutes 26.8 seconds	0.002405 work items / hour

Figure 66: Process Duration Analysis of Application_Announcement_as_Is process

Process Cases Summary | Simulatio... Process Cases Summary | Simulatio... Process Cases Summary | Simulatio... Process

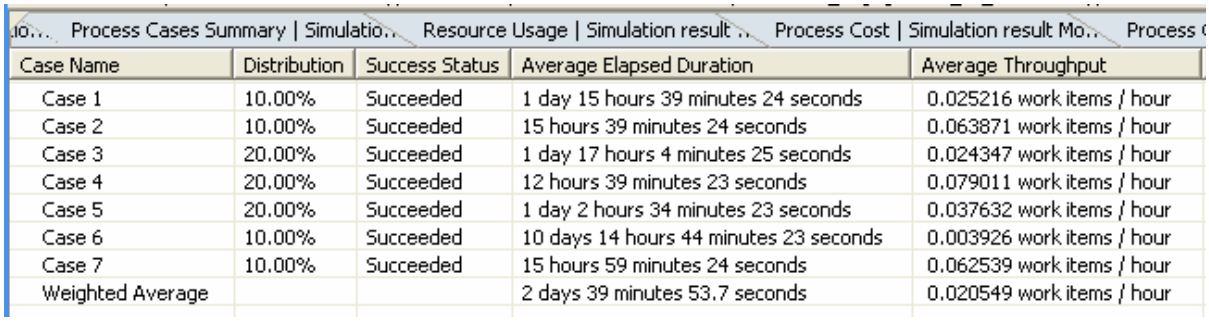
Case Name	Distribution	Success Status	Average Elapsed Duration	Average Throughput
Case 1	30.00%	Succeeded	22 hours 24 minutes 24 seconds	0.044630 work items / hour
Case 2	20.00%	Succeeded	14 hours 49 minutes 24 seconds	0.067461 work items / hour
Case 3	40.00%	Succeeded	1 day 8 hours 19 minutes 24 seconds	0.030937 work items / hour
Case 4	10.00%	Succeeded	10 days 14 hours 19 minutes 24 seconds	0.003932 work items / hour
Weighted Average			2 days 2 minutes 54 seconds	0.020812 work items / hour

Figure 67: Process Duration Analysis of Chairman_Election_as_Is process

Process Cost | Simulation result Mo... Process Cases Summary | Simulatio... Process Cases Summary | Simulatio... Pro

Case Name	Distribution	Success Status	Average Elapsed Duration	Average Throughput
Case 1	40.00%	Succeeded	2 days 7 hours 50 minutes 3 seconds	0.017910 work items / hour
Case 2	20.00%	Succeeded	45 minutes 3 seconds	1.331853 work items / hour
Case 3	40.00%	Succeeded	7 hours 20 minutes 4 seconds	0.136343 work items / hour
Weighted Average			1 day 1 hour 25 minutes 3.4 seconds	0.039343 work items / hour

Figure 68: Process Duration Analysis of Extraordinary_G_A_as_Is process



Process Cases Summary | Simulatio... Resource Usage | Simulation result ... Process Cost | Simulation result Mo... Process

Case Name	Distribution	Success Status	Average Elapsed Duration	Average Throughput
Case 1	10.00%	Succeeded	1 day 15 hours 39 minutes 24 seconds	0.025216 work items / hour
Case 2	10.00%	Succeeded	15 hours 39 minutes 24 seconds	0.063871 work items / hour
Case 3	20.00%	Succeeded	1 day 17 hours 4 minutes 25 seconds	0.024347 work items / hour
Case 4	20.00%	Succeeded	12 hours 39 minutes 23 seconds	0.079011 work items / hour
Case 5	20.00%	Succeeded	1 day 2 hours 34 minutes 23 seconds	0.037632 work items / hour
Case 6	10.00%	Succeeded	10 days 14 hours 44 minutes 23 seconds	0.003926 work items / hour
Case 7	10.00%	Succeeded	15 hours 59 minutes 24 seconds	0.062539 work items / hour
Weighted Average			2 days 39 minutes 53.7 seconds	0.020549 work items / hour

Figure 69: Process Duration Analysis of Professor_Engagement_as_Is process

5.6.8.2 Process Cases Summary

To see the process cases summary, select simulation result element and *Dynamic Analysis → Process Cases Analysis → Process Cases Summary*. The process cases summary analysis (**Figure 70**, **Figure 71**, **Figure 72** and **Figure 73**) shows summary details for all the process cases produced during the simulation of a process. A process case is defined as a set of process instances that have the same processing path.

We use this analysis to have an overview of the process cases generated in a simulation. This analysis provides high level summary information for each process case, including duration and cost information and an indicator whether the process case was successful or not. This analysis lists the activities completed in each case and quantifies their ***average total cost*** and ***average total elapsed duration***.

We have determined that ***the average process elapsed duration*** in the above particular process cases is unacceptably high**.** Alternatively, we investigate the reasons that cause a particular process case to fail.

We analyze details of the two worst cases of each process, so we can see what the time consuming activities are. We have found that the high consuming activities are:

- The ***Application_Announcement_as_Is*** process (**Figure 75** and **Figure 76**) contains the Proclamation subprocess, where the Decision of proclamation the place, Decision of not proclamation the place, Notification to National Academy of Letters and Sciences, Send Proclamation to Newspapers and Send Proclamation to National Printing-house are the consuming activities, Define Electors Body subprocess, where the Establish Table of Electors, Send Request to Ministry, Completion of Electors Body and Send G.A. Decision to Electors are the consuming activities, the Convoke G.A. Session for Election and the Composition of Recommendatory Committee are the consuming activities. This is the first bottleneck of the current process.

- The ***Chairman_Election_as_Is*** process (**Figure 77**) contains the Send Application for Chairman Election, the Candidates Applications, the Convened Electors Body and the Vote subprocess where the Decision of not election, Definition of new date of election and Chairman Election Decision are the consuming activities. This is the first bottleneck of this process.
- The ***Extraordinary_G_A_as_Is*** process (**Figure 74**) contains the Chairman Decision and the Send Chairman Decision consuming activities. This is the first bottleneck of this process.
- The ***Professor_Engagement_as_Is*** process (**Figure 78**) contains the Define Electors Body subprocess, where the Establish Table of Electors, Send Request to Ministry, Completion of Electors Body and Send G.A. Decision to Electors are the consuming activities, and the Convoke G.A. Session for Engagement are the consuming activities. This is the first bottleneck of this process.

The Define Electors body is a heavy time-consuming activity which is used in the ***Application_Announcement_as_Is*** and in the ***Professor_Engagement_as_Is*** processes. The above delays are caused by the process, requiring lot of time to the secretary. The process cases summary enables us to assign the delays to the enter order information and account number activities. Now we have to look inside those activities to figure out which resource is an issue.

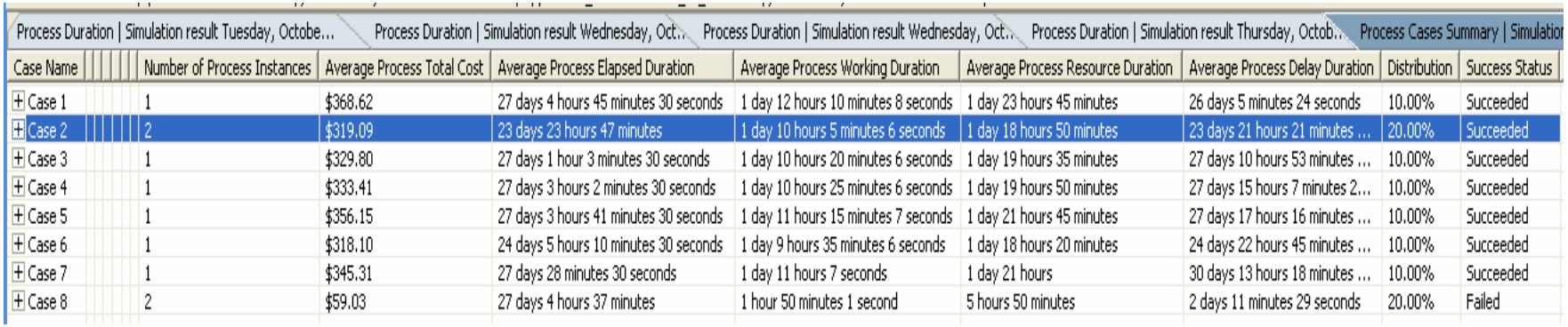
5.6.8.3 Resource Usage

To see the resource usage, select the simulation result element and *Dynamic Analysis → Aggregated Analysis → Resource Usage*. This analysis shows information about usage of each resource that is allocated in a process simulation.

This analysis helps in resource planning as it enables us to see how each resource is allocated to different activities across the process. In addition to showing how a resource uses its time to accomplish one or more activities, this analysis shows where shortages of resources cause delays in completing activities. We can use this information to determine where additional resources are required.

We take a look on the above described activities (**Figure 79**) to identify which resources to analyze where the secretary resource is used. We have to look in the resource usage analysis if this resource has high shortage duration.

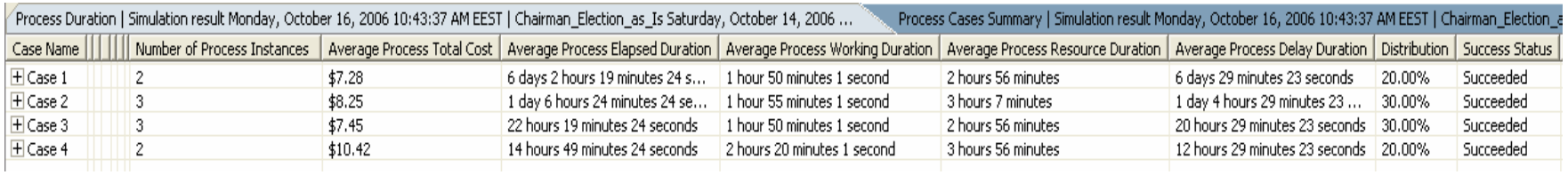
The resource usage sheets are shown in **Figure 80**, **Figure 81**, **Figure 82** and **Figure 83**, shows the exponential growth of the shortage duration for the secretary in all processes. This demonstrates that the secretary is really the bottleneck of the processes.



Process Duration | Simulation result Tuesday, Octobe... | Process Duration | Simulation result Wednesday, Oct... | Process Duration | Simulation result Wednesday, Oct... | Process Duration | Simulation result Thursday, Octob... | Process Cases Summary | Simulatior

Case Name	Number of Process Instances	Average Process Total Cost	Average Process Elapsed Duration	Average Process Working Duration	Average Process Resource Duration	Average Process Delay Duration	Distribution	Success Status
Case 1	1	$368.62	27 days 4 hours 45 minutes 30 seconds	1 day 12 hours 10 minutes 8 seconds	1 day 23 hours 45 minutes	26 days 5 minutes 24 seconds	10.00%	Succeeded
Case 2	2	$319.09	23 days 23 hours 47 minutes	1 day 10 hours 5 minutes 6 seconds	1 day 18 hours 50 minutes	23 days 21 hours 21 minutes ...	20.00%	Succeeded
Case 3	1	$329.80	27 days 1 hour 3 minutes 30 seconds	1 day 10 hours 20 minutes 6 seconds	1 day 19 hours 35 minutes	27 days 10 hours 53 minutes ...	10.00%	Succeeded
Case 4	1	$333.41	27 days 3 hours 2 minutes 30 seconds	1 day 10 hours 25 minutes 6 seconds	1 day 19 hours 50 minutes	27 days 15 hours 7 minutes 2...	10.00%	Succeeded
Case 5	1	$356.15	27 days 3 hours 41 minutes 30 seconds	1 day 11 hours 15 minutes 7 seconds	1 day 21 hours 45 minutes	27 days 17 hours 16 minutes ...	10.00%	Succeeded
Case 6	1	$318.10	24 days 5 hours 10 minutes 30 seconds	1 day 9 hours 35 minutes 6 seconds	1 day 18 hours 20 minutes	24 days 22 hours 45 minutes ...	10.00%	Succeeded
Case 7	1	$345.31	27 days 28 minutes 30 seconds	1 day 11 hours 7 seconds	1 day 21 hours	30 days 13 hours 18 minutes ...	10.00%	Succeeded
Case 8	2	$59.03	27 days 4 hours 37 minutes	1 hour 50 minutes 1 second	5 hours 50 minutes	2 days 11 minutes 29 seconds	20.00%	Failed

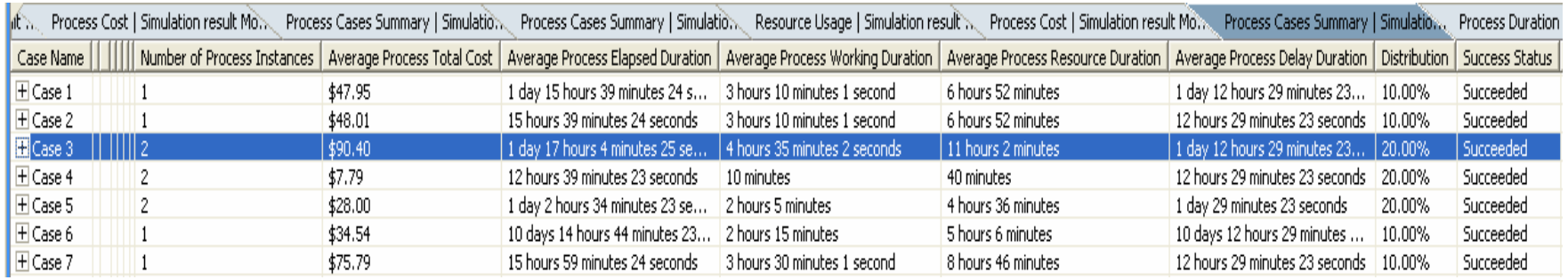
Figure 70: Process Cases Summary of Application_Announcement_as_Is process



Process Duration | Simulation result Monday, October 16, 2006 10:43:37 AM EEST | Chairman_Election_as_Is Saturday, October 14, 2006 ... | Process Cases Summary | Simulation result Monday, October 16, 2006 10:43:37 AM EEST | Chairman_Election_a

Case Name	Number of Process Instances	Average Process Total Cost	Average Process Elapsed Duration	Average Process Working Duration	Average Process Resource Duration	Average Process Delay Duration	Distribution	Success Status
Case 1	2	$7.28	6 days 2 hours 19 minutes 24 s...	1 hour 50 minutes 1 second	2 hours 56 minutes	6 days 29 minutes 23 seconds	20.00%	Succeeded
Case 2	3	$8.25	1 day 6 hours 24 minutes 24 se...	1 hour 55 minutes 1 second	3 hours 7 minutes	1 day 4 hours 29 minutes 23 ...	30.00%	Succeeded
Case 3	3	$7.45	22 hours 19 minutes 24 seconds	1 hour 50 minutes 1 second	2 hours 56 minutes	20 hours 29 minutes 23 seconds	30.00%	Succeeded
Case 4	2	$10.42	14 hours 49 minutes 24 seconds	2 hours 20 minutes 1 second	3 hours 56 minutes	12 hours 29 minutes 23 seconds	20.00%	Succeeded

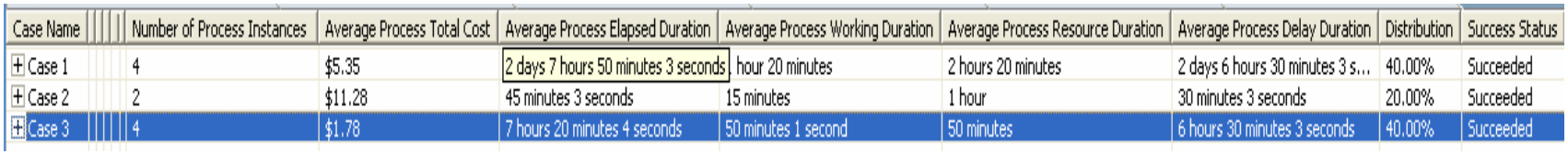
Figure 71: Process Cases Summary of Chairman_Election_as_Is process



Process Cost | Simulation result Mo... | Process Cases Summary | Simulatio... | Process Cases Summary | Simulatio... | Resource Usage | Simulation result ... | Process Cost | Simulation result Mo... | Process Cases Summary | Simulatio... | Process Duration

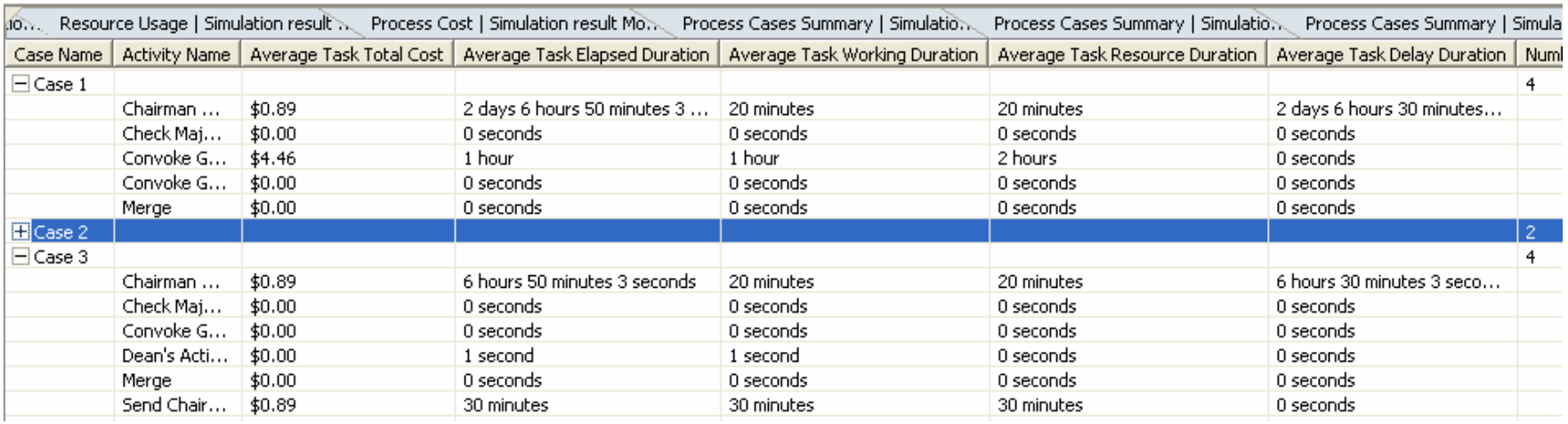
Case Name	Number of Process Instances	Average Process Total Cost	Average Process Elapsed Duration	Average Process Working Duration	Average Process Resource Duration	Average Process Delay Duration	Distribution	Success Status
Case 1	1	$47.95	1 day 15 hours 39 minutes 24 s...	3 hours 10 minutes 1 second	6 hours 52 minutes	1 day 12 hours 29 minutes 23...	10.00%	Succeeded
Case 2	1	$48.01	15 hours 39 minutes 24 seconds	3 hours 10 minutes 1 second	6 hours 52 minutes	12 hours 29 minutes 23 seconds	10.00%	Succeeded
Case 3	2	$90.40	1 day 17 hours 4 minutes 25 se...	4 hours 35 minutes 2 seconds	11 hours 2 minutes	1 day 12 hours 29 minutes 23...	20.00%	Succeeded
Case 4	2	$7.79	12 hours 39 minutes 23 seconds	10 minutes	40 minutes	12 hours 29 minutes 23 seconds	20.00%	Succeeded
Case 5	2	$28.00	1 day 2 hours 34 minutes 23 se...	2 hours 5 minutes	4 hours 36 minutes	1 day 29 minutes 23 seconds	20.00%	Succeeded
Case 6	1	$34.54	10 days 14 hours 44 minutes 23...	2 hours 15 minutes	5 hours 6 minutes	10 days 12 hours 29 minutes ...	10.00%	Succeeded
Case 7	1	$75.79	15 hours 59 minutes 24 seconds	3 hours 30 minutes 1 second	8 hours 46 minutes	12 hours 29 minutes 23 seconds	10.00%	Succeeded

Figure 72: Process Cases Summary of Professor_Engagement_as_Is process



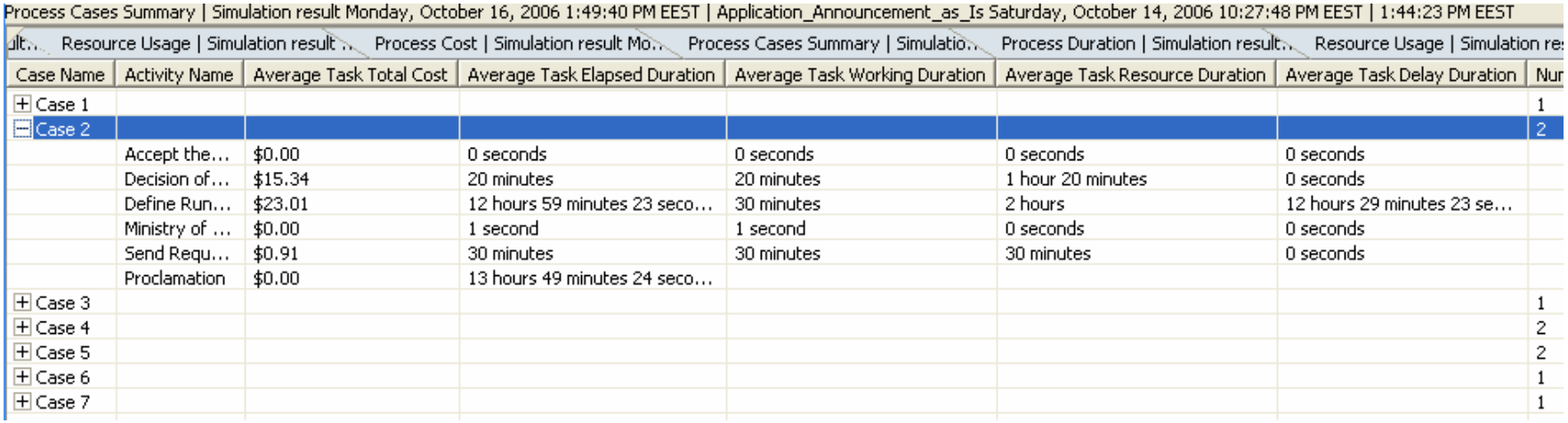
Case Name	Number of Process Instances	Average Process Total Cost	Average Process Elapsed Duration	Average Process Working Duration	Average Process Resource Duration	Average Process Delay Duration	Distribution	Success Status
Case 1	4	$5.35	2 days 7 hours 50 minutes 3 seconds	hour 20 minutes	2 hours 20 minutes	2 days 6 hours 30 minutes 3 s...	40.00%	Succeeded
Case 2	2	$11.28	45 minutes 3 seconds	15 minutes	1 hour	30 minutes 3 seconds	20.00%	Succeeded
Case 3	4	$1.78	7 hours 20 minutes 4 seconds	50 minutes 1 second	50 minutes	6 hours 30 minutes 3 seconds	40.00%	Succeeded

Figure 73: Process Cases Summary of Extraordinary_G_A_as_Is process



Case Name	Activity Name	Average Task Total Cost	Average Task Elapsed Duration	Average Task Working Duration	Average Task Resource Duration	Average Task Delay Duration	Numl
Case 1							4
	Chairman ...	$0.89	2 days 6 hours 50 minutes 3 ...	20 minutes	20 minutes	2 days 6 hours 30 minutes...	
	Check Maj...	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Convoke G...	$4.46	1 hour	1 hour	2 hours	0 seconds	
	Convoke G...	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
Case 2							2
Case 3							4
	Chairman ...	$0.89	6 hours 50 minutes 3 seconds	20 minutes	20 minutes	6 hours 30 minutes 3 seco...	
	Check Maj...	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Convoke G...	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Dean's Acti...	$0.00	1 second	1 second	0 seconds	0 seconds	
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Send Chair...	$0.89	30 minutes	30 minutes	30 minutes	0 seconds	

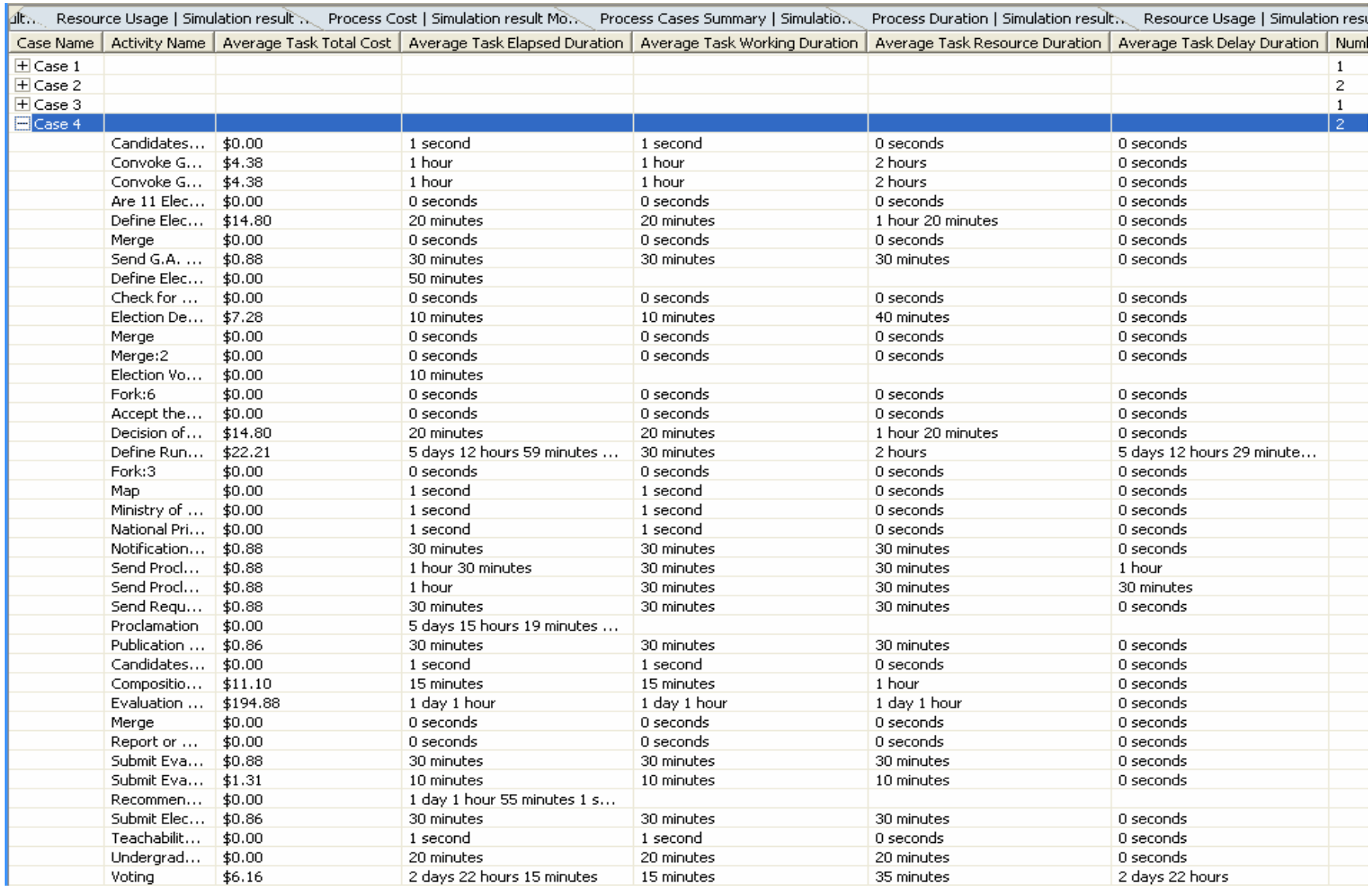
Figure 74: Process cases 1 and 3 analysis of Extraordinary_G_A_as_Is process



Process Cases Summary | Simulation result Monday, October 16, 2006 1:49:40 PM EEST | Application_Announcement_as_Is Saturday, October 14, 2006 10:27:48 PM EEST | 1:44:23 PM EEST

Case Name	Activity Name	Average Task Total Cost	Average Task Elapsed Duration	Average Task Working Duration	Average Task Resource Duration	Average Task Delay Duration	Nur
Case 1							1
Case 2							2
	Accept the...	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Decision of...	$15.34	20 minutes	20 minutes	1 hour 20 minutes	0 seconds	
	Define Run...	$23.01	12 hours 59 minutes 23 seco...	30 minutes	2 hours	12 hours 29 minutes 23 se...	
	Ministry of ...	$0.00	1 second	1 second	0 seconds	0 seconds	
	Send Requ...	$0.91	30 minutes	30 minutes	30 minutes	0 seconds	
	Proclamation	$0.00	13 hours 49 minutes 24 seco...				
Case 3							1
Case 4							2
Case 5							2
Case 6							1
Case 7							1

Figure 75: Process case 2 analysis of Application_Announcement_as_Is process



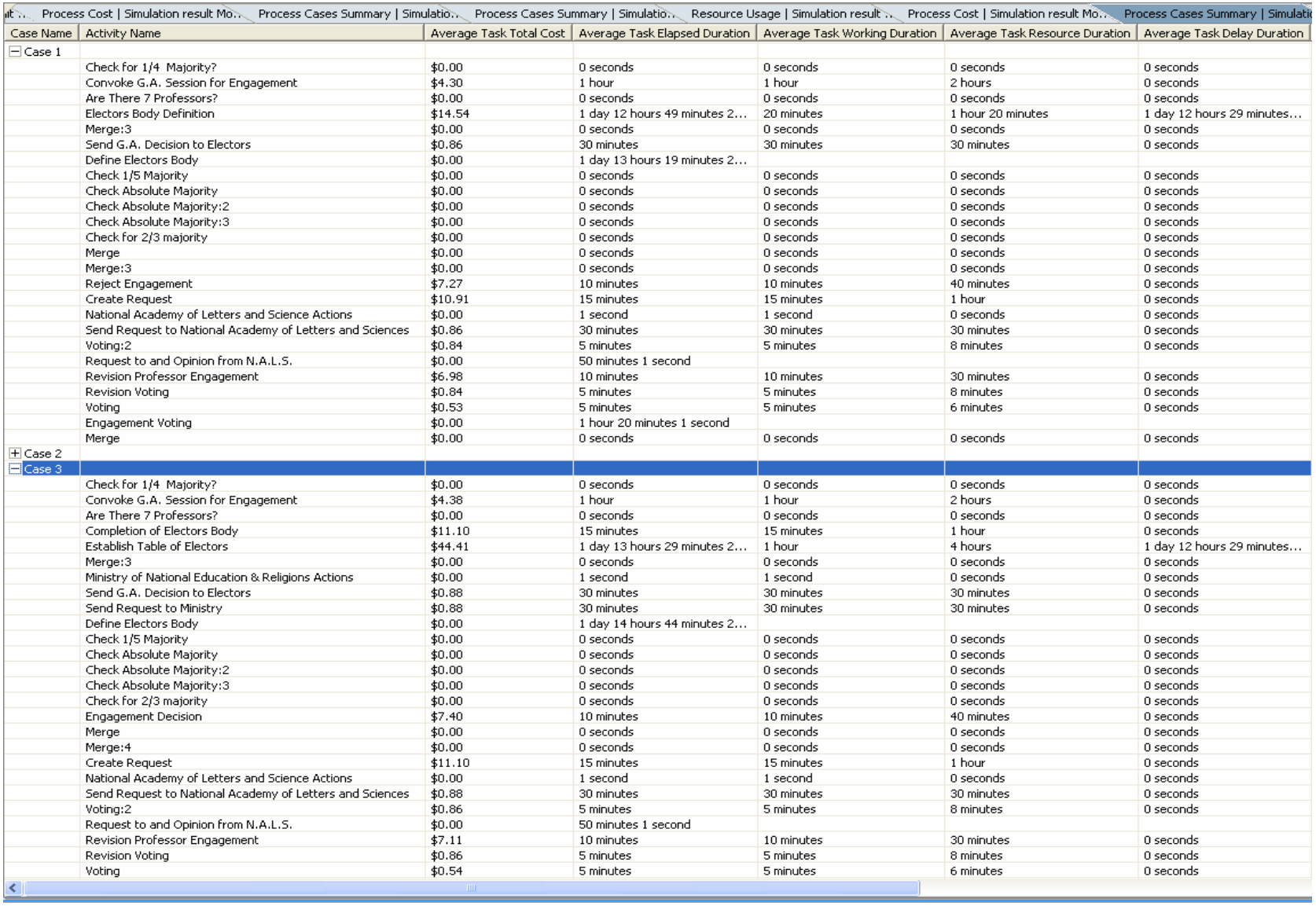
ult... | Resource Usage | Simulation result ... | Process Cost | Simulation result Mo... | Process Cases Summary | Simulatio... | Process Duration | Simulation result... | Resource Usage | Simulation resu

Case Name	Activity Name	Average Task Total Cost	Average Task Elapsed Duration	Average Task Working Duration	Average Task Resource Duration	Average Task Delay Duration	Numl
⊞ Case 1							1
⊞ Case 2							2
⊞ Case 3							1
⊟ Case 4							2
	Candidates...	$0.00	1 second	1 second	0 seconds	0 seconds	
	Convoke G...	$4.38	1 hour	1 hour	2 hours	0 seconds	
	Convoke G...	$4.38	1 hour	1 hour	2 hours	0 seconds	
	Are 11 Elec...	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Define Elec...	$14.80	20 minutes	20 minutes	1 hour 20 minutes	0 seconds	
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Send G.A. ...	$0.88	30 minutes	30 minutes	30 minutes	0 seconds	
	Define Elec...	$0.00	50 minutes				
	Check for ...	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Election De...	$7.28	10 minutes	10 minutes	40 minutes	0 seconds	
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Merge:2	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Election Vo...	$0.00	10 minutes				
	Fork:6	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Accept the...	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Decision of...	$14.80	20 minutes	20 minutes	1 hour 20 minutes	0 seconds	
	Define Run...	$22.21	5 days 12 hours 59 minutes ...	30 minutes	2 hours	5 days 12 hours 29 minute...	
	Fork:3	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Map	$0.00	1 second	1 second	0 seconds	0 seconds	
	Ministry of ...	$0.00	1 second	1 second	0 seconds	0 seconds	
	National Pri...	$0.00	1 second	1 second	0 seconds	0 seconds	
	Notification...	$0.88	30 minutes	30 minutes	30 minutes	0 seconds	
	Send Procl...	$0.88	1 hour 30 minutes	30 minutes	30 minutes	1 hour	
	Send Procl...	$0.88	1 hour	30 minutes	30 minutes	30 minutes	
	Send Requ...	$0.88	30 minutes	30 minutes	30 minutes	0 seconds	
	Proclamation	$0.00	5 days 15 hours 19 minutes ...				
	Publication ...	$0.86	30 minutes	30 minutes	30 minutes	0 seconds	
	Candidates...	$0.00	1 second	1 second	0 seconds	0 seconds	
	Compositio...	$11.10	15 minutes	15 minutes	1 hour	0 seconds	
	Evaluation ...	$194.88	1 day 1 hour	1 day 1 hour	1 day 1 hour	0 seconds	
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Report or ...	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Submit Eva...	$0.88	30 minutes	30 minutes	30 minutes	0 seconds	
	Submit Eva...	$1.31	10 minutes	10 minutes	10 minutes	0 seconds	
	Recommen...	$0.00	1 day 1 hour 55 minutes 1 s...				
	Submit Elec...	$0.86	30 minutes	30 minutes	30 minutes	0 seconds	
	Teachabilit...	$0.00	1 second	1 second	0 seconds	0 seconds	
	Undergrad...	$0.00	20 minutes	20 minutes	20 minutes	0 seconds	
	Voting	$6.16	2 days 22 hours 15 minutes	15 minutes	35 minutes	2 days 22 hours	

Figure 76: Process cases 4 analysis of Application_Announcement_as_Is process

Case Name	Activity Name	Average Task Total Cost	Average Task Elapsed Duration	Average Task Working Duration	Average Task Resource Duration	Average Task Delay Duration	Numb
Case 1							3
	Candidates...	$1.38	15 minutes	15 minutes	15 minutes	0 seconds	
	Convened ...	$2.28	30 minutes	30 minutes	1 hour	0 seconds	
	Dean's Acti...	$0.00	1 second	1 second	0 seconds	0 seconds	
	Send Appli...	$0.93	20 hours 59 minutes 23 seco...	30 minutes	30 minutes	20 hours 29 minutes 23 se...	
	Chairman E...	$2.28	30 minutes	30 minutes	1 hour	0 seconds	
	Check Abs...	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Check Num...	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Merge:2	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Merge:3	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Repeat Vot...	$0.93	5 minutes	5 minutes	11 minutes	0 seconds	
	Voting	$0.93	5 minutes	5 minutes	11 minutes	0 seconds	
	Vote	$0.00	40 minutes				
Case 2							2
Case 3							4
	Candidates...	$1.32	15 minutes	15 minutes	15 minutes	0 seconds	
	Convened ...	$2.18	30 minutes	30 minutes	1 hour	0 seconds	
	Dean's Acti...	$0.00	1 second	1 second	0 seconds	0 seconds	
	Send Appli...	$0.89	1 day 6 hours 59 minutes 23...	30 minutes	30 minutes	1 day 6 hours 29 minutes ...	
	Chairman E...	$2.18	30 minutes	30 minutes	1 hour	0 seconds	
	Check Num...	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Check of 1...	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Merge:2	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Merge:3	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Voting	$0.89	5 minutes	5 minutes	11 minutes	0 seconds	
	Vote	$0.00	35 minutes				
Case 4							1

Figure 77: Process cases 1 and 3 analysis of Chairman_Election_as_Is process



Case Name	Activity Name	Average Task Total Cost	Average Task Elapsed Duration	Average Task Working Duration	Average Task Resource Duration	Average Task Delay Duration
Case 1						
	Check for 1/4 Majority?	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Convoke G.A. Session for Engagement	$4.30	1 hour	1 hour	2 hours	0 seconds
	Are There 7 Professors?	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Electors Body Definition	$14.54	1 day 12 hours 49 minutes 2...	20 minutes	1 hour 20 minutes	1 day 12 hours 29 minutes...
	Merge:3	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Send G.A. Decision to Electors	$0.86	30 minutes	30 minutes	30 minutes	0 seconds
	Define Electors Body	$0.00	1 day 13 hours 19 minutes 2...			
	Check 1/5 Majority	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Check Absolute Majority	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Check Absolute Majority:2	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Check Absolute Majority:3	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Check for 2/3 majority	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Merge:3	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Reject Engagement	$7.27	10 minutes	10 minutes	40 minutes	0 seconds
	Create Request	$10.91	15 minutes	15 minutes	1 hour	0 seconds
	National Academy of Letters and Science Actions	$0.00	1 second	1 second	0 seconds	0 seconds
	Send Request to National Academy of Letters and Sciences	$0.86	30 minutes	30 minutes	30 minutes	0 seconds
	Voting:2	$0.84	5 minutes	5 minutes	8 minutes	0 seconds
	Request to and Opinion from N.A.L.S.	$0.00	50 minutes 1 second			
	Revision Professor Engagement	$6.98	10 minutes	10 minutes	30 minutes	0 seconds
	Revision Voting	$0.84	5 minutes	5 minutes	8 minutes	0 seconds
	Voting	$0.53	5 minutes	5 minutes	6 minutes	0 seconds
	Engagement Voting	$0.00	1 hour 20 minutes 1 second			
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
Case 2						
Case 3						
	Check for 1/4 Majority?	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Convoke G.A. Session for Engagement	$4.38	1 hour	1 hour	2 hours	0 seconds
	Are There 7 Professors?	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Completion of Electors Body	$11.10	15 minutes	15 minutes	1 hour	0 seconds
	Establish Table of Electors	$44.41	1 day 13 hours 29 minutes 2...	1 hour	4 hours	1 day 12 hours 29 minutes...
	Merge:3	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Ministry of National Education & Religions Actions	$0.00	1 second	1 second	0 seconds	0 seconds
	Send G.A. Decision to Electors	$0.88	30 minutes	30 minutes	30 minutes	0 seconds
	Send Request to Ministry	$0.88	30 minutes	30 minutes	30 minutes	0 seconds
	Define Electors Body	$0.00	1 day 14 hours 44 minutes 2...			
	Check 1/5 Majority	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Check Absolute Majority	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Check Absolute Majority:2	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Check Absolute Majority:3	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Check for 2/3 majority	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Engagement Decision	$7.40	10 minutes	10 minutes	40 minutes	0 seconds
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Merge:4	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Create Request	$11.10	15 minutes	15 minutes	1 hour	0 seconds
	National Academy of Letters and Science Actions	$0.00	1 second	1 second	0 seconds	0 seconds
	Send Request to National Academy of Letters and Sciences	$0.88	30 minutes	30 minutes	30 minutes	0 seconds
	Voting:2	$0.86	5 minutes	5 minutes	8 minutes	0 seconds
	Request to and Opinion from N.A.L.S.	$0.00	50 minutes 1 second			
	Revision Professor Engagement	$7.11	10 minutes	10 minutes	30 minutes	0 seconds
	Revision Voting	$0.86	5 minutes	5 minutes	8 minutes	0 seconds
	Voting	$0.54	5 minutes	5 minutes	6 minutes	0 seconds

Figure 78: Process cases 1 and 3 analysis of Professor_Engagement_as_Is process

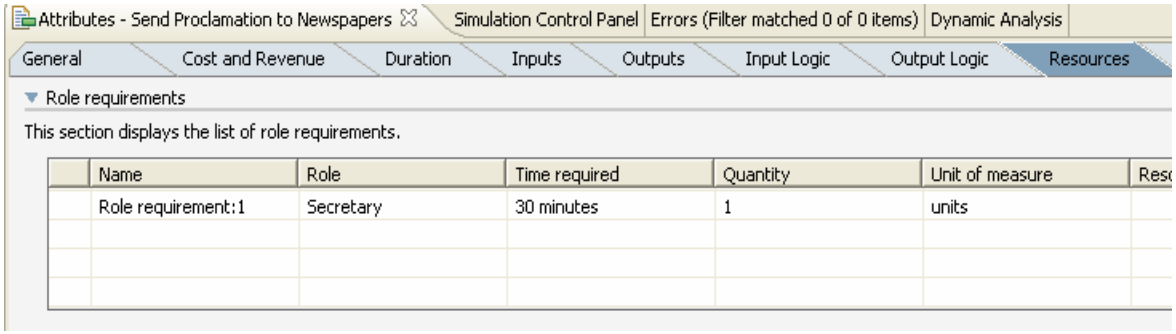
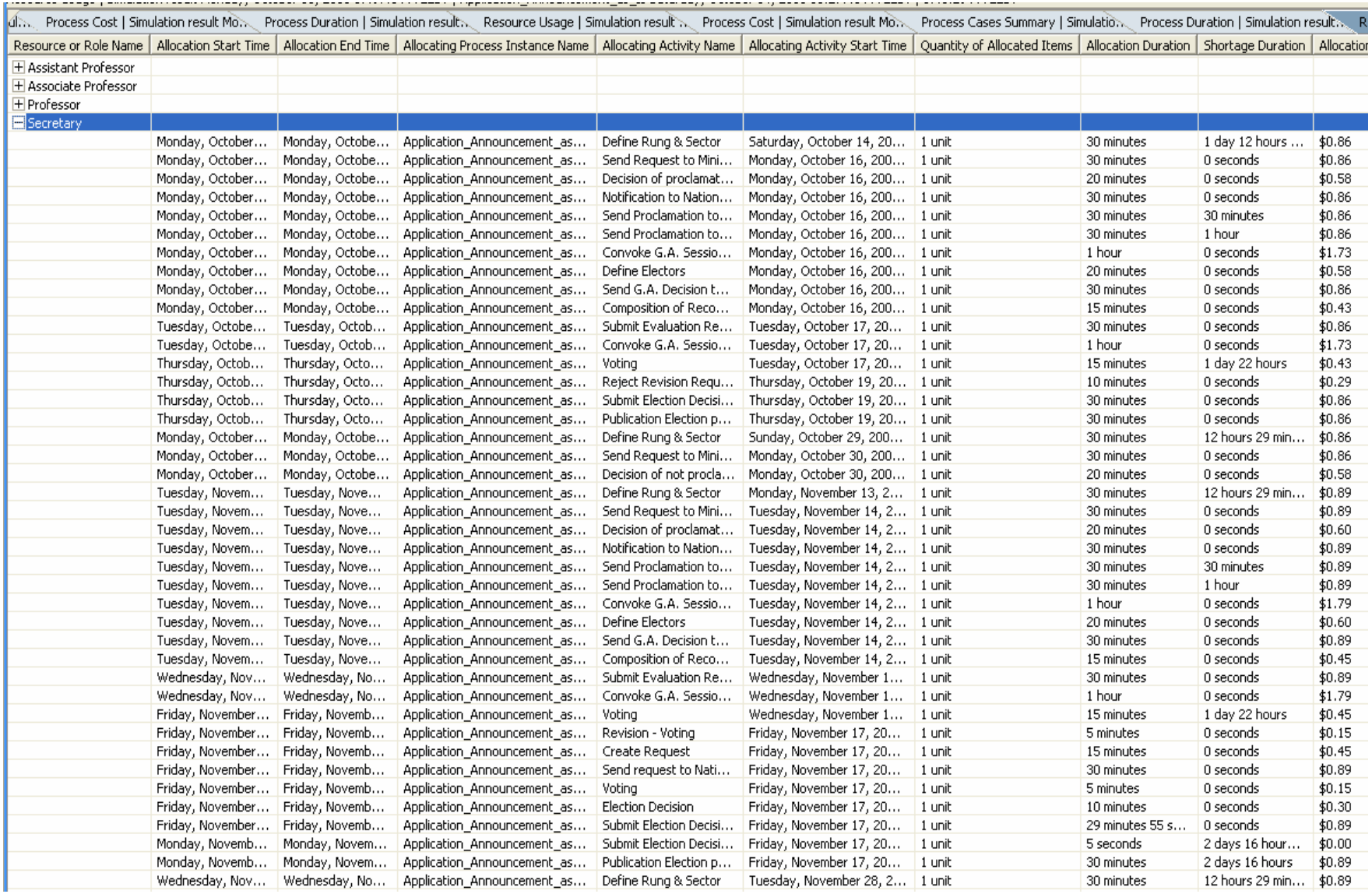


Figure 79: Resources allocation at Send Proclamation to Newspapers activity.

Process Cost | Simulation result Mo... | Process Cases Summary | Simulatio... | Process Cases Summary | Simulatio... | Process Cases Summary | Simulatio... | Process Duration | Simulation result... | Process Cases Summary | Simulatio...

Resource or Role Name	Allocation Start Time	Allocation End Time	Allocating Process Instance Name	Allocating Activity Name	Allocating Activity Start Time	Quantity of Allocated Items	Allocation Duration	Shortage Duration	Allocation
Assistant Professor									
Associate Professor									
Professor									
	Monday, October...	Monday, Octobe...	Extraordinary_G_A_as_Is 1	Chairman Decision	Monday, October 16, 200...	1 unit	20 minutes	30 minutes 3 se...	$0.86
	Monday, October...	Monday, Octobe...	Extraordinary_G_A_as_Is 1	Convoke General Ass...	Monday, October 16, 200...	1 unit	1 hour	0 seconds	$2.58
	Tuesday, Octobe...	Tuesday, Octob...	Extraordinary_G_A_as_Is 2	Reject the Request	Tuesday, October 31, 20...	9 units	15 minutes	30 minutes 3 se...	$6.00
	Wednesday, Nov...	Wednesday, No...	Extraordinary_G_A_as_Is 3	Chairman Decision	Wednesday, November 1...	1 unit	20 minutes	30 minutes 3 se...	$0.89
	Thursday, Novem...	Thursday, Nove...	Extraordinary_G_A_as_Is 4	Chairman Decision	Thursday, November 30, ...	1 unit	20 minutes	30 minutes 3 se...	$0.89
	Thursday, Novem...	Thursday, Nove...	Extraordinary_G_A_as_Is 4	Convoke General Ass...	Thursday, November 30, ...	1 unit	1 hour	0 seconds	$2.67
	Friday, December...	Friday, Decemb...	Extraordinary_G_A_as_Is 5	Chairman Decision	Friday, December 15, 200...	1 unit	20 minutes	30 minutes 3 se...	$0.86
	Monday, January...	Monday, Januar...	Extraordinary_G_A_as_Is 6	Chairman Decision	Saturday, December 30, ...	1 unit	20 minutes	9 days 30 minut...	$0.86
	Monday, January...	Monday, Januar...	Extraordinary_G_A_as_Is 6	Convoke General Ass...	Monday, January 8, 2007...	1 unit	1 hour	0 seconds	$2.58
	Monday, January...	Monday, Januar...	Extraordinary_G_A_as_Is 7	Chairman Decision	Sunday, January 14, 200...	1 unit	20 minutes	1 day 30 minut...	$0.86
	Monday, January...	Monday, Januar...	Extraordinary_G_A_as_Is 8	Reject the Request	Monday, January 29, 200...	9 units	15 minutes	30 minutes 3 se...	$6.00
	Tuesday, Februar...	Tuesday, Febru...	Extraordinary_G_A_as_Is 9	Chairman Decision	Tuesday, February 13, 2...	1 unit	20 minutes	30 minutes 3 se...	$0.95
	Tuesday, Februar...	Tuesday, February 13, 2007 10:20:00 AM EET	9	Convoke General Ass...	Tuesday, February 13, 2...	1 unit	1 hour	0 seconds	$2.86
	Wednesday, Febr...	Wednesday, Fe...	Extraordinary_G_A_as_Is 10	Chairman Decision	Wednesday, February 28...	1 unit	20 minutes	30 minutes 3 se...	$0.95
Secretary									
	Monday, October...	Monday, Octobe...	Extraordinary_G_A_as_Is 1	Convoke General Ass...	Monday, October 16, 200...	1 unit	1 hour	0 seconds	$1.73
	Tuesday, Octobe...	Tuesday, Octob...	Extraordinary_G_A_as_Is 2	Reject the Request	Tuesday, October 31, 20...	1 unit	15 minutes	30 minutes 3 se...	$0.45
	Wednesday, Nov...	Wednesday, No...	Extraordinary_G_A_as_Is 3	Send Chairman Decisi...	Wednesday, November 1...	1 unit	30 minutes	0 seconds	$0.89
	Thursday, Novem...	Thursday, Nove...	Extraordinary_G_A_as_Is 4	Convoke General Ass...	Thursday, November 30, ...	1 unit	1 hour	0 seconds	$1.79
	Friday, December...	Friday, Decemb...	Extraordinary_G_A_as_Is 5	Send Chairman Decisi...	Friday, December 15, 200...	1 unit	30 minutes	0 seconds	$0.86
	Monday, January...	Monday, Januar...	Extraordinary_G_A_as_Is 6	Convoke General Ass...	Monday, January 8, 2007...	1 unit	1 hour	0 seconds	$1.73
	Monday, January...	Monday, Januar...	Extraordinary_G_A_as_Is 7	Send Chairman Decisi...	Monday, January 15, 200...	1 unit	30 minutes	0 seconds	$0.86
	Monday, January...	Monday, Januar...	Extraordinary_G_A_as_Is 8	Reject the Request	Monday, January 29, 200...	1 unit	15 minutes	30 minutes 3 se...	$0.45
	Tuesday, Februar...	Tuesday, Febru...	Extraordinary_G_A_as_Is 9	Convoke General Ass...	Tuesday, February 13, 2...	1 unit	1 hour	0 seconds	$1.91
	Wednesday, Febr...	Wednesday, Fe...	Extraordinary_G_A_as_Is 10	Send Chairman Decisi...	Wednesday, February 28...	1 unit	30 minutes	0 seconds	$0.96

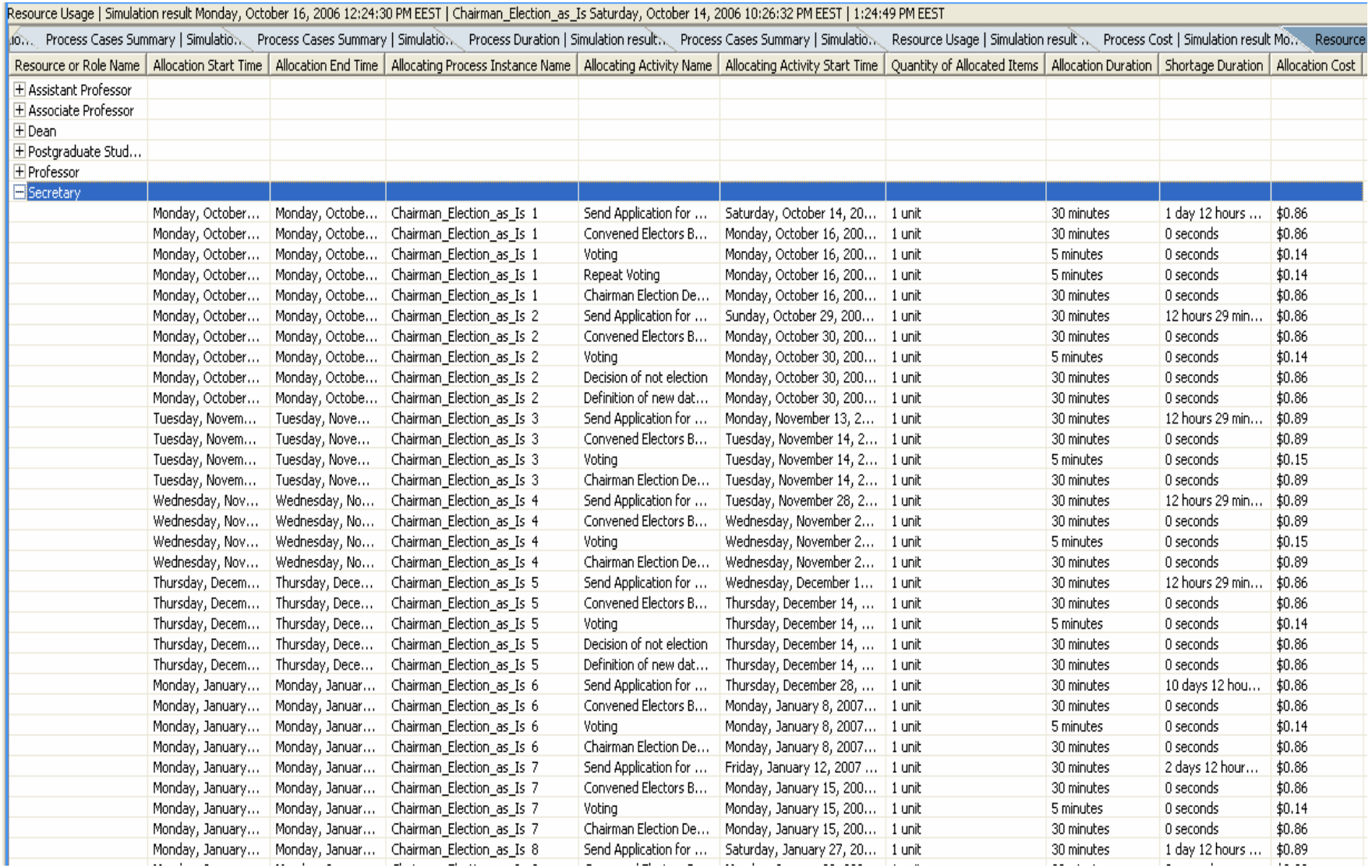
Figure 80: Secretary and Professor Shortage Duration at Extraordinary_G_A_as_Is process



Process Cost | Simulation result Mo... | Process Duration | Simulation result... | Resource Usage | Simulation result ... | Process Cost | Simulation result Mo... | Process Cases Summary | Simulatio... | Process Duration | Simulation result... | R

Resource or Role Name	Allocation Start Time	Allocation End Time	Allocating Process Instance Name	Allocating Activity Name	Allocating Activity Start Time	Quantity of Allocated Items	Allocation Duration	Shortage Duration	Allocatior
Assistant Professor									
Associate Professor									
Professor									
Secretary									
	Monday, October...	Monday, Octobe...	Application_Announcement_as...	Define Rung & Sector	Saturday, October 14, 20...	1 unit	30 minutes	1 day 12 hours ...	$0.86
	Monday, October...	Monday, Octobe...	Application_Announcement_as...	Send Request to Mini...	Monday, October 16, 200...	1 unit	30 minutes	0 seconds	$0.86
	Monday, October...	Monday, Octobe...	Application_Announcement_as...	Decision of proclamat...	Monday, October 16, 200...	1 unit	20 minutes	0 seconds	$0.58
	Monday, October...	Monday, Octobe...	Application_Announcement_as...	Notification to Nation...	Monday, October 16, 200...	1 unit	30 minutes	0 seconds	$0.86
	Monday, October...	Monday, Octobe...	Application_Announcement_as...	Send Proclamation to...	Monday, October 16, 200...	1 unit	30 minutes	30 minutes	$0.86
	Monday, October...	Monday, Octobe...	Application_Announcement_as...	Send Proclamation to...	Monday, October 16, 200...	1 unit	30 minutes	1 hour	$0.86
	Monday, October...	Monday, Octobe...	Application_Announcement_as...	Convoke G.A. Sessio...	Monday, October 16, 200...	1 unit	1 hour	0 seconds	$1.73
	Monday, October...	Monday, Octobe...	Application_Announcement_as...	Define Electors	Monday, October 16, 200...	1 unit	20 minutes	0 seconds	$0.58
	Monday, October...	Monday, Octobe...	Application_Announcement_as...	Send G.A. Decision t...	Monday, October 16, 200...	1 unit	30 minutes	0 seconds	$0.86
	Monday, October...	Monday, Octobe...	Application_Announcement_as...	Composition of Reco...	Monday, October 16, 200...	1 unit	15 minutes	0 seconds	$0.43
	Tuesday, Octobe...	Tuesday, Octob...	Application_Announcement_as...	Submit Evaluation Re...	Tuesday, October 17, 20...	1 unit	30 minutes	0 seconds	$0.86
	Tuesday, Octobe...	Tuesday, Octob...	Application_Announcement_as...	Convoke G.A. Sessio...	Tuesday, October 17, 20...	1 unit	1 hour	0 seconds	$1.73
	Thursday, Octob...	Thursday, Octo...	Application_Announcement_as...	Voting	Tuesday, October 17, 20...	1 unit	15 minutes	1 day 22 hours	$0.43
	Thursday, Octob...	Thursday, Octo...	Application_Announcement_as...	Reject Revision Requ...	Thursday, October 19, 20...	1 unit	10 minutes	0 seconds	$0.29
	Thursday, Octob...	Thursday, Octo...	Application_Announcement_as...	Submit Election Decisi...	Thursday, October 19, 20...	1 unit	30 minutes	0 seconds	$0.86
	Thursday, Octob...	Thursday, Octo...	Application_Announcement_as...	Publication Election p...	Thursday, October 19, 20...	1 unit	30 minutes	0 seconds	$0.86
	Monday, October...	Monday, Octobe...	Application_Announcement_as...	Define Rung & Sector	Sunday, October 29, 200...	1 unit	30 minutes	12 hours 29 min...	$0.86
	Monday, October...	Monday, Octobe...	Application_Announcement_as...	Send Request to Mini...	Monday, October 30, 200...	1 unit	30 minutes	0 seconds	$0.86
	Monday, October...	Monday, Octobe...	Application_Announcement_as...	Decision of not procla...	Monday, October 30, 200...	1 unit	20 minutes	0 seconds	$0.58
	Tuesday, Novem...	Tuesday, Nove...	Application_Announcement_as...	Define Rung & Sector	Monday, November 13, 2...	1 unit	30 minutes	12 hours 29 min...	$0.89
	Tuesday, Novem...	Tuesday, Nove...	Application_Announcement_as...	Send Request to Mini...	Tuesday, November 14, 2...	1 unit	30 minutes	0 seconds	$0.89
	Tuesday, Novem...	Tuesday, Nove...	Application_Announcement_as...	Decision of proclamat...	Tuesday, November 14, 2...	1 unit	20 minutes	0 seconds	$0.60
	Tuesday, Novem...	Tuesday, Nove...	Application_Announcement_as...	Notification to Nation...	Tuesday, November 14, 2...	1 unit	30 minutes	0 seconds	$0.89
	Tuesday, Novem...	Tuesday, Nove...	Application_Announcement_as...	Send Proclamation to...	Tuesday, November 14, 2...	1 unit	30 minutes	30 minutes	$0.89
	Tuesday, Novem...	Tuesday, Nove...	Application_Announcement_as...	Send Proclamation to...	Tuesday, November 14, 2...	1 unit	30 minutes	1 hour	$0.89
	Tuesday, Novem...	Tuesday, Nove...	Application_Announcement_as...	Convoke G.A. Sessio...	Tuesday, November 14, 2...	1 unit	1 hour	0 seconds	$1.79
	Tuesday, Novem...	Tuesday, Nove...	Application_Announcement_as...	Define Electors	Tuesday, November 14, 2...	1 unit	20 minutes	0 seconds	$0.60
	Tuesday, Novem...	Tuesday, Nove...	Application_Announcement_as...	Send G.A. Decision t...	Tuesday, November 14, 2...	1 unit	30 minutes	0 seconds	$0.89
	Tuesday, Novem...	Tuesday, Nove...	Application_Announcement_as...	Composition of Reco...	Tuesday, November 14, 2...	1 unit	15 minutes	0 seconds	$0.45
	Wednesday, Nov...	Wednesday, No...	Application_Announcement_as...	Submit Evaluation Re...	Wednesday, November 1...	1 unit	30 minutes	0 seconds	$0.89
	Wednesday, Nov...	Wednesday, No...	Application_Announcement_as...	Convoke G.A. Sessio...	Wednesday, November 1...	1 unit	1 hour	0 seconds	$1.79
	Friday, November...	Friday, Novemb...	Application_Announcement_as...	Voting	Wednesday, November 1...	1 unit	15 minutes	1 day 22 hours	$0.45
	Friday, November...	Friday, Novemb...	Application_Announcement_as...	Revision - Voting	Friday, November 17, 20...	1 unit	5 minutes	0 seconds	$0.15
	Friday, November...	Friday, Novemb...	Application_Announcement_as...	Create Request	Friday, November 17, 20...	1 unit	15 minutes	0 seconds	$0.45
	Friday, November...	Friday, Novemb...	Application_Announcement_as...	Send request to Nati...	Friday, November 17, 20...	1 unit	30 minutes	0 seconds	$0.89
	Friday, November...	Friday, Novemb...	Application_Announcement_as...	Voting	Friday, November 17, 20...	1 unit	5 minutes	0 seconds	$0.15
	Friday, November...	Friday, Novemb...	Application_Announcement_as...	Election Decision	Friday, November 17, 20...	1 unit	10 minutes	0 seconds	$0.30
	Friday, November...	Friday, Novemb...	Application_Announcement_as...	Submit Election Decisi...	Friday, November 17, 20...	1 unit	29 minutes 55 s...	0 seconds	$0.89
	Monday, Novemb...	Monday, Novem...	Application_Announcement_as...	Submit Election Decisi...	Friday, November 17, 20...	1 unit	5 seconds	2 days 16 hour...	$0.00
	Monday, Novemb...	Monday, Novem...	Application_Announcement_as...	Publication Election p...	Friday, November 17, 20...	1 unit	30 minutes	2 days 16 hours	$0.89
	Wednesday, Nov...	Wednesday, No...	Application_Announcement_as...	Define Rung & Sector	Tuesday, November 28, 2...	1 unit	30 minutes	12 hours 29 min...	$0.89

Figure 81: Secretary Shortage Duration at Application_Announcement_as_Is process

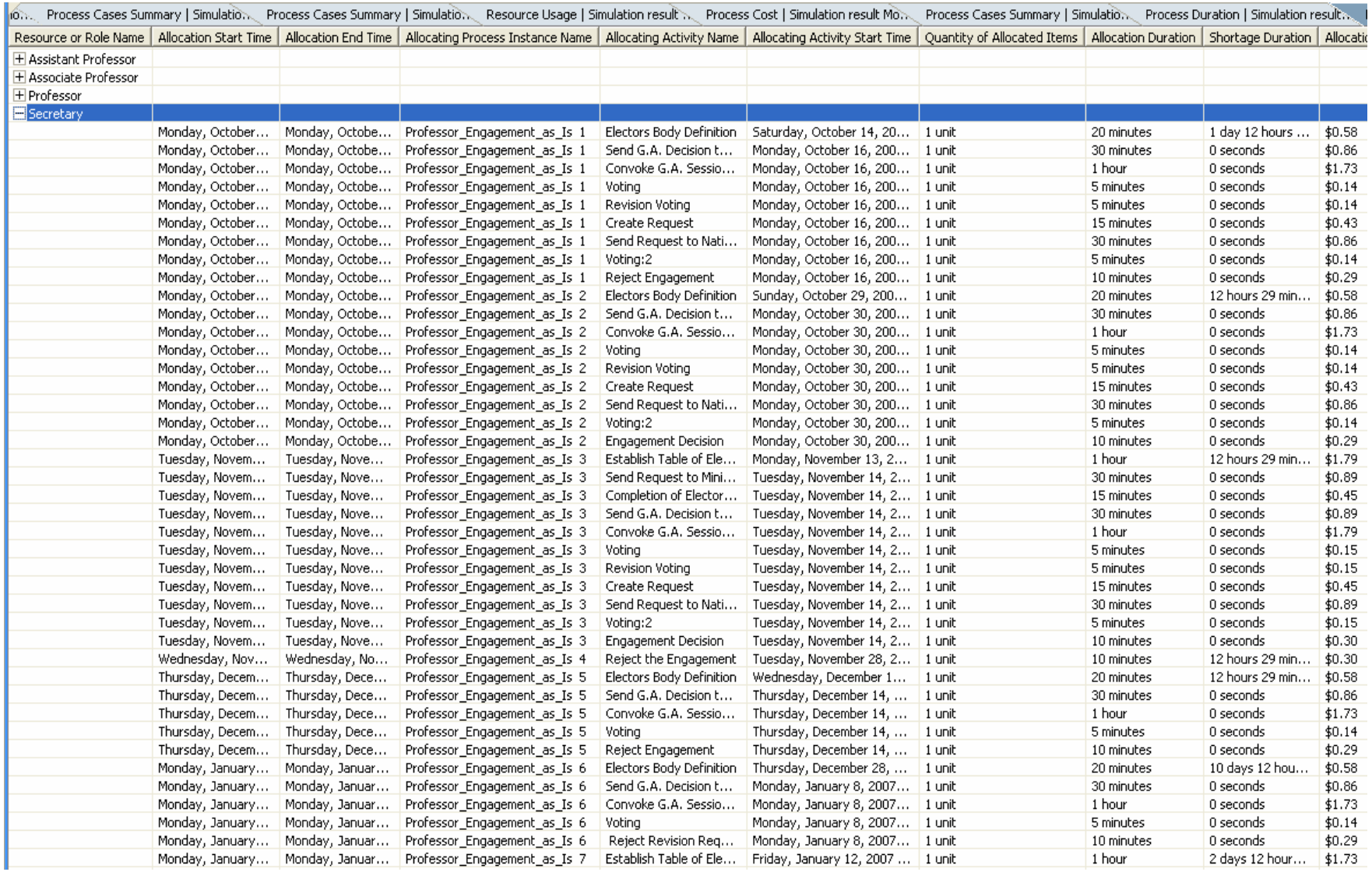


Resource Usage | Simulation result Monday, October 16, 2006 12:24:30 PM EEST | Chairman_Election_as_Is Saturday, October 14, 2006 10:26:32 PM EEST | 1:24:49 PM EEST

Process Cases Summary | Simulatio... | Process Cases Summary | Simulatio... | Process Duration | Simulation result... | Process Cases Summary | Simulatio... | Resource Usage | Simulation result ... | Process Cost | Simulation result Mo... | Resource

Resource or Role Name	Allocation Start Time	Allocation End Time	Allocating Process Instance Name	Allocating Activity Name	Allocating Activity Start Time	Quantity of Allocated Items	Allocation Duration	Shortage Duration	Allocation Cost
⊞ Assistant Professor									
⊞ Associate Professor									
⊞ Dean									
⊞ Postgraduate Stud...									
⊞ Professor									
⊟ Secretary									
	Monday, October...	Monday, Octobe...	Chairman_Election_as_Is 1	Send Application for ...	Saturday, October 14, 20...	1 unit	30 minutes	1 day 12 hours ...	$0.86
	Monday, October...	Monday, Octobe...	Chairman_Election_as_Is 1	Convened Electors B...	Monday, October 16, 200...	1 unit	30 minutes	0 seconds	$0.86
	Monday, October...	Monday, Octobe...	Chairman_Election_as_Is 1	Voting	Monday, October 16, 200...	1 unit	5 minutes	0 seconds	$0.14
	Monday, October...	Monday, Octobe...	Chairman_Election_as_Is 1	Repeat Voting	Monday, October 16, 200...	1 unit	5 minutes	0 seconds	$0.14
	Monday, October...	Monday, Octobe...	Chairman_Election_as_Is 1	Chairman Election De...	Monday, October 16, 200...	1 unit	30 minutes	0 seconds	$0.86
	Monday, October...	Monday, Octobe...	Chairman_Election_as_Is 2	Send Application for ...	Sunday, October 29, 200...	1 unit	30 minutes	12 hours 29 min...	$0.86
	Monday, October...	Monday, Octobe...	Chairman_Election_as_Is 2	Convened Electors B...	Monday, October 30, 200...	1 unit	30 minutes	0 seconds	$0.86
	Monday, October...	Monday, Octobe...	Chairman_Election_as_Is 2	Voting	Monday, October 30, 200...	1 unit	5 minutes	0 seconds	$0.14
	Monday, October...	Monday, Octobe...	Chairman_Election_as_Is 2	Decision of not election	Monday, October 30, 200...	1 unit	30 minutes	0 seconds	$0.86
	Monday, October...	Monday, Octobe...	Chairman_Election_as_Is 2	Definition of new dat...	Monday, October 30, 200...	1 unit	30 minutes	0 seconds	$0.86
	Tuesday, Novem...	Tuesday, Nove...	Chairman_Election_as_Is 3	Send Application for ...	Monday, November 13, 2...	1 unit	30 minutes	12 hours 29 min...	$0.89
	Tuesday, Novem...	Tuesday, Nove...	Chairman_Election_as_Is 3	Convened Electors B...	Tuesday, November 14, 2...	1 unit	30 minutes	0 seconds	$0.89
	Tuesday, Novem...	Tuesday, Nove...	Chairman_Election_as_Is 3	Voting	Tuesday, November 14, 2...	1 unit	5 minutes	0 seconds	$0.15
	Tuesday, Novem...	Tuesday, Nove...	Chairman_Election_as_Is 3	Chairman Election De...	Tuesday, November 14, 2...	1 unit	30 minutes	0 seconds	$0.89
	Wednesday, Nov...	Wednesday, No...	Chairman_Election_as_Is 4	Send Application for ...	Tuesday, November 28, 2...	1 unit	30 minutes	12 hours 29 min...	$0.89
	Wednesday, Nov...	Wednesday, No...	Chairman_Election_as_Is 4	Convened Electors B...	Wednesday, November 2...	1 unit	30 minutes	0 seconds	$0.89
	Wednesday, Nov...	Wednesday, No...	Chairman_Election_as_Is 4	Voting	Wednesday, November 2...	1 unit	5 minutes	0 seconds	$0.15
	Wednesday, Nov...	Wednesday, No...	Chairman_Election_as_Is 4	Chairman Election De...	Wednesday, November 2...	1 unit	30 minutes	0 seconds	$0.89
	Thursday, Decem...	Thursday, Dece...	Chairman_Election_as_Is 5	Send Application for ...	Wednesday, December 1...	1 unit	30 minutes	12 hours 29 min...	$0.86
	Thursday, Decem...	Thursday, Dece...	Chairman_Election_as_Is 5	Convened Electors B...	Thursday, December 14, ...	1 unit	30 minutes	0 seconds	$0.86
	Thursday, Decem...	Thursday, Dece...	Chairman_Election_as_Is 5	Voting	Thursday, December 14, ...	1 unit	5 minutes	0 seconds	$0.14
	Thursday, Decem...	Thursday, Dece...	Chairman_Election_as_Is 5	Decision of not election	Thursday, December 14, ...	1 unit	30 minutes	0 seconds	$0.86
	Thursday, Decem...	Thursday, Dece...	Chairman_Election_as_Is 5	Definition of new dat...	Thursday, December 14, ...	1 unit	30 minutes	0 seconds	$0.86
	Monday, January...	Monday, Januar...	Chairman_Election_as_Is 6	Send Application for ...	Thursday, December 28, ...	1 unit	30 minutes	10 days 12 hou...	$0.86
	Monday, January...	Monday, Januar...	Chairman_Election_as_Is 6	Convened Electors B...	Monday, January 8, 2007...	1 unit	30 minutes	0 seconds	$0.86
	Monday, January...	Monday, Januar...	Chairman_Election_as_Is 6	Voting	Monday, January 8, 2007...	1 unit	5 minutes	0 seconds	$0.14
	Monday, January...	Monday, Januar...	Chairman_Election_as_Is 6	Chairman Election De...	Monday, January 8, 2007...	1 unit	30 minutes	0 seconds	$0.86
	Monday, January...	Monday, Januar...	Chairman_Election_as_Is 7	Send Application for ...	Friday, January 12, 2007 ...	1 unit	30 minutes	2 days 12 hour...	$0.86
	Monday, January...	Monday, Januar...	Chairman_Election_as_Is 7	Convened Electors B...	Monday, January 15, 200...	1 unit	30 minutes	0 seconds	$0.86
	Monday, January...	Monday, Januar...	Chairman_Election_as_Is 7	Voting	Monday, January 15, 200...	1 unit	5 minutes	0 seconds	$0.14
	Monday, January...	Monday, Januar...	Chairman_Election_as_Is 7	Chairman Election De...	Monday, January 15, 200...	1 unit	30 minutes	0 seconds	$0.86
	Monday, January...	Monday, Januar...	Chairman_Election_as_Is 8	Send Application for ...	Saturday, January 27, 20...	1 unit	30 minutes	1 day 12 hours ...	$0.89

Figure 82: Secretary Shortage Duration at Chairman_Election_as_Isprocess



Resource or Role Name	Allocation Start Time	Allocation End Time	Allocating Process Instance Name	Allocating Activity Name	Allocating Activity Start Time	Quantity of Allocated Items	Allocation Duration	Shortage Duration	Allocati
⊞ Assistant Professor									
⊞ Associate Professor									
⊞ Professor									
⊟ Secretary									
	Monday, October...	Monday, Octobe...	Professor_Engagement_as_Is 1	Electors Body Definition	Saturday, October 14, 20...	1 unit	20 minutes	1 day 12 hours ...	$0.58
	Monday, October...	Monday, Octobe...	Professor_Engagement_as_Is 1	Send G.A. Decision t...	Monday, October 16, 200...	1 unit	30 minutes	0 seconds	$0.86
	Monday, October...	Monday, Octobe...	Professor_Engagement_as_Is 1	Convoke G.A. Sessio...	Monday, October 16, 200...	1 unit	1 hour	0 seconds	$1.73
	Monday, October...	Monday, Octobe...	Professor_Engagement_as_Is 1	Voting	Monday, October 16, 200...	1 unit	5 minutes	0 seconds	$0.14
	Monday, October...	Monday, Octobe...	Professor_Engagement_as_Is 1	Revision Voting	Monday, October 16, 200...	1 unit	5 minutes	0 seconds	$0.14
	Monday, October...	Monday, Octobe...	Professor_Engagement_as_Is 1	Create Request	Monday, October 16, 200...	1 unit	15 minutes	0 seconds	$0.43
	Monday, October...	Monday, Octobe...	Professor_Engagement_as_Is 1	Send Request to Nati...	Monday, October 16, 200...	1 unit	30 minutes	0 seconds	$0.86
	Monday, October...	Monday, Octobe...	Professor_Engagement_as_Is 1	Voting:2	Monday, October 16, 200...	1 unit	5 minutes	0 seconds	$0.14
	Monday, October...	Monday, Octobe...	Professor_Engagement_as_Is 1	Reject Engagement	Monday, October 16, 200...	1 unit	10 minutes	0 seconds	$0.29
	Monday, October...	Monday, Octobe...	Professor_Engagement_as_Is 2	Electors Body Definition	Sunday, October 29, 200...	1 unit	20 minutes	12 hours 29 min...	$0.58
	Monday, October...	Monday, Octobe...	Professor_Engagement_as_Is 2	Send G.A. Decision t...	Monday, October 30, 200...	1 unit	30 minutes	0 seconds	$0.86
	Monday, October...	Monday, Octobe...	Professor_Engagement_as_Is 2	Convoke G.A. Sessio...	Monday, October 30, 200...	1 unit	1 hour	0 seconds	$1.73
	Monday, October...	Monday, Octobe...	Professor_Engagement_as_Is 2	Voting	Monday, October 30, 200...	1 unit	5 minutes	0 seconds	$0.14
	Monday, October...	Monday, Octobe...	Professor_Engagement_as_Is 2	Revision Voting	Monday, October 30, 200...	1 unit	5 minutes	0 seconds	$0.14
	Monday, October...	Monday, Octobe...	Professor_Engagement_as_Is 2	Create Request	Monday, October 30, 200...	1 unit	15 minutes	0 seconds	$0.43
	Monday, October...	Monday, Octobe...	Professor_Engagement_as_Is 2	Send Request to Nati...	Monday, October 30, 200...	1 unit	30 minutes	0 seconds	$0.86
	Monday, October...	Monday, Octobe...	Professor_Engagement_as_Is 2	Voting:2	Monday, October 30, 200...	1 unit	5 minutes	0 seconds	$0.14
	Monday, October...	Monday, Octobe...	Professor_Engagement_as_Is 2	Engagement Decision	Monday, October 30, 200...	1 unit	10 minutes	0 seconds	$0.29
	Tuesday, Novem...	Tuesday, Nove...	Professor_Engagement_as_Is 3	Establish Table of Ele...	Monday, November 13, 2...	1 unit	1 hour	12 hours 29 min...	$1.79
	Tuesday, Novem...	Tuesday, Nove...	Professor_Engagement_as_Is 3	Send Request to Mini...	Tuesday, November 14, 2...	1 unit	30 minutes	0 seconds	$0.89
	Tuesday, Novem...	Tuesday, Nove...	Professor_Engagement_as_Is 3	Completion of Elector...	Tuesday, November 14, 2...	1 unit	15 minutes	0 seconds	$0.45
	Tuesday, Novem...	Tuesday, Nove...	Professor_Engagement_as_Is 3	Send G.A. Decision t...	Tuesday, November 14, 2...	1 unit	30 minutes	0 seconds	$0.89
	Tuesday, Novem...	Tuesday, Nove...	Professor_Engagement_as_Is 3	Convoke G.A. Sessio...	Tuesday, November 14, 2...	1 unit	1 hour	0 seconds	$1.79
	Tuesday, Novem...	Tuesday, Nove...	Professor_Engagement_as_Is 3	Voting	Tuesday, November 14, 2...	1 unit	5 minutes	0 seconds	$0.15
	Tuesday, Novem...	Tuesday, Nove...	Professor_Engagement_as_Is 3	Revision Voting	Tuesday, November 14, 2...	1 unit	5 minutes	0 seconds	$0.15
	Tuesday, Novem...	Tuesday, Nove...	Professor_Engagement_as_Is 3	Create Request	Tuesday, November 14, 2...	1 unit	15 minutes	0 seconds	$0.45
	Tuesday, Novem...	Tuesday, Nove...	Professor_Engagement_as_Is 3	Send Request to Nati...	Tuesday, November 14, 2...	1 unit	30 minutes	0 seconds	$0.89
	Tuesday, Novem...	Tuesday, Nove...	Professor_Engagement_as_Is 3	Voting:2	Tuesday, November 14, 2...	1 unit	5 minutes	0 seconds	$0.15
	Tuesday, Novem...	Tuesday, Nove...	Professor_Engagement_as_Is 3	Engagement Decision	Tuesday, November 14, 2...	1 unit	10 minutes	0 seconds	$0.30
	Wednesday, Nov...	Wednesday, No...	Professor_Engagement_as_Is 4	Reject the Engagement	Tuesday, November 28, 2...	1 unit	10 minutes	12 hours 29 min...	$0.30
	Thursday, Decem...	Thursday, Dece...	Professor_Engagement_as_Is 5	Electors Body Definition	Wednesday, December 1...	1 unit	20 minutes	12 hours 29 min...	$0.58
	Thursday, Decem...	Thursday, Dece...	Professor_Engagement_as_Is 5	Send G.A. Decision t...	Thursday, December 14, ...	1 unit	30 minutes	0 seconds	$0.86
	Thursday, Decem...	Thursday, Dece...	Professor_Engagement_as_Is 5	Convoke G.A. Sessio...	Thursday, December 14, ...	1 unit	1 hour	0 seconds	$1.73
	Thursday, Decem...	Thursday, Dece...	Professor_Engagement_as_Is 5	Voting	Thursday, December 14, ...	1 unit	5 minutes	0 seconds	$0.14
	Thursday, Decem...	Thursday, Dece...	Professor_Engagement_as_Is 5	Reject Engagement	Thursday, December 14, ...	1 unit	10 minutes	0 seconds	$0.29
	Monday, January...	Monday, Januar...	Professor_Engagement_as_Is 6	Electors Body Definition	Thursday, December 28, ...	1 unit	20 minutes	10 days 12 hou...	$0.58
	Monday, January...	Monday, Januar...	Professor_Engagement_as_Is 6	Send G.A. Decision t...	Monday, January 8, 2007...	1 unit	30 minutes	0 seconds	$0.86
	Monday, January...	Monday, Januar...	Professor_Engagement_as_Is 6	Convoke G.A. Sessio...	Monday, January 8, 2007...	1 unit	1 hour	0 seconds	$1.73
	Monday, January...	Monday, Januar...	Professor_Engagement_as_Is 6	Voting	Monday, January 8, 2007...	1 unit	5 minutes	0 seconds	$0.14
	Monday, January...	Monday, Januar...	Professor_Engagement_as_Is 6	Reject Revision Req...	Monday, January 8, 2007...	1 unit	10 minutes	0 seconds	$0.29
	Monday, January...	Monday, Januar...	Professor_Engagement_as_Is 7	Establish Table of Ele...	Friday, January 12, 2007 ...	1 unit	1 hour	2 days 12 hour...	$1.73

Figure 83: Secretary Shortage Duration at Professor_Engagement_as_Is process

This analysis shows the overbooking of the secretary and the result in term of shortage durations. To fix this problem, two solutions can be proposed:

- Add a new secretary
- Transfer activities from the secretary to the General Assembly Application.

In response to this bottleneck, the new process will eliminate the need of use the secretary resource, in send requests, decisions and notifications. The new General Assembly Application will be available 24 hours a day, 7 days a week.

5.6.8.4 Process Cost

To see the process cost, select the simulation result element and *Dynamic Analysis → Process Cases Analysis → Process Cost.* The process cost analysis shows the average cost and revenue for all process instances in each case in the current simulation result, and the weighted average costs and revenues for all process cases are shown in **Figure 84**, **Figure 85**, **Figure 86** and **Figure 87**.

We use this analysis when you want to examine process level costs and revenues for each generated process case. During this simulation the **average costs** were:

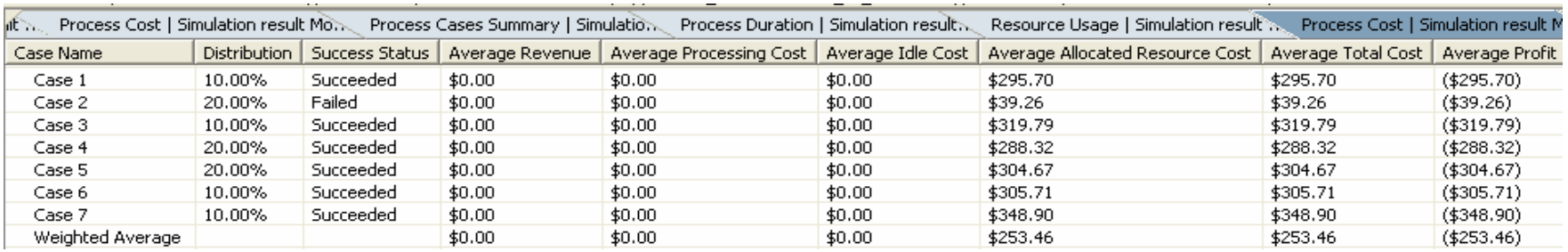
- The average cost for Application_Announcement_as_Is process is 253 €.
- The average cost for Chairman_Election_as_Is process is 8.22 €.
- The average cost for Extraordinary_G_A_as_Is process is 5.1 €.
- The average cost for Professor_Engagement_as_Is process is 45.7 €.

Also we have determined that the average profit in case 2 of Application_Announcement_as_Is process, in case 3 of Extraordinary_G_A_as_Is process and in case 4 of Professor_Engagement_as_Is process is unacceptably low.

The simulation and analysis of the current processes models shows significant bottlenecks that must be reduced to make the business more effective and flexible.

5.7 Modelling Future Processes

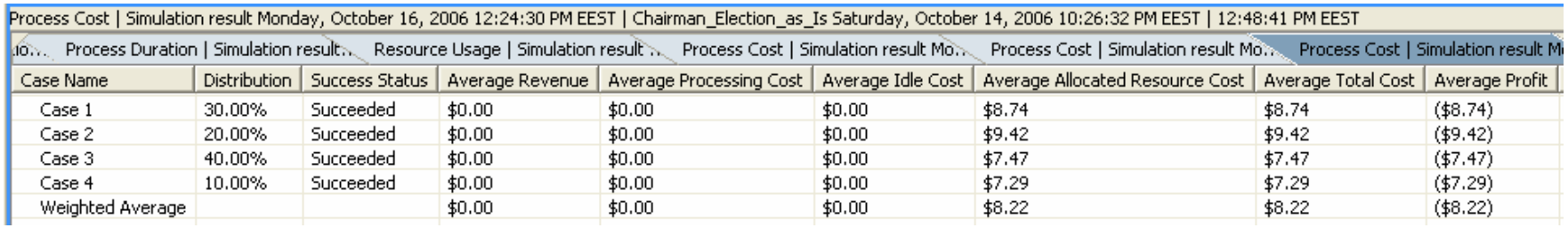
The following paragraphs, according to the results of simulation and analysis, describe how the current processes are modified to become the Future processes without bottlenecks. The Future models enable the General Assembly of the Department to capture the potential results of any changes it makes to its processes. The Future models do not only provide simulation data and analysis; it will serve as a blueprint for the solution architect and programmers whose responsibility it is to create and implement the new runtime processes.



Process Cost | Simulation result Mo... | Process Cases Summary | Simulatio... | Process Duration | Simulation result... | Resource Usage | Simulation result ... | Process Cost | Simulation result M

Case Name	Distribution	Success Status	Average Revenue	Average Processing Cost	Average Idle Cost	Average Allocated Resource Cost	Average Total Cost	Average Profit
Case 1	10.00%	Succeeded	$0.00	$0.00	$0.00	$295.70	$295.70	($295.70)
Case 2	20.00%	Failed	$0.00	$0.00	$0.00	$39.26	$39.26	($39.26)
Case 3	10.00%	Succeeded	$0.00	$0.00	$0.00	$319.79	$319.79	($319.79)
Case 4	20.00%	Succeeded	$0.00	$0.00	$0.00	$288.32	$288.32	($288.32)
Case 5	20.00%	Succeeded	$0.00	$0.00	$0.00	$304.67	$304.67	($304.67)
Case 6	10.00%	Succeeded	$0.00	$0.00	$0.00	$305.71	$305.71	($305.71)
Case 7	10.00%	Succeeded	$0.00	$0.00	$0.00	$348.90	$348.90	($348.90)
Weighted Average			$0.00	$0.00	$0.00	$253.46	$253.46	($253.46)

Figure 84: Process cost analysis of Application_Announcement_as_Is process

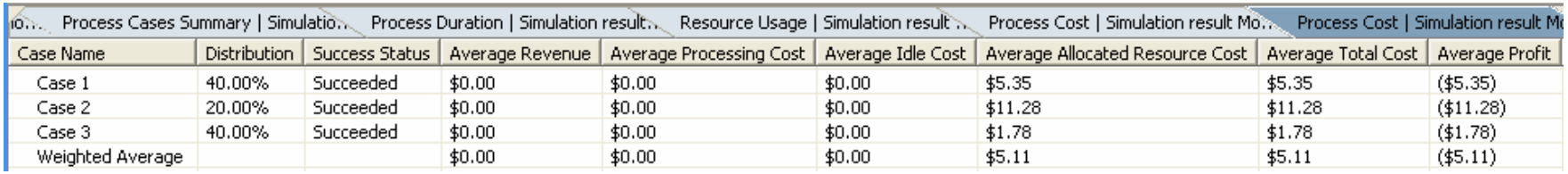


Process Cost | Simulation result Monday, October 16, 2006 12:24:30 PM EEST | Chairman_Election_as_Is Saturday, October 14, 2006 10:26:32 PM EEST | 12:48:41 PM EEST

io... | Process Duration | Simulation result... | Resource Usage | Simulation result ... | Process Cost | Simulation result Mo... | Process Cost | Simulation result Mo... | Process Cost | Simulation result M

Case Name	Distribution	Success Status	Average Revenue	Average Processing Cost	Average Idle Cost	Average Allocated Resource Cost	Average Total Cost	Average Profit
Case 1	30.00%	Succeeded	$0.00	$0.00	$0.00	$8.74	$8.74	($8.74)
Case 2	20.00%	Succeeded	$0.00	$0.00	$0.00	$9.42	$9.42	($9.42)
Case 3	40.00%	Succeeded	$0.00	$0.00	$0.00	$7.47	$7.47	($7.47)
Case 4	10.00%	Succeeded	$0.00	$0.00	$0.00	$7.29	$7.29	($7.29)
Weighted Average			$0.00	$0.00	$0.00	$8.22	$8.22	($8.22)

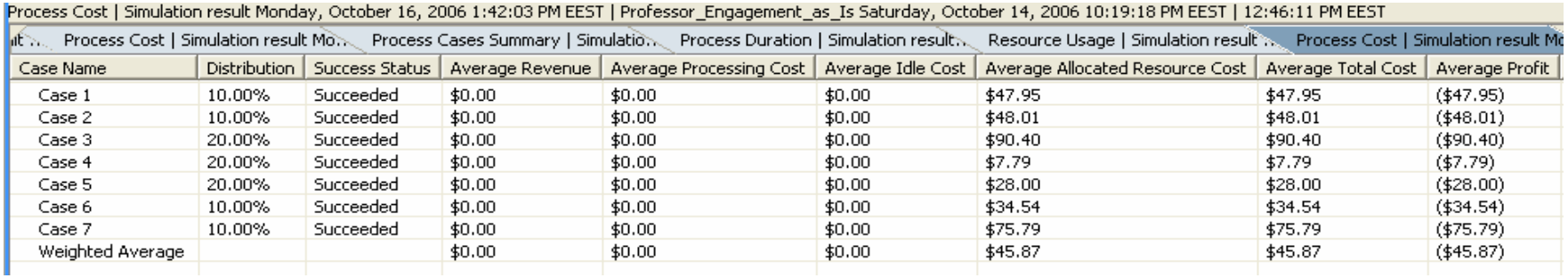
Figure 85: Process cost analysis of Chairman_Election_as_Isprocess



io... | Process Cases Summary | Simulatio... | Process Duration | Simulation result... | Resource Usage | Simulation result ... | Process Cost | Simulation result Mo... | Process Cost | Simulation result M

Case Name	Distribution	Success Status	Average Revenue	Average Processing Cost	Average Idle Cost	Average Allocated Resource Cost	Average Total Cost	Average Profit
Case 1	40.00%	Succeeded	$0.00	$0.00	$0.00	$5.35	$5.35	($5.35)
Case 2	20.00%	Succeeded	$0.00	$0.00	$0.00	$11.28	$11.28	($11.28)
Case 3	40.00%	Succeeded	$0.00	$0.00	$0.00	$1.78	$1.78	($1.78)
Weighted Average			$0.00	$0.00	$0.00	$5.11	$5.11	($5.11)

Figure 86: Process cost analysis of Extraordinary_G_A_as_Isprocess



Process Cost | Simulation result Monday, October 16, 2006 1:42:03 PM EEST | Professor_Engagement_as_Is Saturday, October 14, 2006 10:19:18 PM EEST | 12:46:11 PM EEST

ut ... | Process Cost | Simulation result Mo... | Process Cases Summary | Simulatio... | Process Duration | Simulation result... | Resource Usage | Simulation result ... | Process Cost | Simulation result M

Case Name	Distribution	Success Status	Average Revenue	Average Processing Cost	Average Idle Cost	Average Allocated Resource Cost	Average Total Cost	Average Profit
Case 1	10.00%	Succeeded	$0.00	$0.00	$0.00	$47.95	$47.95	($47.95)
Case 2	10.00%	Succeeded	$0.00	$0.00	$0.00	$48.01	$48.01	($48.01)
Case 3	20.00%	Succeeded	$0.00	$0.00	$0.00	$90.40	$90.40	($90.40)
Case 4	20.00%	Succeeded	$0.00	$0.00	$0.00	$7.79	$7.79	($7.79)
Case 5	20.00%	Succeeded	$0.00	$0.00	$0.00	$28.00	$28.00	($28.00)
Case 6	10.00%	Succeeded	$0.00	$0.00	$0.00	$34.54	$34.54	($34.54)
Case 7	10.00%	Succeeded	$0.00	$0.00	$0.00	$75.79	$75.79	($75.79)
Weighted Average			$0.00	$0.00	$0.00	$45.87	$45.87	($45.87)

Figure 87: Process cost analysis of Professor_Engagement_as_Is process

We will use the current process model as the starting point for the planned revisions to the process model:

- The key changes in the revised process Resource items revisions.
- Define Global tasks to replace of local tasks.
- Define Global processes that are reusable for replacing subprocesses of the current processes.
- Recreate current processes according to changes of the law.
- Redesign the current processes.

The reason for these changes is avoid the above bottlenecks and to make the implementation more flexible, that is, easier to replace one task when required.

5.7.1 Resource Items Revisions

For avoiding resource bottlenecks and making our processes faster we have decided to create the following resource elements:

- **Computer Application**, definition of a computer application, which is a bulk resource.
- **General Assembly Application**, resource which has the attributes of the Computer Application.
- **Online Application**, define a regular Weekday timetable with a time interval of 24 hours, repeated every day.

The General Assembly Application replaced the Secretary role in many activities and is used in other activities reducing the required time for them.

5.7.2 New Global Tasks & Processes

For making our processes more flexible we have decided to create the global tasks for replacing other local tasks at the above described current processes. Below we report the global tasks, that they replace local tasks:

- **Convoke General Assembly:** The Chairman defines the agenda of the General Assembly's Session and convoke it. This global task have replace the following local tasks:
    - ***Convoke G.A. Session for Election*** at subprocess *Proclamation* and the ***Convoke G.A. Session for Election Voting*** of the *Application_Announcement_as_Is* process.
    - ***Convoke General Assembly*** at *Extraordinary_G_A_as_Is* process.
    - ***Convoke G.A. Session for Engagement*** at the *Professor_Engagement_as_Is* process.

- **Publication of Decision:** The Department General Assembly publishes the decision about an issue the have recently discussed. This global task have replace the following local tasks:
    - ***Election Decision*** at subprocess *Election Voting* of the *Application_Announcement_as_Is* process.
    - ***Chairman Election Decision*** at *Chairman_Election_as_Is* process.
    - ***Engagement Decision*** at subprocess *Engagement Voting* of the *Professor_Engagement_as_Is* process.
- **Reject Application:** The Department General Assembly of the Department rejects applications or review requests and publishes the rejection decision. This global task have replace the following local tasks:
    - ***Reject Revision Request*** at subprocess *Election Voting* of the *Application_Announcement_as_Is* process.
    - ***Reject the Request*** at *Extraordinary_G_A_as_Is* process.
    - ***Reject the Engagement*** at *Professor_Engagement_as_Is* process.
- **Reject Decision:** The Department General Assembly publishes the rejection decision. This global task have replace the following local tasks:
    - ***Reject Decision*** at subprocess *Election Voting* of the *Application_Announcement_as_Is* process.
    - ***Reject Decision*** at subprocess *Engagement Voting* of the *Professor_Engagement_as_Is* process.
    - ***Decision of not election*** at subprocess *Vote* of the *Chairman_Election_as_Is* process.
- **Send Decision:** The General Assembly of the Department sends the decision to other organization and persons. This global task have replace the following local tasks:
    - ***Send Proclamation to Newspapers*** at subprocess Proclamation, the ***Submit Evaluation Report to GA*** and ***Submit Evaluation Report to Candidates*** at subprocess *Recommendatory Committee,* ***Send G.A. Decision to Electors*** and ***Submit Election Decision to Ministry of N. E.& R.*** of the *Application_Announcement_as_Is* process.
    - ***Send Application for Chairman Election*** at *Chairman_Election_as_Is* process.
    - ***Send Chairman Decision to Dean*** at *Extraordinary_G_A_as_Is* process.
    - ***Send G.A. Decision to Electors*** at the *Professor_Engagement_as_Is* process.
- **Send Notification:** The General Assembly of the Department sends the notifications to other organization and persons. This global task have replace the following local tasks:

- ***Notification to National Academy of Letters and Sciences*** at subprocess *Proclamation* and the ***Submit Evaluation Notification to GA*** at subprocess *Recommendatory Committee* of the *Application_Announcement_as_Is* process.

- **Send Request:** The General Assembly of the Department sends the requests to other organization. This global task have replace the following local tasks:
  - ***Send Request to Ministry*** at subprocess *Proclamation*, ***Send Request to Ministry*** at subprocess *Define Electors Body* and the ***Send request to National Academy of Letters*** at subprocess *Request to and Answer from N.A.L.S.* of the *Application_Announcement_as_Is* process.
  - ***Send Request to Ministry*** at subprocess *Define Electors Body* at the *Professor_Engagement_as_Is* process.

We have decided to create global processes for replacing sub-processes and redesigned them to avoid bottlenecks. Below we report the global process:

- **Electors' Body Definition**: This process shows how the Electors body is defined, see **Figure 88**. This global process has replaced the following subprocesses *Define Electors Body* at *Application_Announcement_as_Is* process and *Define Electors Body* at *Professor_Engagement_as_Is* process. The activities in the **Electors Body Definition** process are:
  - We have created the **Electors Repository** to store all Electors data.
  - **Load Repository:** Load the Electors Repository with the appropriate data.
  - **Are enough Electors? Decision:** Check if there are enough electors.
  - **Define Electors:** The Department General Assembly defines the electors from the Department Faculty.
  - **Establish Table of Electors:** The General Assembly Application use the Electors data from the Electors Repository and create the Electors Table that should be sending to Ministry for approval.
  - **Send Request:** The General Assembly of Department sends request to Ministry.
  - **Ministry of National Education & Religions Actions:** The Ministry decides. This is an external service.
  - **Completion of Electors' Body:** The Department General Assembly complete the Electors table.
  - **Send Decision:** The General Assembly of the Department sends the decision to Electors.

- We have also defined the following business items for the Electors Repository:
  - ***Elector*** which includes all the data that are necessary to define the Elector which may involve in General Assembly procedures; see **Table 18**.

Name	Type	Minimum	Maximum	Ordered	Unique	Default Value
Last Name	String	1	1	False	False	
First Name	String	1	1	False	False	
Social Number	String	1	1	False	True	
Rank	String	1	1	False	False	
Sector	String	1	1	False	False	
University	String	1	1	False	False	

Table 18: Elector

  - ***Table of Electors*** contains all the data of all Electors; see **Table 19**.

Name	Type	Minimum	Maximum	Ordered	Unique	Default Value
Electors	Elector	1	N	False	False	

Table 19: Table of Electors

Changes have been made in the process of Processor's Engagement according to changes in the legislation (Article 1, paragraph 6 of Act 1566/1985, Published in the Official Government Journal numbered A167, and Article 48, paragraph 19v of Act 1404/1983, Published in the Official Government Journal numbered A173). After voting, the relative decision is taken with the absolute majority of all number of department's professors that assembles in common meeting with the Department General Assembly. So the **Engagement Voting** sub-process of ***Professor_Engagement_to_Be*** process has change, see **Figure 89**.

Comparing the two sub-processes, the **Engagement Voting** sub-process of ***Professor_Engagement_as_Is*** process, see **Figure 46**, and the **Engagement Voting** sub-process of ***Professor_Engagement_to_Be*** process, see **Figure 89,** we observe that exist important differences at the **Engagement Voting** sub-process of ***Professor_Engagement_to_Be*** process have been erased tasks, decisions and the sub-process (*Request to and Answer from N.L.S.A.).*

5.7.3 Processes Redesign

According to the above changes we have redesign the processes Announcement of Faculty Vacancy, the Chairman's Election, Extraordinary General Meetings and Professor's Engagement.

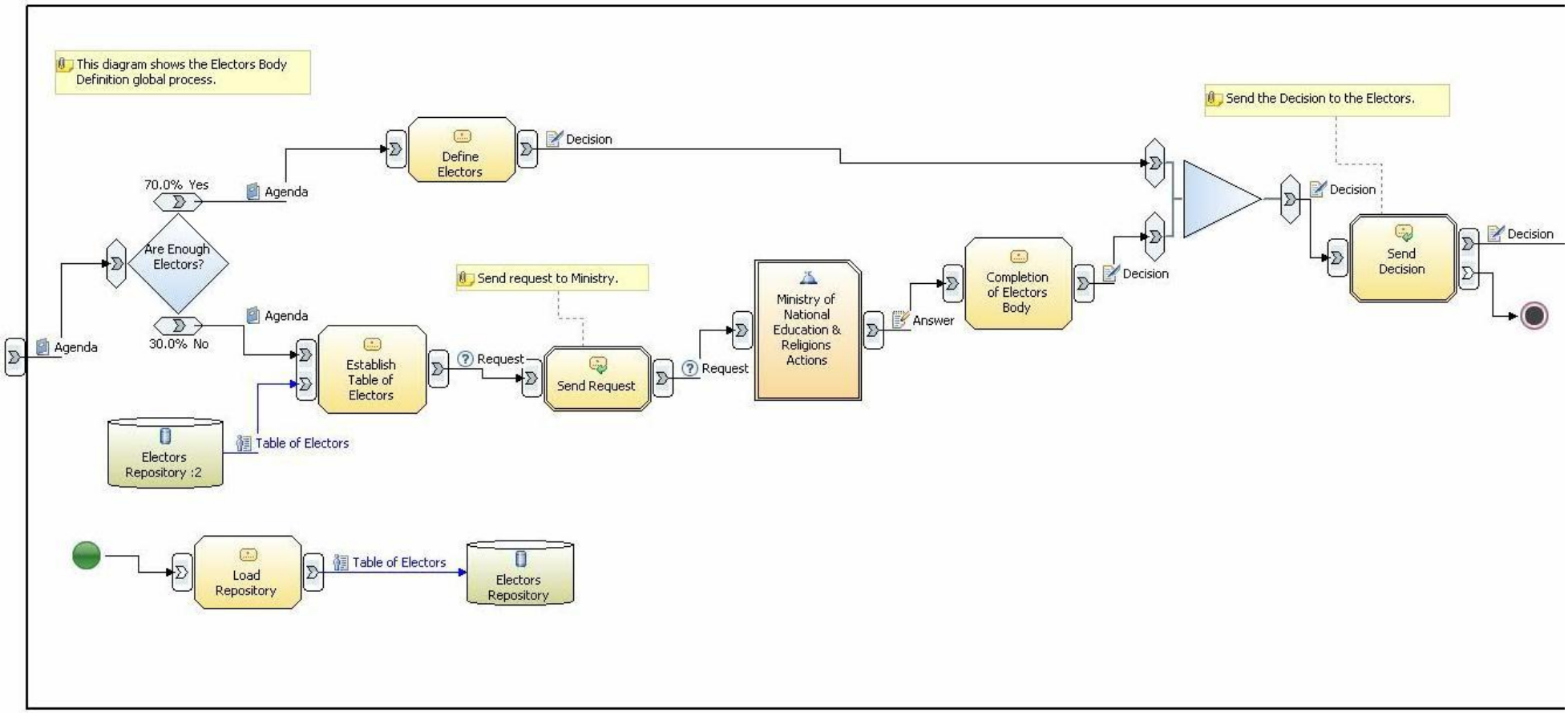


Figure 88: Electors Body Definition Global Process

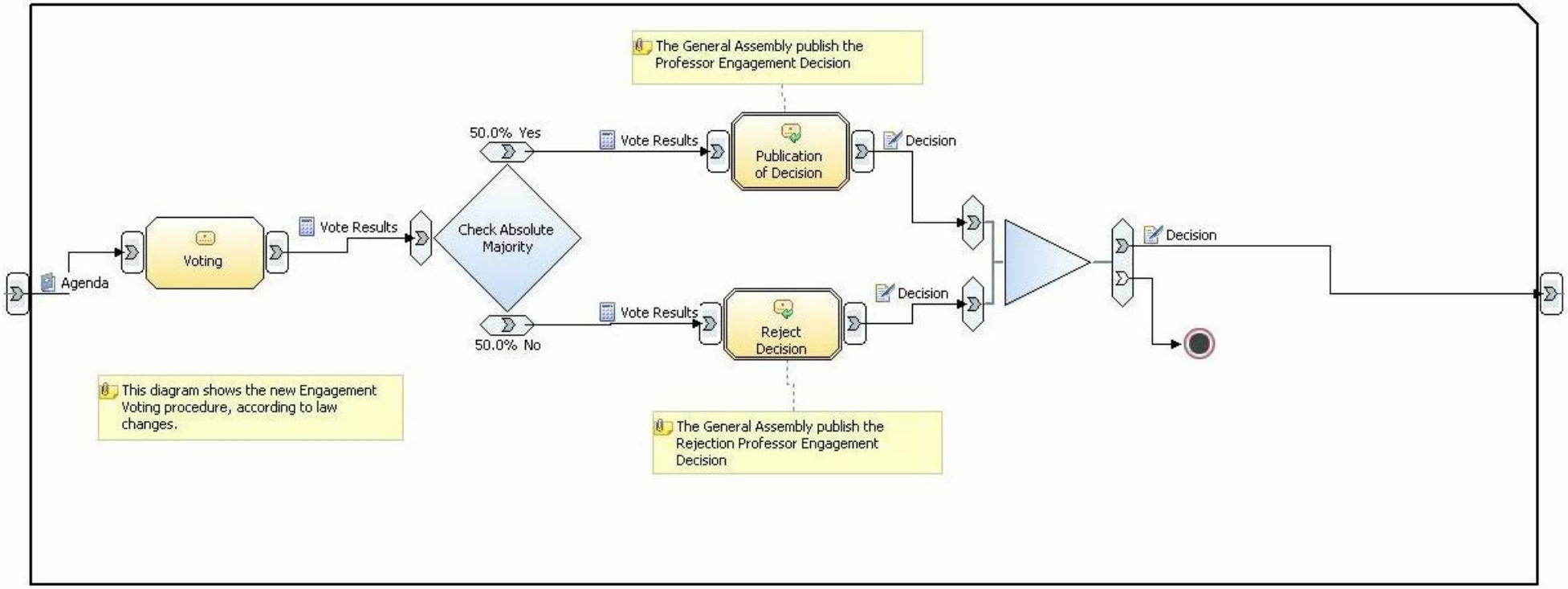


Figure 89: Engagement Voting subprocess of Professor_Engagement_to_Be Future Process after changes have been made according to law changes.

5.7.3.1 Announcement of a Faculty Vacancy

We have decided the make the following changes in the **Application_Announcement_to_Be** process model:

- The Electors Body Definition and the Recommendation Committee sub-processes are executed in parallel. This reduces the waiting time.
- The Send Decision to Ministry and the Publication of Election Proceedings activities are executed in parallel. This reduces the waiting time.
- The activities, Define Rank & Sector, Send Request and Decision of not Proclamation the Place, the Ministry of National Education & Relation Action service and the Accept Request Decision are moved from Proclamation sub-process to the main process for avoiding the failures.

We have decided to make the following changes in the **Recommendation Committee** embedded process model:

- We have created the **General Assembly Application Repository** to store all the Candidates Applications and Memos.
- The application of the Secretariat loads the Candidates Applications & Memos to the General Assembly Application Repository.
- The Recommendatory Committee Members use the General Assembly Application and the General Assembly Application Repository to evaluate the Candidates Applications.

Finally the redesigned **Application_Announcement_to_Be** future process model is shown in **Figure 90**. The **Proclamation** Embedded Process model is shown in **Figure 91**. The **Define Electors' Body** Embedded Process has been replaced with the **Define Electors Body** Global process, see **Figure 88**. The **Recommendation Committee** Embedded Process model is shown in **Figure 92**. The **Election Voting** Embedded Process model is shown in **Figure 93**. The **Request and Answer from N.A.L.S.** Embedded Process model is shown in **Figure 94**.

5.7.3.2 The Chairman's Election

We have decided the make the following changes in the **Chairman_Election_ to_Be** process model:

- We have created the **Members Repository** to store all the General Assembly Members data that are electors at the Chairman's Election process.

- The services **Members from Undergraduate, Members from Postgraduate** and **Members from EDTP** load to the Members Repository the General Assembly Members data that are electors at the Chairman Election process.
- In the **Convened Electors Body** activity the General Assembly Application is used to convoke, using the data from the Members Repository, the General Assembly for the Chairman's Election.

The **Chairman_Election_ to_Be** process model is shown in **Figure 95**. The **Vote Embedded Process** model is shown in **Figure 96**.

5.7.3.3 Extraordinary General Meetings

The **Extraordinary_G_A_to_Be** process model is shown in **Figure 98**. Here we only replace tasks with the global tasks described above.

5.7.3.4 Professor's Engagement

The **Professor_Engagement_to_Be** process model is shown in **Figure 97**. The **Define Electors' Body** Embedded Process has been replaced with the **Define Electors Body** Global process, see **Figure 88**. The **Engagement Voting** Embedded Process model has been replaced with the **Engagement Voting** as is shown in **Figure 89**.

5.8 Simulating and Analysing the Future Processes

This section describes how the Application_Announcement_to_Be, Chairman_Election_to_Be, Extraordinary_G_A_to_Be & Professor_Engagement_to_Be Future Processes were simulated and analyzed. First, we recompile all the Future processes models information's related to the simulation, and then we enter these information's into the simulation attributes of the model and generate simulation snapshots.

Once simulation results and statistics are available we analyze the new simulation performance statistics from the Modeler analysis reports and make conclusions if the new revised processes meet the objectives set.

5.8.1 Overview of simulating the Future processes

For the simulation and analysis of the Future processes we are going to perform the same steps of the process simulation as we described in Section 5.6:

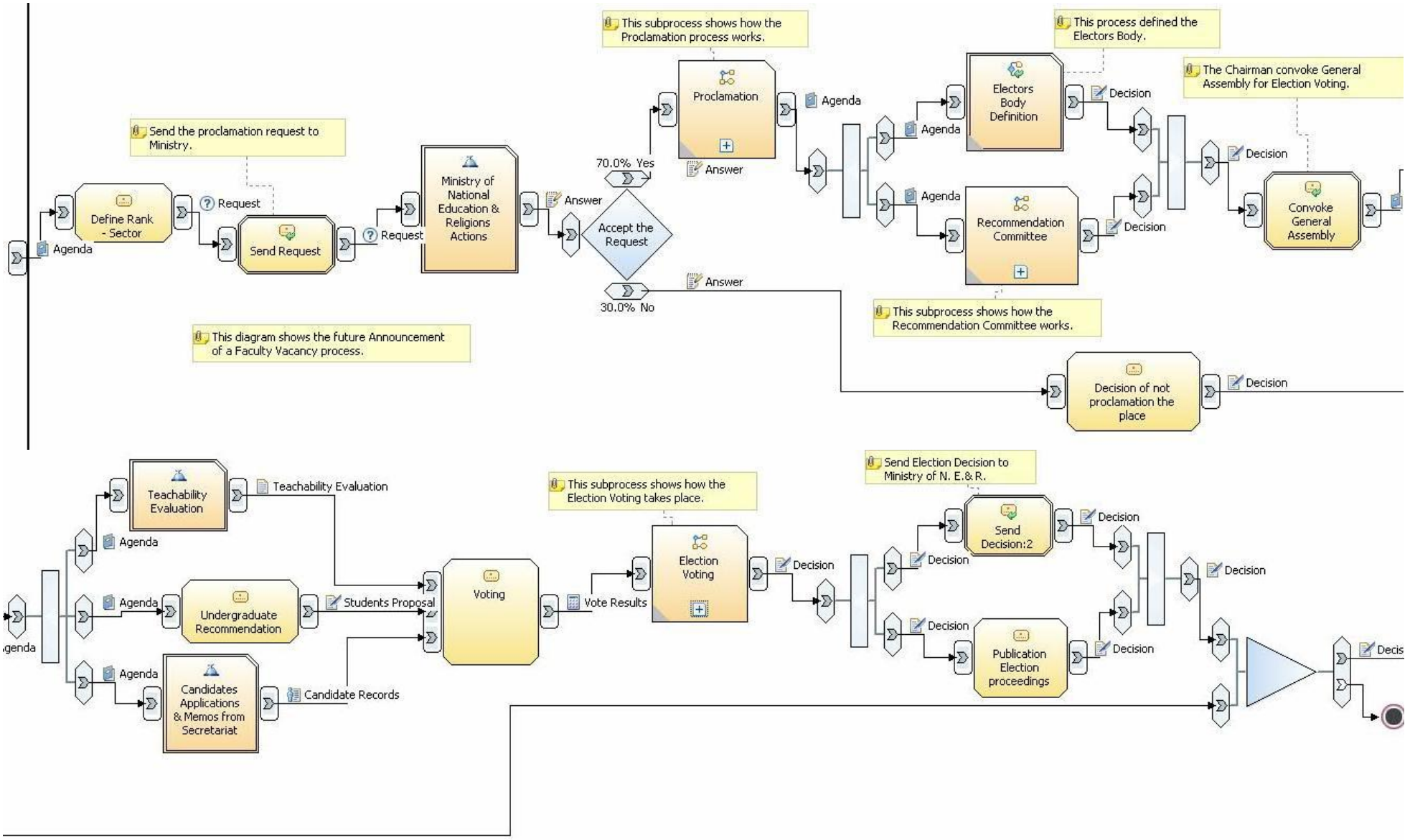


Figure 90: ApplicationAnnouncement_to_Be Process

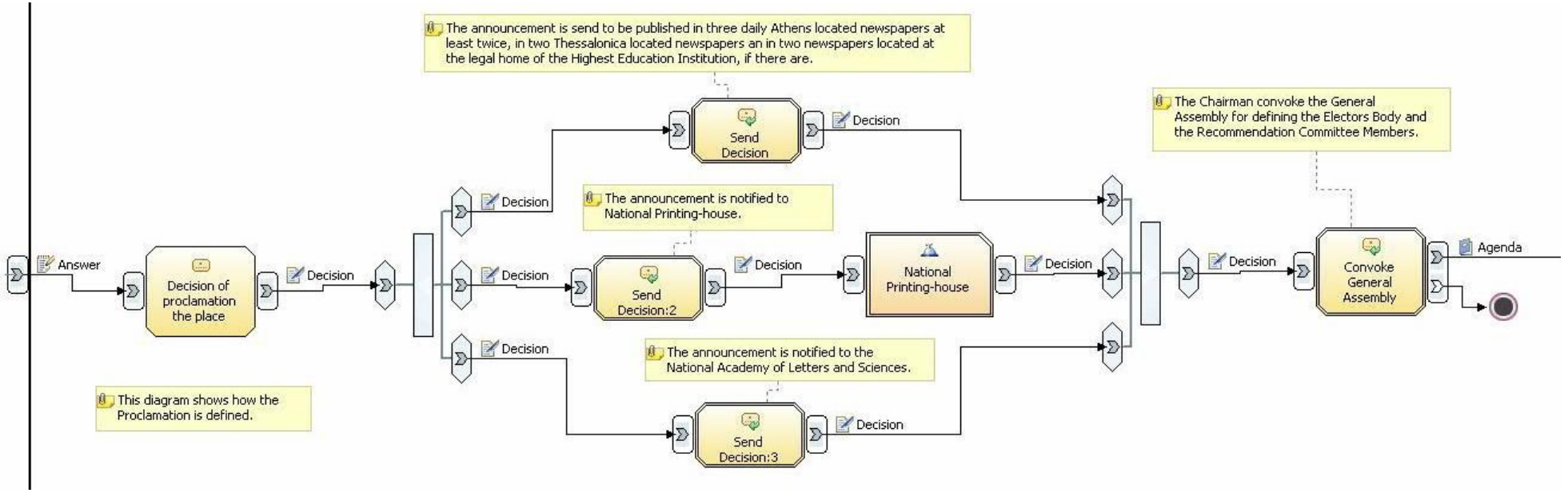


Figure 91: Proclamation Embedded Process

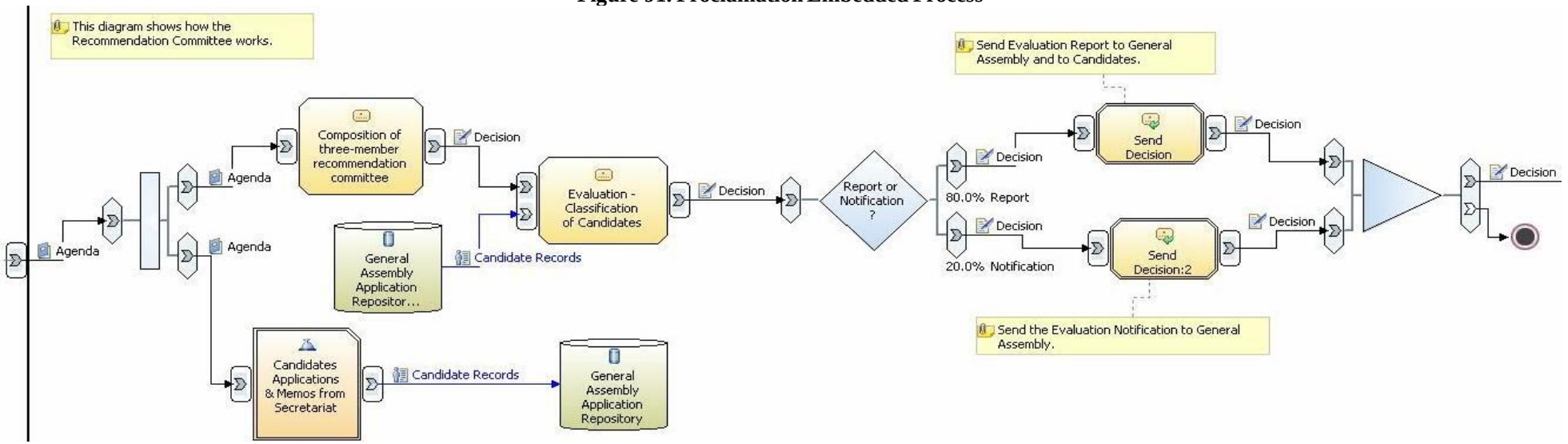


Figure 92: Recommendation Committee Embedded Process

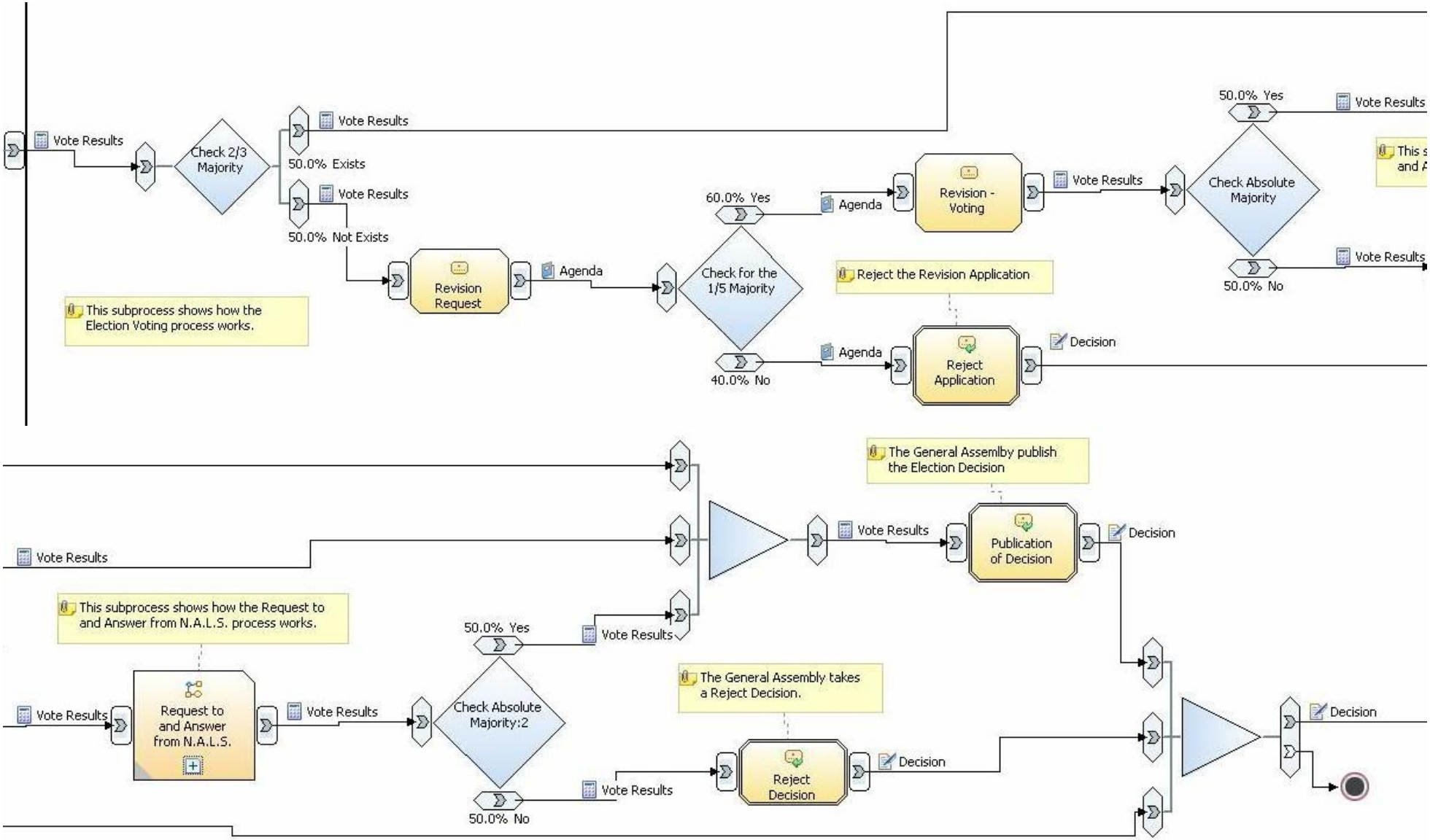


Figure 93: Election Voting Embedded Process

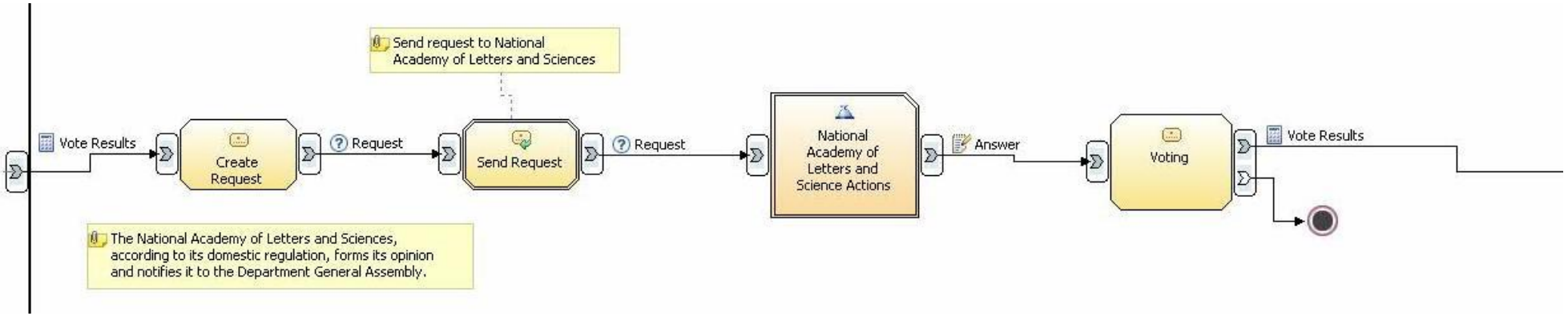


Figure 94: Request to and Answer from N.L.S.A. Embedded Process

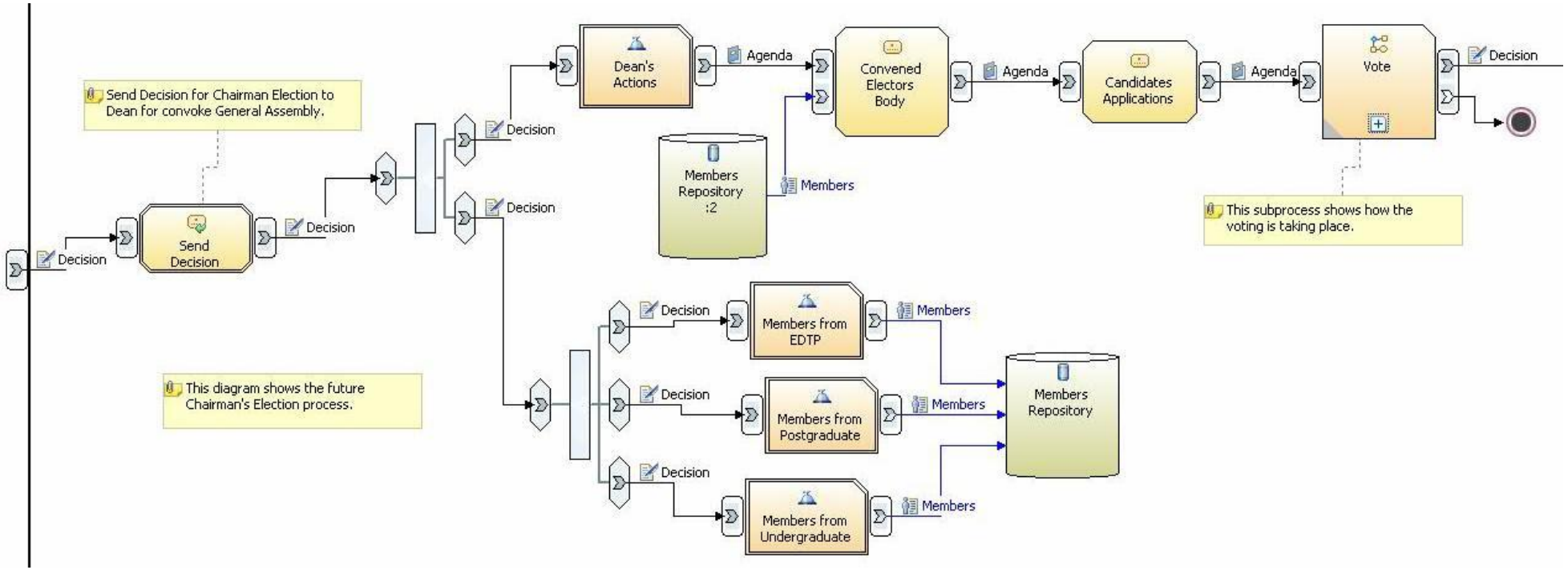


Figure 95: Chairman_Election_to_Be Process

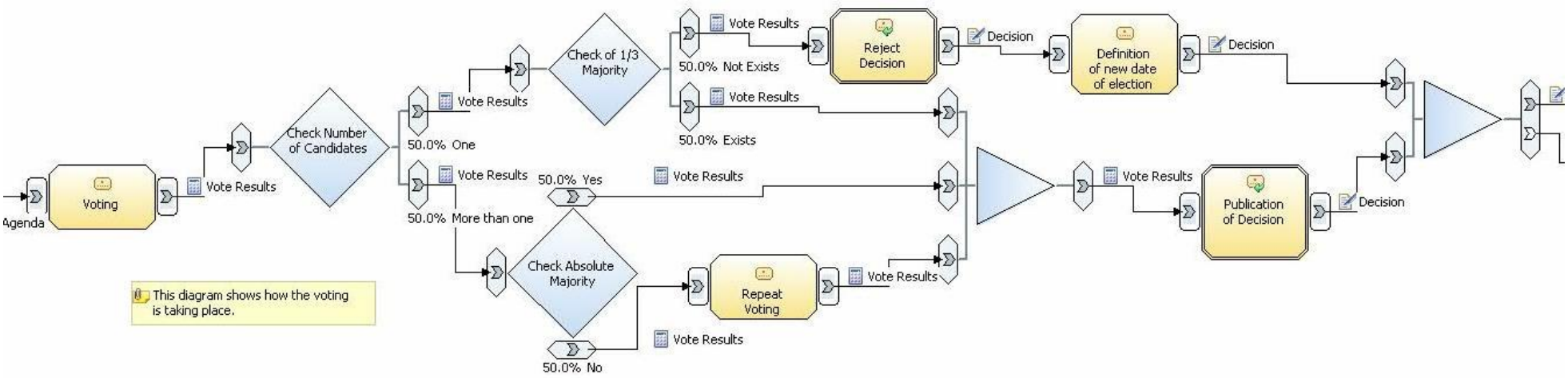


Figure 96: Vote Embedded Process

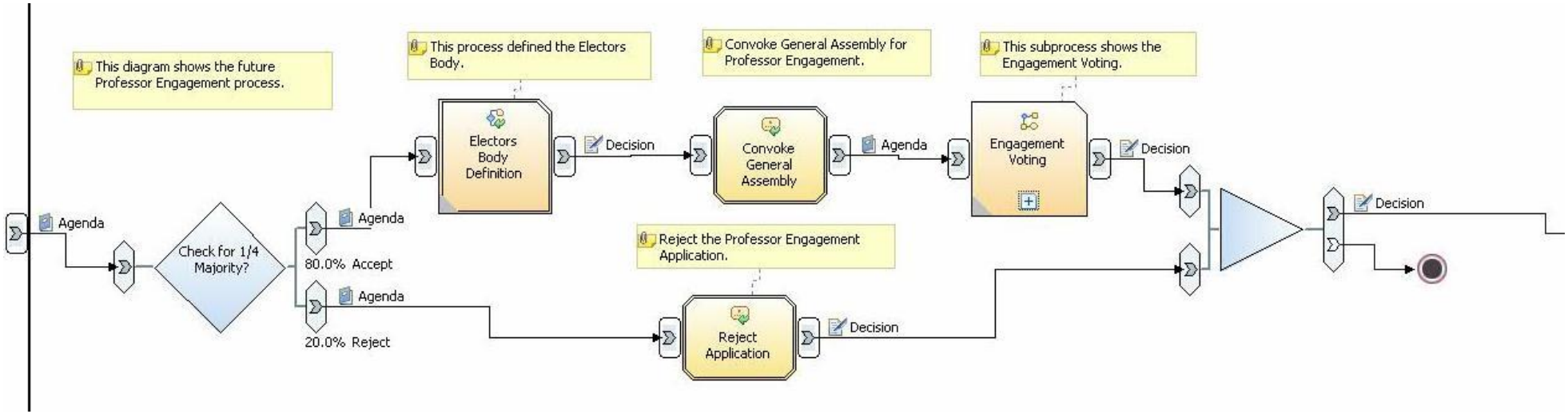


Figure 97: Professor_Engagement_to_Be Process

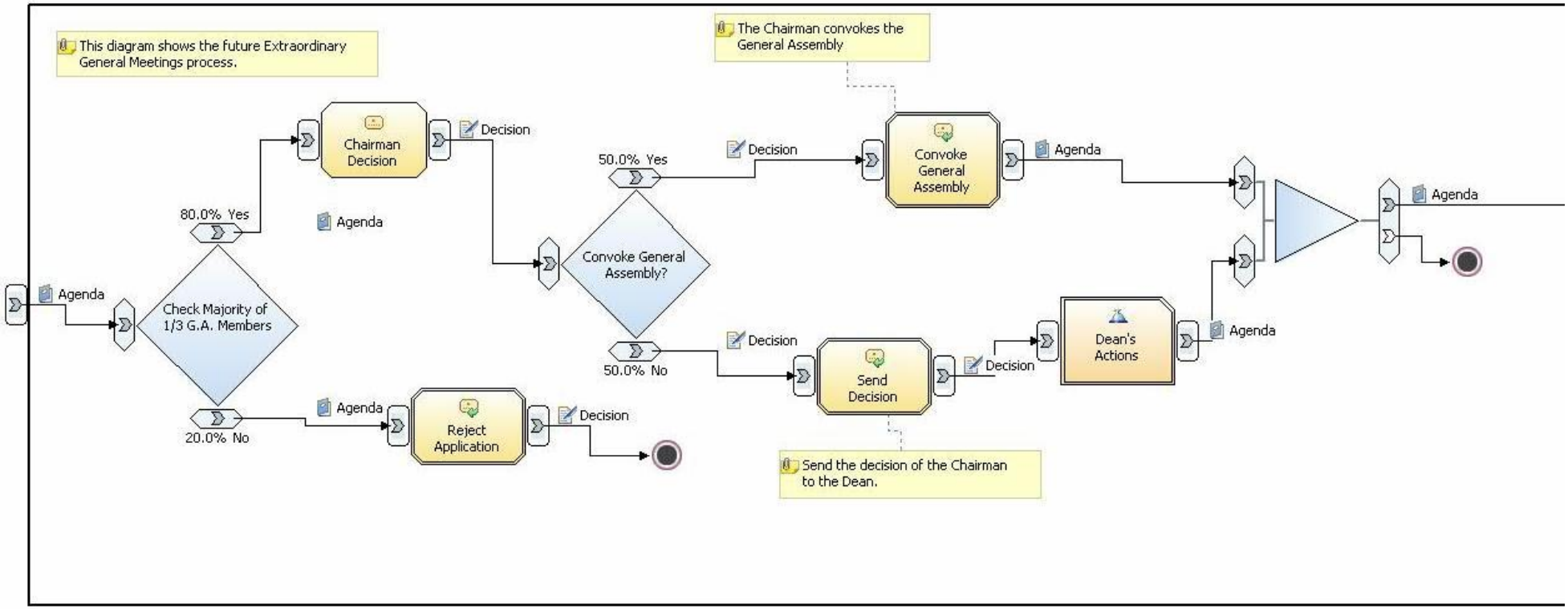


Figure 98: Extraordinary_G_A_to_Be Process

- Define resource requirements:
- Review corporate strategy and objectives
- Review the Future processes models
- Define these matrixes:
    - Roles and costs
    - Activity durations
    - Resource availability
- Define the simulation profile and attributes related to the simulation run
- Enter the simulation attributes in the Modeler
- Create and run a simulation snapshot
- Analyze simulation results

Following the process simulation methodology outlined above, we have completed the following steps:

- Review corporate strategy and objectives
    - We have confirmed that objectives for the revised processes are:
        - The high-level business objectives levels are to **increase revenue** and **reduce costs**.
- We have reviewed all the process model components to prepare for the next step of defining the simulation related matrixes. As a result of the revision of the future processes the following matrixes are compiled:
    - Roles and costs
    - Activity durations
    - Resource availability

5.8.2 Roles and costs matrix

The roles and costs matrix, see Appendix A, shows the number of humans in each role with the assignment of the cost to activities. The cost is defined by the salary divided by the unit of measure, a day in our case. The difference from the current process models is that the General Assembly Application resources are added.

5.8.3 Availability Matrix

The resources availability matrix, see Appendix A, shows the timetables assigned to the resources. In our business case there are two timetables used for the Future Processes models. The timetables are defined in the modeler as follows:

- Day Shift
  - 8 working hours a day,
  - Working days are Monday to Friday
  - Working hours 8:00 AM to 4:00 PM.
- Online Application
  - 24 hours x 7 days a week

5.8.4 Duration Matrix

The duration matrix, see Appendix A, shows the durations of human or system tasks for a specific role and activity. In this case, there are multiple human roles for one activity. The differences from the current process model are the following:

- General Assembly Application resource and corresponding activity duration is added in each activity is involved.
- The Secretary, Chairman and Dean time is reduced in each activity are involved.

5.8.5 Populate role resources with costs and availability

The main difference in processes resources for the Future processes versus the Current processes is that the Secretary is not involved in many activities any longer r; the General Assembly Application is performing these functions now and the time that the other resources are involved is smaller.

5.8.6 Analyzing the Future Processes simulation results

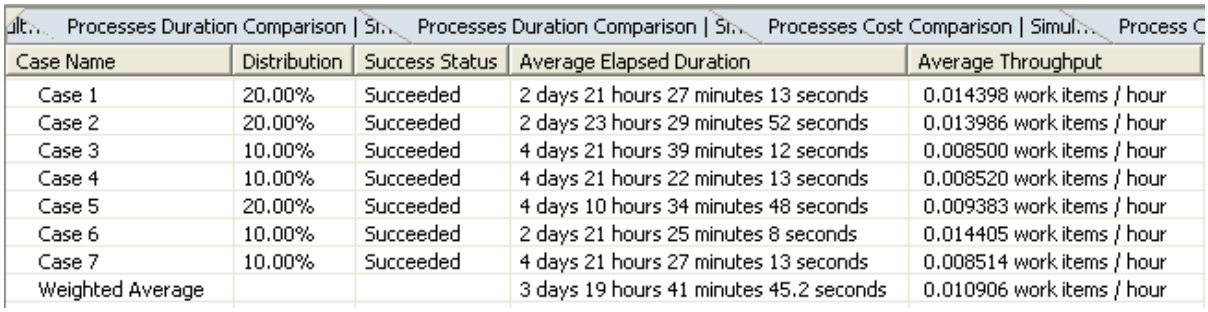
Once the simulations of the processes are complete we generate the same reports as for the current processes. We have performed an analysis based on the simulation data presented in the Modeler's dynamic analysis and reporting capabilities. We have compared the revised processes results with those of the current process to be sure that the new process will help meet the objectives set.

We have run the following specific reports by selecting the results and *Dynamic Analysis*:

- Process duration
- Process cases summary
- Resource usage
- Process cost

5.8.6.1 Process Duration

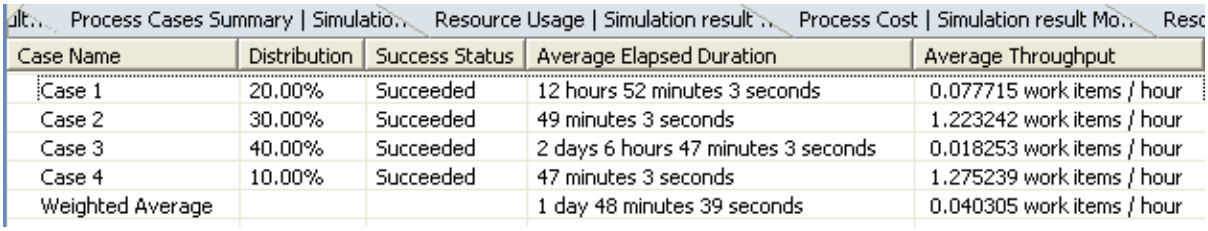
Process duration analysis, as we have said above, shows the process instance elapsed duration and throughput details for each process case in a simulation. We have gotten the process duration information, selecting the simulation result element are shown in **Figure 99**, **Figure 100**, **Figure 101** and **Figure 102** for each process.



ult... | Processes Duration Comparison | Si... | Processes Duration Comparison | Si... | Processes Cost Comparison | Simul... | Process C

Case Name	Distribution	Success Status	Average Elapsed Duration	Average Throughput
Case 1	20.00%	Succeeded	2 days 21 hours 27 minutes 13 seconds	0.014398 work items / hour
Case 2	20.00%	Succeeded	2 days 23 hours 29 minutes 52 seconds	0.013986 work items / hour
Case 3	10.00%	Succeeded	4 days 21 hours 39 minutes 12 seconds	0.008500 work items / hour
Case 4	10.00%	Succeeded	4 days 21 hours 22 minutes 13 seconds	0.008520 work items / hour
Case 5	20.00%	Succeeded	4 days 10 hours 34 minutes 48 seconds	0.009383 work items / hour
Case 6	10.00%	Succeeded	2 days 21 hours 25 minutes 8 seconds	0.014405 work items / hour
Case 7	10.00%	Succeeded	4 days 21 hours 27 minutes 13 seconds	0.008514 work items / hour
Weighted Average			3 days 19 hours 41 minutes 45.2 seconds	0.010906 work items / hour

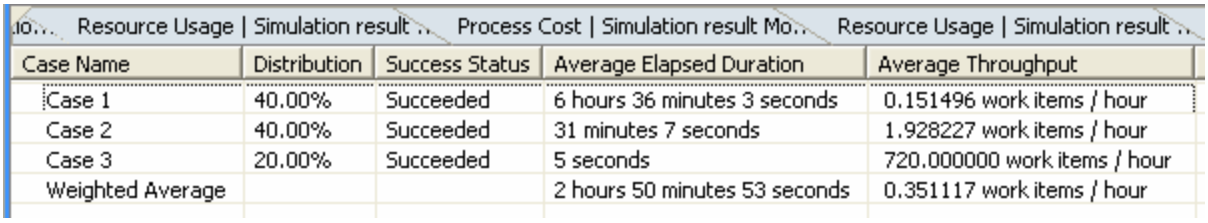
Figure 99: Process duration analysis of Application_Announcement_to_Be process



ult... | Process Cases Summary | Simulatio... | Resource Usage | Simulation result ... | Process Cost | Simulation result Mo... | Resc

Case Name	Distribution	Success Status	Average Elapsed Duration	Average Throughput
Case 1	20.00%	Succeeded	12 hours 52 minutes 3 seconds	0.077715 work items / hour
Case 2	30.00%	Succeeded	49 minutes 3 seconds	1.223242 work items / hour
Case 3	40.00%	Succeeded	2 days 6 hours 47 minutes 3 seconds	0.018253 work items / hour
Case 4	10.00%	Succeeded	47 minutes 3 seconds	1.275239 work items / hour
Weighted Average			1 day 48 minutes 39 seconds	0.040305 work items / hour

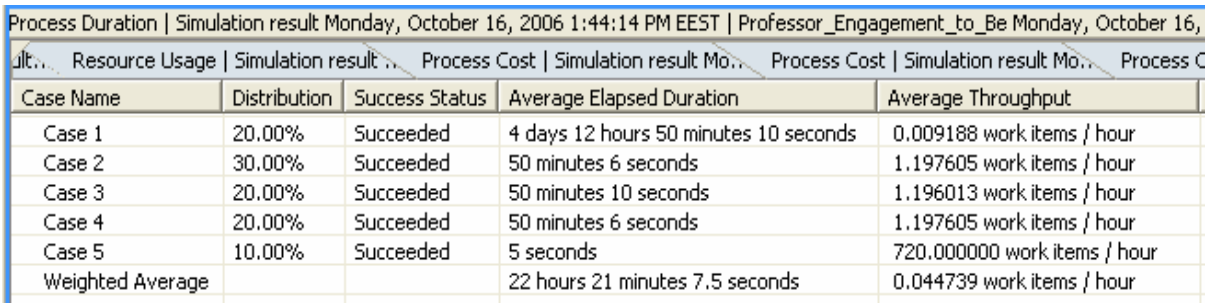
Figure 100: Process duration analysis of Chairman_Election_to_Be process



io... | Resource Usage | Simulation result ... | Process Cost | Simulation result Mo... | Resource Usage | Simulation result ...

Case Name	Distribution	Success Status	Average Elapsed Duration	Average Throughput
Case 1	40.00%	Succeeded	6 hours 36 minutes 3 seconds	0.151496 work items / hour
Case 2	40.00%	Succeeded	31 minutes 7 seconds	1.928227 work items / hour
Case 3	20.00%	Succeeded	5 seconds	720.000000 work items / hour
Weighted Average			2 hours 50 minutes 53 seconds	0.351117 work items / hour

Figure 101: Process duration analysis of Extraordinary_G_A_to_Be process



Process Duration | Simulation result Monday, October 16, 2006 1:44:14 PM EEST | Professor_Engagement_to_Be Monday, October 16,

ult... Resource Usage | Simulation result ... Process Cost | Simulation result Mo... Process Cost | Simulation result Mo... Process C

Case Name	Distribution	Success Status	Average Elapsed Duration	Average Throughput
Case 1	20.00%	Succeeded	4 days 12 hours 50 minutes 10 seconds	0.009188 work items / hour
Case 2	30.00%	Succeeded	50 minutes 6 seconds	1.197605 work items / hour
Case 3	20.00%	Succeeded	50 minutes 10 seconds	1.196013 work items / hour
Case 4	20.00%	Succeeded	50 minutes 6 seconds	1.197605 work items / hour
Case 5	10.00%	Succeeded	5 seconds	720.000000 work items / hour
Weighted Average			22 hours 21 minutes 7.5 seconds	0.044739 work items / hour

Figure 102: Process duration analysis of Professor_Engagement_to_Be process

At this point, we can validate that the **average duration** of the revised processes are:

- The Application_Announcement_to_Be future process has 3 days 19 hours 41 minutes and 45.2 seconds.
- The Chairman_Election_to_Be future process has 1 day 19 49 minutes and 39 seconds.
- The Extraordinary_G_A_to_Be future process has 2 hours 50 minutes and 53 seconds.
- The Professor_Engagement_to_Be future process has 22 hours 21 minutes and 7.5 seconds.

5.8.6.2 Process Cases Summary

The process cases summary analysis, as we have said above, shows summary details for all the process cases produced during the simulation of a process. We have gotten the process cases information, selecting the simulation result element shown in **Figure 103**, **Figure 104**, **Figure 105** and **Figure 109** for each process.

All processes cases run significantly faster and the average task delay is near to zero. Also all the processes cases are succeed.

5.8.6.3 Resource Usage

This analysis shows information about usage of each resource that is allocated in a process simulation shown in **Figure 112**, **Figure 113**, **Figure 114** and **Figure 115**.

The new General Assembly Application, which replaced the Secretary in many activities, reduced the resource allocation and is available 24 by 7, does resolve the resource shortage duration issues of the current processes.

Case Name	Number of Process Instances	Average Process Total Cost	Average Process Elapsed Duration	Average Process Working Duration	Average Process Resource Duration	Average Process Delay Duration	Distribution	Success Status
Case 1	2	$212.62	2 days 21 hours 27 minutes 13 ...	21 hours 42 minutes 32 seconds	1 day 1 hour 58 minutes 36 seconds	1 day 23 hours 54 minutes 57...	20.00%	Succeeded
Case 2	2	$201.84	2 days 23 hours 29 minutes 52 ...	21 hours 40 minutes 27 seconds	1 day 1 hour 46 minutes 16 seconds	2 days 1 hour 59 minutes 41 ...	20.00%	Succeeded
Case 3	1	$210.48	4 days 21 hours 39 minutes 12 ...	21 hours 54 minutes 31 seconds	1 day 2 hours 18 minutes 9 seconds	3 days 23 hours 54 minutes 5...	10.00%	Succeeded
Case 4	1	$200.41	4 days 21 hours 22 minutes 13 ...	21 hours 42 minutes 36 seconds	1 day 1 hour 44 minutes 39 seconds	3 days 23 hours 59 minutes 5...	10.00%	Succeeded
Case 5	2	$21.84	4 days 10 hours 34 minutes 48 ...	30 minutes 4 seconds	2 hours 1 minute 33 seconds	4 days 10 hours 4 minutes 44...	20.00%	Succeeded
Case 6	1	$212.86	2 days 21 hours 25 minutes 8 s...	21 hours 40 minutes 27 seconds	1 day 1 hour 46 minutes 16 seconds	1 day 23 hours 54 minutes 57...	10.00%	Succeeded
Case 7	1	$208.67	4 days 21 hours 27 minutes 13 ...	21 hours 42 minutes 32 seconds	1 day 1 hour 58 minutes 36 seconds	3 days 23 hours 54 minutes 5...	10.00%	Succeeded

Figure 103: Process cases summary analysis of Application_Announcement_to_Be process

Case Name	Number of Process Instances	Average Process Total Cost	Average Process Elapsed Duration	Average Process Working Duration	Average Process Resource Duration	Average Process Delay Duration	Distribution	Success Status
Case 1	2	$2.14	12 hours 52 minutes 3 seconds	22 minutes 7 seconds	34 minutes 23 seconds	12 hours 29 minutes 59 seconds	20.00%	Succeeded
Case 2	3	$2.70	49 minutes 3 seconds	19 minutes 7 seconds	32 minutes 38 seconds	29 minutes 59 seconds	30.00%	Succeeded
Case 3	4	$1.83	2 days 6 hours 47 minutes 3 se...	17 minutes 7 seconds	24 minutes 28 seconds	2 days 6 hours 29 minutes 59...	40.00%	Succeeded
Case 4	1	$1.98	47 minutes 3 seconds	17 minutes 7 seconds	24 minutes 28 seconds	29 minutes 59 seconds	10.00%	Succeeded

Figure 104: Process cases summary analysis of Chairman_Election_to_Be process

Process Cases Summary | Simulation result Monday, October 16, 2006 1:44:14 PM EEST | Professor_Engagement_to_Be Monday, October 16, 2006 12:32:55 PM EEST | 12:55:51 PM EEST

Case Name	Number of Process Instances	Average Process Total Cost	Average Process Elapsed Duration	Average Process Working Duration	Average Process Resource Duration	Average Process Delay Duration	Distribution	Success Status
Case 1	2	$4.67	4 days 12 hours 50 minutes 10 ...	20 minutes 8 seconds	44 minutes 21 seconds	4 days 12 hours 30 minutes 3...	20.00%	Succeeded
Case 2	3	$8.56	50 minutes 6 seconds	20 minutes 4 seconds	58 minutes 18 seconds	30 minutes 3 seconds	30.00%	Succeeded
Case 3	2	$4.83	50 minutes 10 seconds	20 minutes 8 seconds	44 minutes 31 seconds	30 minutes 3 seconds	20.00%	Succeeded
Case 4	2	$8.75	50 minutes 6 seconds	20 minutes 4 seconds	58 minutes 28 seconds	30 minutes 3 seconds	20.00%	Succeeded
Case 5	1	$0.00	5 seconds	5 seconds	5 seconds	0 seconds	10.00%	Succeeded

Figure 105: Process cases summary analysis of Professor_Engagement_to_Be process

Si... | Processes Duration Comparison | Si... | Processes Cost Comparison | Simul... | Process Cost | Simulation result Mo... | Process Duration | Simulation result... | Resource Usage | Simulation result ... | Process Cost | Simulation res

Case Name	Activity Name	Average Task Total Cost	Average Task Elapsed Duration	Average Task Working Duration	Average Task Resource Duration	Average Task Delay Duration	Nun
⊞ Case 1							2
⊞ Case 2							2
⊟ Case 3							1
	Accept the Request	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Candidates Applications & Memos from Secretariat	$0.00	1 second	1 second	0 seconds	0 seconds	
	Convoke General Assembly	$0.37	5 minutes	5 minutes	11 minutes	0 seconds	
	Define Rung - Sector	$15.05	20 minutes	20 minutes	1 hour 21 minutes	0 seconds	
	Check 2/3 Majority	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Check Absolute Majority	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Check Absolute Majority:2	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Check for the 1/5 Majority	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Merge:2	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Publication of Decision	$0.09	3 minutes	3 minutes	3 minutes 15 seconds	0 seconds	
	Create Request	$0.15	5 minutes	5 minutes	6 minutes	0 seconds	
	National Academy of Letters and Science Actions	$0.00	1 second	1 second	0 seconds	0 seconds	
	Send Request	$0.00	3 seconds	3 seconds	3 seconds	0 seconds	
	Voting	$0.78	2 minutes	2 minutes	5 minutes 10 seconds	0 seconds	
	Request to and Answer from N.A.L.S.	$0.00	7 minutes 4 seconds				
	Revision - Voting	$0.78	2 minutes	2 minutes	5 minutes 10 seconds	0 seconds	
	Revision Request	$3.61	5 minutes	5 minutes	15 minutes 30 seconds	0 seconds	
	Election Voting	$0.00	17 minutes 4 seconds				
	Are Enough Electors?	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Define Electors	$7.52	10 minutes	10 minutes	41 minutes	0 seconds	
	Load Repository	$0.00	1 second	1 second	0 seconds	0 seconds	
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Send Decision	$0.00	3 seconds	3 seconds	3 seconds	0 seconds	
	Electors Body Definition	$0.00	10 minutes 3 seconds				
	Fork	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Fork:2	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Fork:6	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Join	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Join:2	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Ministry of National Education & Religions Actions	$0.00	1 second	1 second	0 seconds	0 seconds	
	Convoke General Assembly	$0.37	5 minutes	5 minutes	11 minutes	0 seconds	
	Decision of proclamation the place	$7.52	10 minutes	10 minutes	40 minutes 30 seconds	0 seconds	
	Fork	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Join	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	National Printing-house	$0.00	1 second	1 second	0 seconds	0 seconds	
	Send Decision	$0.00	3 seconds	3 seconds	3 seconds	0 seconds	
	Send Decision:2	$0.00	3 seconds	3 seconds	3 seconds	0 seconds	
	Send Decision:3	$0.00	3 seconds	3 seconds	3 seconds	0 seconds	
	Proclamation	$0.00	15 minutes 4 seconds				

Figure 106: Process case 3 summary analysis of Application_Announcement_to_Be process

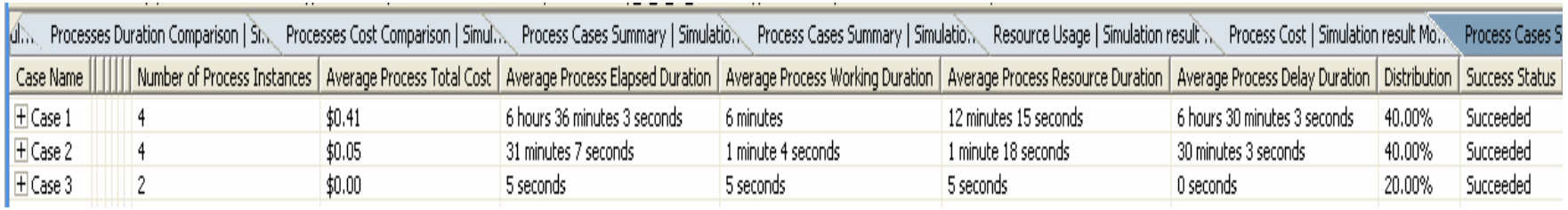
⊟ Case 7						
	Accept the Request	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Candidates Applications & Memos from Secretariat	$0.00	1 second	1 second	0 seconds	0 seconds
	Convoke General Assembly	$0.36	5 minutes	5 minutes	11 minutes	0 seconds
	Define Rung - Sector	$16.12	20 minutes	20 minutes	1 hour 21 minutes	0 seconds
	Check 2/3 Majority	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Check for the 1/5 Majority	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Reject Application	$0.00	5 seconds	5 seconds	5 seconds	0 seconds
	Revision Request	$3.50	5 minutes	5 minutes	15 minutes 30 seconds	0 seconds
	Election Voting	$0.00	5 minutes 5 seconds			
	Are Enough Electors?	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Define Electors	$8.06	10 minutes	10 minutes	41 minutes	0 seconds
	Load Repository	$0.00	1 second	1 second	0 seconds	0 seconds
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Send Decision	$0.00	3 seconds	3 seconds	3 seconds	0 seconds
	Electors Body Definition	$0.00	10 minutes 3 seconds			
	Fork	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Fork:2	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Fork:6	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Join	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Join:2	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Ministry of National Education & Religions Actions	$0.00	1 second	1 second	0 seconds	0 seconds
	Convoke General Assembly	$0.40	5 minutes	5 minutes	11 minutes	0 seconds
	Decision of proclamation the place	$8.06	10 minutes	10 minutes	40 minutes 30 seconds	0 seconds
	Fork	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Join	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	National Printing-house	$0.00	1 second	1 second	0 seconds	0 seconds
	Send Decision	$0.00	3 seconds	3 seconds	3 seconds	0 seconds
	Send Decision:2	$0.00	3 seconds	3 seconds	3 seconds	0 seconds
	Send Decision:3	$0.00	3 seconds	3 seconds	3 seconds	0 seconds
	Proclamation	$0.00	15 minutes 4 seconds			
	Publication Election proceedings	$0.43	15 minutes	15 minutes	16 minutes	0 seconds
	Candidates Applications & Memos from Secretariat	$0.00	1 second	1 second	0 seconds	0 seconds
	Composition of three-member recommendatory ...	$8.06	20 minutes	10 minutes	40 minutes	10 minutes
	Evaluation - Classification of Candidates	$157.59	20 hours	20 hours	21 hours	0 seconds
	Fork	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Report or Notification?	$0.00	0 seconds	0 seconds	0 seconds	0 seconds
	Send Decision:2	$0.00	3 seconds	3 seconds	3 seconds	0 seconds
	Recommendatory Committee	$0.00	20 hours 20 minutes 3 seconds			
	Send Decision:2	$0.00	3 seconds	3 seconds	3 seconds	0 seconds
	Send Request	$0.00	3 seconds	3 seconds	3 seconds	0 seconds
	Teachability Evaluation	$0.00	1 second	1 second	0 seconds	0 seconds
	Undergraduate Recommendation	$0.00	10 minutes	10 minutes	10 minutes	0 seconds
	Voting	$6.09	3 days 23 hours 56 minutes ...	12 minutes	32 minutes 10 seconds	3 days 23 hours 44 minute...

Figure 107: Process case 3 summary analysis of Application_Announcement_to_Be process

Processes Duration Comparison | Simulation result Mo... | Processes Cost Comparison | Simulation result Monda... | Processes Duration Comparison | Simulation result Mo... | Processes Cost Comparison | Simulatic

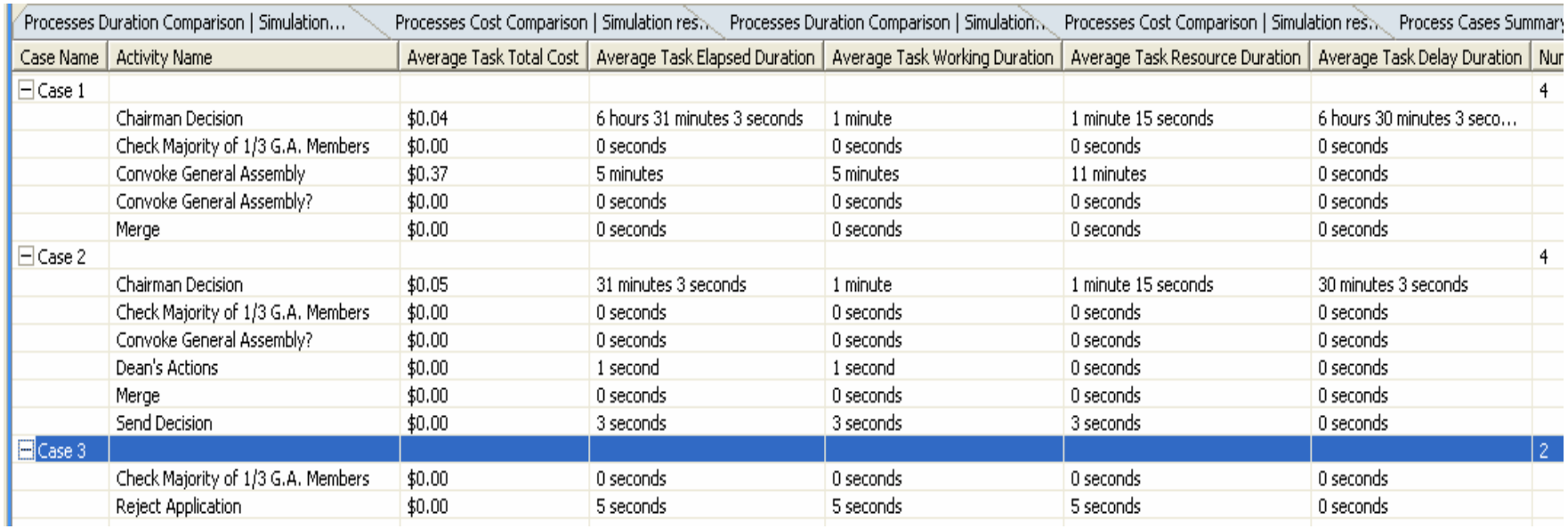
Case Name	Activity Name	Average Task Total Cost	Average Task Elapsed Duration	Average Task Working Duration	Average Task Resource Duration	Average Task Delay Duration	Num
⊟ Case 1							2
	Candidates Applications	$0.86	10 minutes	10 minutes	10 minutes	0 seconds	
	Convened Electors Body	$0.06	12 hours 31 minutes 59 seco...	2 minutes	3 minutes	12 hours 29 minutes 59 se...	
	Dean's Actions	$0.00	1 second	1 second	0 seconds	0 seconds	
	Fork	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Fork:2	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Members from EDTP	$0.00	1 second	1 second	0 seconds	0 seconds	
	Members from Postgraduate	$0.00	1 second	1 second	0 seconds	0 seconds	
	Members from Undergraduate	$0.00	1 second	1 second	0 seconds	0 seconds	
	Send Decision	$0.00	3 seconds	3 seconds	3 seconds	0 seconds	
	Check Number of Candidates	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Check of 1/3 Majority	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Definition of new date of election	$0.35	5 minutes	5 minutes	10 minutes 5 seconds	0 seconds	
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Reject Decision	$0.09	3 minutes	3 minutes	3 minutes 5 seconds	0 seconds	
	Voting	$0.78	2 minutes	2 minutes	8 minutes 10 seconds	0 seconds	
	Vote	$0.00	10 minutes				
⊞ Case 2							3
⊟ Case 3							4
	Candidates Applications	$0.88	10 minutes	10 minutes	10 minutes	0 seconds	
	Convened Electors Body	$0.06	2 days 6 hours 31 minutes 5...	2 minutes	3 minutes	2 days 6 hours 29 minutes...	
	Dean's Actions	$0.00	1 second	1 second	0 seconds	0 seconds	
	Fork	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Fork:2	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Members from EDTP	$0.00	1 second	1 second	0 seconds	0 seconds	
	Members from Postgraduate	$0.00	1 second	1 second	0 seconds	0 seconds	
	Members from Undergraduate	$0.00	1 second	1 second	0 seconds	0 seconds	
	Send Decision	$0.00	3 seconds	3 seconds	3 seconds	0 seconds	
	Check Number of Candidates	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Check of 1/3 Majority	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Merge:2	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Publication of Decision	$0.09	3 minutes	3 minutes	3 minutes 15 seconds	0 seconds	
	Voting	$0.80	2 minutes	2 minutes	8 minutes 10 seconds	0 seconds	
	Vote	$0.00	5 minutes				
⊞ Case 4							1

Figure 108: Process cases 1 & 3 summary analysis of Chairman_Election_to_Be process



Case Name	Number of Process Instances	Average Process Total Cost	Average Process Elapsed Duration	Average Process Working Duration	Average Process Resource Duration	Average Process Delay Duration	Distribution	Success Status
Case 1	4	$0.41	6 hours 36 minutes 3 seconds	6 minutes	12 minutes 15 seconds	6 hours 30 minutes 3 seconds	40.00%	Succeeded
Case 2	4	$0.05	31 minutes 7 seconds	1 minute 4 seconds	1 minute 18 seconds	30 minutes 3 seconds	40.00%	Succeeded
Case 3	2	$0.00	5 seconds	5 seconds	5 seconds	0 seconds	20.00%	Succeeded

Figure 109: Process cases summary analysis of Extraordinary_G_A_to_Be process



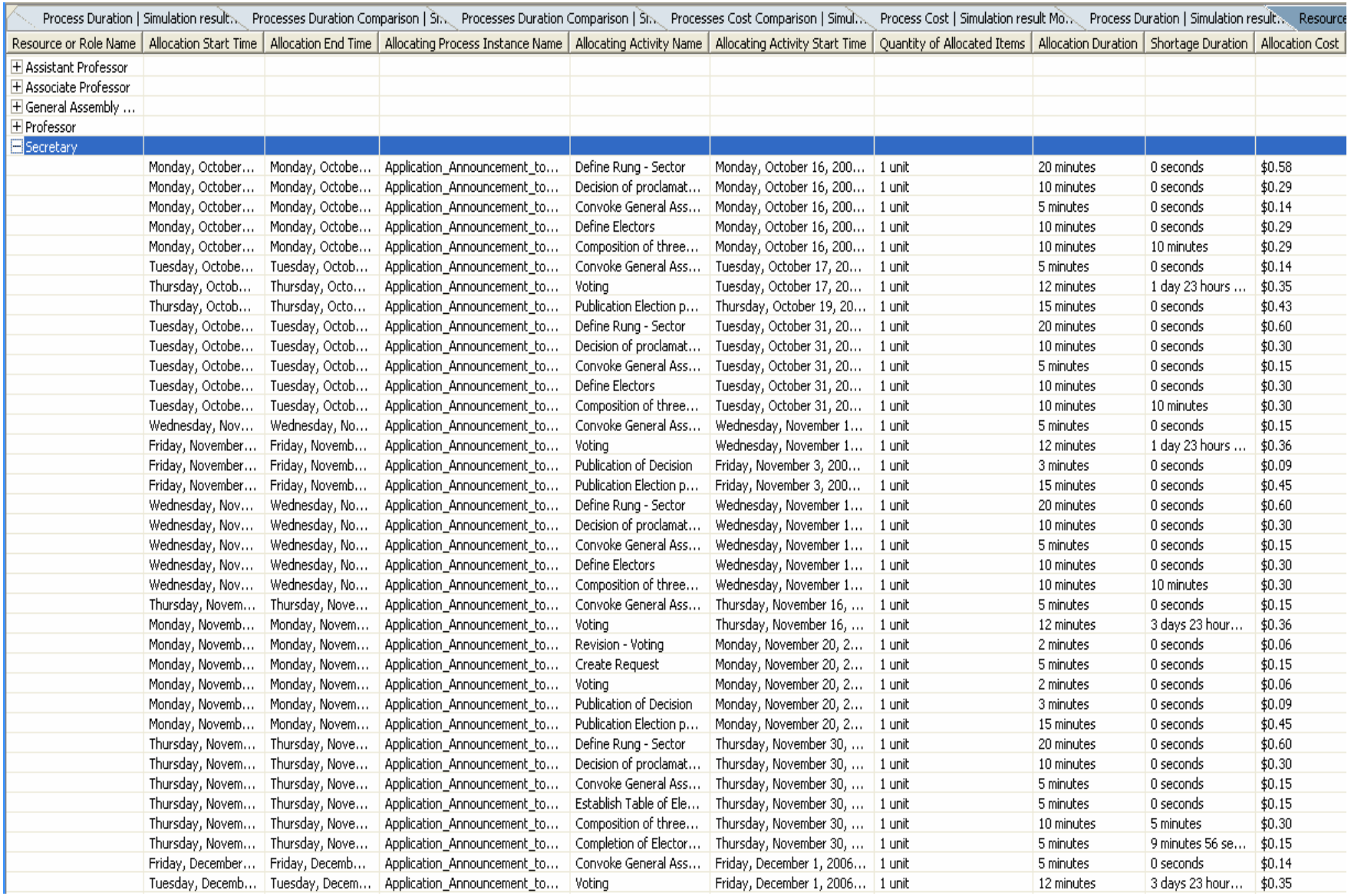
Case Name	Activity Name	Average Task Total Cost	Average Task Elapsed Duration	Average Task Working Duration	Average Task Resource Duration	Average Task Delay Duration	Nur
Case 1							4
	Chairman Decision	$0.04	6 hours 31 minutes 3 seconds	1 minute	1 minute 15 seconds	6 hours 30 minutes 3 seco…	
	Check Majority of 1/3 G.A. Members	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Convoke General Assembly	$0.37	5 minutes	5 minutes	11 minutes	0 seconds	
	Convoke General Assembly?	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
Case 2							4
	Chairman Decision	$0.05	31 minutes 3 seconds	1 minute	1 minute 15 seconds	30 minutes 3 seconds	
	Check Majority of 1/3 G.A. Members	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Convoke General Assembly?	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Dean's Actions	$0.00	1 second	1 second	0 seconds	0 seconds	
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Send Decision	$0.00	3 seconds	3 seconds	3 seconds	0 seconds	
Case 3							2
	Check Majority of 1/3 G.A. Members	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Reject Application	$0.00	5 seconds	5 seconds	5 seconds	0 seconds	

Figure 110: Process cases 1 & 2 summary analysis of Extraordinary_G_A_to_Be process

Process Cases Summary | Simulation result Monday, October 16, 2006 1:44:14 PM EEST | Professor_Engagement_to_Be Monday, October 16, 2006 12:32:55 PM EEST | 12:55:51 PM EEST

Case Name	Activity Name	Average Task Total Cost	Average Task Elapsed Duration	Average Task Working Duration	Average Task Resource Duration	Average Task Delay Duration	Numl
⊟ Case 1							2
	Check for 1/4 Majority?	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Convoke General Assembly	$0.36	5 minutes	5 minutes	11 minutes	0 seconds	
	Are Enough Electors?	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Completion of Electors Body	$0.14	5 minutes	5 minutes	6 minutes	0 seconds	
	Establish Table of Electors	$3.64	4 days 12 hours 35 minutes ...	5 minutes	21 minutes	4 days 12 hours 30 minute...	
	Load Repository	$0.00	1 second	1 second	0 seconds	0 seconds	
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Ministry of National Education & Religions Actions	$0.00	1 second	1 second	0 seconds	0 seconds	
	Send Decision	$0.00	3 seconds	3 seconds	3 seconds	0 seconds	
	Send Request	$0.00	3 seconds	3 seconds	3 seconds	0 seconds	
	Electors Body Definition	$0.00	4 days 12 hours 40 minutes ...				
	Check Absolute Majority	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Merge:2	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Reject Decision	$0.09	3 minutes	3 minutes	3 minutes 5 seconds	0 seconds	
	Voting	$0.44	2 minutes	2 minutes	3 minutes 10 seconds	0 seconds	
	Engagement Voting	$0.00	5 minutes				
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
⊞ Case 2							3
⊟ Case 3							2
	Check for 1/4 Majority?	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Convoke General Assembly	$0.37	5 minutes	5 minutes	11 minutes	0 seconds	
	Are Enough Electors?	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Completion of Electors Body	$0.15	5 minutes	5 minutes	6 minutes	0 seconds	
	Establish Table of Electors	$3.76	35 minutes 3 seconds	5 minutes	21 minutes	30 minutes 3 seconds	
	Load Repository	$0.00	1 second	1 second	0 seconds	0 seconds	
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Ministry of National Education & Religions Actions	$0.00	1 second	1 second	0 seconds	0 seconds	
	Send Decision	$0.00	3 seconds	3 seconds	3 seconds	0 seconds	
	Send Request	$0.00	3 seconds	3 seconds	3 seconds	0 seconds	
	Electors Body Definition	$0.00	40 minutes 10 seconds				
	Check Absolute Majority	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Merge:2	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
	Publication of Decision	$0.09	3 minutes	3 minutes	3 minutes 15 seconds	0 seconds	
	Voting	$0.46	2 minutes	2 minutes	3 minutes 10 seconds	0 seconds	
	Engagement Voting	$0.00	5 minutes				
	Merge	$0.00	0 seconds	0 seconds	0 seconds	0 seconds	
⊞ Case 4							2
⊞ Case 5							1

Figure 111: Process cases 1 & 3 summary analysis of Professor_Engagement_to_Be process



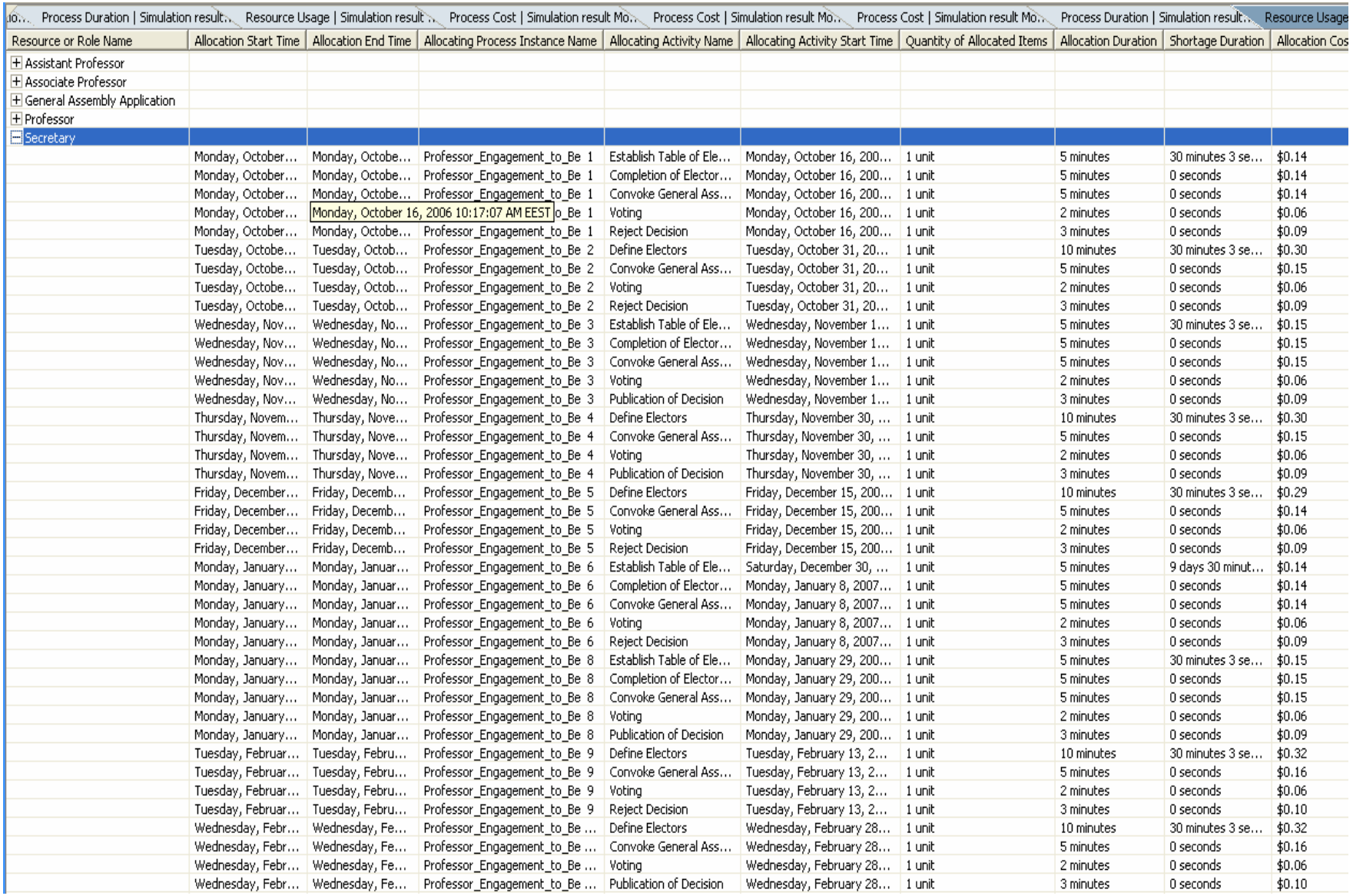
Process Duration | Simulation result... | Processes Duration Comparison | Si... | Processes Duration Comparison | Si... | Processes Cost Comparison | Simul... | Process Cost | Simulation result Mo... | Process Duration | Simulation result... | Resource

Resource or Role Name	Allocation Start Time	Allocation End Time	Allocating Process Instance Name	Allocating Activity Name	Allocating Activity Start Time	Quantity of Allocated Items	Allocation Duration	Shortage Duration	Allocation Cost
⊞ Assistant Professor									
⊞ Associate Professor									
⊞ General Assembly ...									
⊞ Professor									
⊟ Secretary									
	Monday, October...	Monday, Octobe...	Application_Announcement_to...	Define Rung - Sector	Monday, October 16, 200...	1 unit	20 minutes	0 seconds	$0.58
	Monday, October...	Monday, Octobe...	Application_Announcement_to...	Decision of proclamat...	Monday, October 16, 200...	1 unit	10 minutes	0 seconds	$0.29
	Monday, October...	Monday, Octobe...	Application_Announcement_to...	Convoke General Ass...	Monday, October 16, 200...	1 unit	5 minutes	0 seconds	$0.14
	Monday, October...	Monday, Octobe...	Application_Announcement_to...	Define Electors	Monday, October 16, 200...	1 unit	10 minutes	0 seconds	$0.29
	Monday, October...	Monday, Octobe...	Application_Announcement_to...	Composition of three...	Monday, October 16, 200...	1 unit	10 minutes	10 minutes	$0.29
	Tuesday, Octobe...	Tuesday, Octob...	Application_Announcement_to...	Convoke General Ass...	Tuesday, October 17, 20...	1 unit	5 minutes	0 seconds	$0.14
	Thursday, Octob...	Thursday, Octo...	Application_Announcement_to...	Voting	Tuesday, October 17, 20...	1 unit	12 minutes	1 day 23 hours ...	$0.35
	Thursday, Octob...	Thursday, Octo...	Application_Announcement_to...	Publication Election p...	Thursday, October 19, 20...	1 unit	15 minutes	0 seconds	$0.43
	Tuesday, Octobe...	Tuesday, Octob...	Application_Announcement_to...	Define Rung - Sector	Tuesday, October 31, 20...	1 unit	20 minutes	0 seconds	$0.60
	Tuesday, Octobe...	Tuesday, Octob...	Application_Announcement_to...	Decision of proclamat...	Tuesday, October 31, 20...	1 unit	10 minutes	0 seconds	$0.30
	Tuesday, Octobe...	Tuesday, Octob...	Application_Announcement_to...	Convoke General Ass...	Tuesday, October 31, 20...	1 unit	5 minutes	0 seconds	$0.15
	Tuesday, Octobe...	Tuesday, Octob...	Application_Announcement_to...	Define Electors	Tuesday, October 31, 20...	1 unit	10 minutes	0 seconds	$0.30
	Tuesday, Octobe...	Tuesday, Octob...	Application_Announcement_to...	Composition of three...	Tuesday, October 31, 20...	1 unit	10 minutes	10 minutes	$0.30
	Wednesday, Nov...	Wednesday, No...	Application_Announcement_to...	Convoke General Ass...	Wednesday, November 1...	1 unit	5 minutes	0 seconds	$0.15
	Friday, November...	Friday, Novemb...	Application_Announcement_to...	Voting	Wednesday, November 1...	1 unit	12 minutes	1 day 23 hours ...	$0.36
	Friday, November...	Friday, Novemb...	Application_Announcement_to...	Publication of Decision	Friday, November 3, 200...	1 unit	3 minutes	0 seconds	$0.09
	Friday, November...	Friday, Novemb...	Application_Announcement_to...	Publication Election p...	Friday, November 3, 200...	1 unit	15 minutes	0 seconds	$0.45
	Wednesday, Nov...	Wednesday, No...	Application_Announcement_to...	Define Rung - Sector	Wednesday, November 1...	1 unit	20 minutes	0 seconds	$0.60
	Wednesday, Nov...	Wednesday, No...	Application_Announcement_to...	Decision of proclamat...	Wednesday, November 1...	1 unit	10 minutes	0 seconds	$0.30
	Wednesday, Nov...	Wednesday, No...	Application_Announcement_to...	Convoke General Ass...	Wednesday, November 1...	1 unit	5 minutes	0 seconds	$0.15
	Wednesday, Nov...	Wednesday, No...	Application_Announcement_to...	Define Electors	Wednesday, November 1...	1 unit	10 minutes	0 seconds	$0.30
	Wednesday, Nov...	Wednesday, No...	Application_Announcement_to...	Composition of three...	Wednesday, November 1...	1 unit	10 minutes	10 minutes	$0.30
	Thursday, Novem...	Thursday, Nove...	Application_Announcement_to...	Convoke General Ass...	Thursday, November 16, ...	1 unit	5 minutes	0 seconds	$0.15
	Monday, Novemb...	Monday, Novem...	Application_Announcement_to...	Voting	Thursday, November 16, ...	1 unit	12 minutes	3 days 23 hour...	$0.36
	Monday, Novemb...	Monday, Novem...	Application_Announcement_to...	Revision - Voting	Monday, November 20, 2...	1 unit	2 minutes	0 seconds	$0.06
	Monday, Novemb...	Monday, Novem...	Application_Announcement_to...	Create Request	Monday, November 20, 2...	1 unit	5 minutes	0 seconds	$0.15
	Monday, Novemb...	Monday, Novem...	Application_Announcement_to...	Voting	Monday, November 20, 2...	1 unit	2 minutes	0 seconds	$0.06
	Monday, Novemb...	Monday, Novem...	Application_Announcement_to...	Publication of Decision	Monday, November 20, 2...	1 unit	3 minutes	0 seconds	$0.09
	Monday, Novemb...	Monday, Novem...	Application_Announcement_to...	Publication Election p...	Monday, November 20, 2...	1 unit	15 minutes	0 seconds	$0.45
	Thursday, Novem...	Thursday, Nove...	Application_Announcement_to...	Define Rung - Sector	Thursday, November 30, ...	1 unit	20 minutes	0 seconds	$0.60
	Thursday, Novem...	Thursday, Nove...	Application_Announcement_to...	Decision of proclamat...	Thursday, November 30, ...	1 unit	10 minutes	0 seconds	$0.30
	Thursday, Novem...	Thursday, Nove...	Application_Announcement_to...	Convoke General Ass...	Thursday, November 30, ...	1 unit	5 minutes	0 seconds	$0.15
	Thursday, Novem...	Thursday, Nove...	Application_Announcement_to...	Establish Table of Ele...	Thursday, November 30, ...	1 unit	5 minutes	0 seconds	$0.15
	Thursday, Novem...	Thursday, Nove...	Application_Announcement_to...	Composition of three...	Thursday, November 30, ...	1 unit	10 minutes	5 minutes	$0.30
	Thursday, Novem...	Thursday, Nove...	Application_Announcement_to...	Completion of Elector...	Thursday, November 30, ...	1 unit	5 minutes	9 minutes 56 se...	$0.15
	Friday, December...	Friday, Decemb...	Application_Announcement_to...	Convoke General Ass...	Friday, December 1, 2006...	1 unit	5 minutes	0 seconds	$0.14
	Tuesday, Decemb...	Tuesday, Decem...	Application_Announcement_to...	Voting	Friday, December 1, 2006...	1 unit	12 minutes	3 days 23 hour...	$0.35

Figure 112: Resources analysis of Application_Announcement_to_Be process

Resource or Role Name	Allo...	All...	Allocating Process Instance...	Allocating Activity Name	Allocating Activity Start Time	Quantity of Allocated Items	Allocation Duration	Shortage Duration	Allocation Cost
⊞ Assistant Professor									
⊞ Associate Professor									
⊞ Dean									
⊞ General Assembly ...									
⊞ Postgraduate Stud...									
⊞ Professor									
⊟ Secretary									
	Mo...	M...	Chairman_Election_to_Be 1	Convened Electors Body	Monday, October 16, 200...	1 unit	2 minutes	29 minutes 59 s...	$0.06
	Mo...	M...	Chairman_Election_to_Be 1	Voting	Monday, October 16, 200...	1 unit	2 minutes	0 seconds	$0.06
	Mo...	M...	Chairman_Election_to_Be 1	Reject Decision	Monday, October 16, 200...	1 unit	3 minutes	0 seconds	$0.09
	Mo...	M...	Chairman_Election_to_Be 1	Definition of new date of election	Monday, October 16, 200...	1 unit	5 minutes	0 seconds	$0.14
	Tu...	Tu...	Chairman_Election_to_Be 2	Convened Electors Body	Tuesday, October 31, 20...	1 unit	2 minutes	29 minutes 59 s...	$0.06
	Tu...	Tu...	Chairman_Election_to_Be 2	Voting	Tuesday, October 31, 20...	1 unit	2 minutes	0 seconds	$0.06
	Tu...	Tu...	Chairman_Election_to_Be 2	Repeat Voting	Tuesday, October 31, 20...	1 unit	2 minutes	0 seconds	$0.06
	Tu...	Tu...	Chairman_Election_to_Be 2	Publication of Decision	Tuesday, October 31, 20...	1 unit	3 minutes	0 seconds	$0.09
	We...	W...	Chairman_Election_to_Be 3	Convened Electors Body	Wednesday, November 1...	1 unit	2 minutes	29 minutes 59 s...	$0.06
	We...	W...	Chairman_Election_to_Be 3	Voting	Wednesday, November 1...	1 unit	2 minutes	0 seconds	$0.06
	We...	W...	Chairman_Election_to_Be 3	Publication of Decision	Wednesday, November 1...	1 unit	3 minutes	0 seconds	$0.09
	Th...	Th...	Chairman_Election_to_Be 4	Convened Electors Body	Thursday, November 30, ...	1 unit	2 minutes	29 minutes 59 s...	$0.06
	Th...	Th...	Chairman_Election_to_Be 4	Voting	Thursday, November 30, ...	1 unit	2 minutes	0 seconds	$0.06
	Th...	Th...	Chairman_Election_to_Be 4	Publication of Decision	Thursday, November 30, ...	1 unit	3 minutes	0 seconds	$0.09
	Fri...	Fri...	Chairman_Election_to_Be 5	Convened Electors Body	Friday, December 15, 200...	1 unit	2 minutes	29 minutes 59 s...	$0.06
	Fri...	Fri...	Chairman_Election_to_Be 5	Voting	Friday, December 15, 200...	1 unit	2 minutes	0 seconds	$0.06
	Fri...	Fri...	Chairman_Election_to_Be 5	Repeat Voting	Friday, December 15, 200...	1 unit	2 minutes	0 seconds	$0.06
	Fri...	Fri...	Chairman_Election_to_Be 5	Publication of Decision	Friday, December 15, 200...	1 unit	3 minutes	0 seconds	$0.09
	Mo...	M...	Chairman_Election_to_Be 6	Convened Electors Body	Saturday, December 30, ...	1 unit	2 minutes	9 days 29 minut...	$0.06
	Mo...	M...	Chairman_Election_to_Be 6	Voting	Monday, January 8, 2007...	1 unit	2 minutes	0 seconds	$0.06
	Mo...	M...	Chairman_Election_to_Be 6	Publication of Decision	Monday, January 8, 2007...	1 unit	3 minutes	0 seconds	$0.09
	Mo...	M...	Chairman_Election_to_Be 7	Convened Electors Body	Sunday, January 14, 200...	1 unit	2 minutes	1 day 29 minut...	$0.06
	Mo...	M...	Chairman_Election_to_Be 7	Voting	Monday, January 15, 200...	1 unit	2 minutes	0 seconds	$0.06
	Mo...	M...	Chairman_Election_to_Be 7	Reject Decision	Monday, January 15, 200...	1 unit	3 minutes	0 seconds	$0.09
	Mo...	M...	Chairman_Election_to_Be 7	Definition of new date of election	Monday, January 15, 200...	1 unit	5 minutes	0 seconds	$0.14
	Mo...	M...	Chairman_Election_to_Be 8	Convened Electors Body	Monday, January 29, 200...	1 unit	2 minutes	29 minutes 59 s...	$0.06
	Mo...	M...	Chairman_Election_to_Be 8	Voting	Monday, January 29, 200...	1 unit	2 minutes	0 seconds	$0.06
	Mo...	M...	Chairman_Election_to_Be 8	Publication of Decision	Monday, January 29, 200...	1 unit	3 minutes	0 seconds	$0.09
	Tu...	Tu...	Chairman_Election_to_Be 9	Convened Electors Body	Tuesday, February 13, 2...	1 unit	2 minutes	29 minutes 59 s...	$0.06
	Tu...	Tu...	Chairman_Election_to_Be 9	Voting	Tuesday, February 13, 2...	1 unit	2 minutes	0 seconds	$0.06
	Tu...	Tu...	Chairman_Election_to_Be 9	Publication of Decision	Tuesday, February 13, 2...	1 unit	3 minutes	0 seconds	$0.10
	We...	W...	Chairman_Election_to_Be 10	Convened Electors Body	Wednesday, February 28...	1 unit	2 minutes	29 minutes 59 s...	$0.06

Figure 113: Resources analysis of Chairman_Election_to_Be process



Resource or Role Name	Allocation Start Time	Allocation End Time	Allocating Process Instance Name	Allocating Activity Name	Allocating Activity Start Time	Quantity of Allocated Items	Allocation Duration	Shortage Duration	Allocation Cos
Assistant Professor									
Associate Professor									
General Assembly Application									
Professor									
Secretary									
	Monday, October...	Monday, Octobe...	Professor_Engagement_to_Be 1	Establish Table of Ele...	Monday, October 16, 200...	1 unit	5 minutes	30 minutes 3 se...	$0.14
	Monday, October...	Monday, Octobe...	Professor_Engagement_to_Be 1	Completion of Elector...	Monday, October 16, 200...	1 unit	5 minutes	0 seconds	$0.14
	Monday, October...	Monday, Octobe...	Professor_Engagement_to_Be 1	Convoke General Ass...	Monday, October 16, 200...	1 unit	5 minutes	0 seconds	$0.14
	Monday, October...	Monday, October 16, 2006 10:17:07 AM EEST	o_Be 1	Voting	Monday, October 16, 200...	1 unit	2 minutes	0 seconds	$0.06
	Monday, October...	Monday, Octobe...	Professor_Engagement_to_Be 1	Reject Decision	Monday, October 16, 200...	1 unit	3 minutes	0 seconds	$0.09
	Tuesday, Octobe...	Tuesday, Octob...	Professor_Engagement_to_Be 2	Define Electors	Tuesday, October 31, 20...	1 unit	10 minutes	30 minutes 3 se...	$0.30
	Tuesday, Octobe...	Tuesday, Octob...	Professor_Engagement_to_Be 2	Convoke General Ass...	Tuesday, October 31, 20...	1 unit	5 minutes	0 seconds	$0.15
	Tuesday, Octobe...	Tuesday, Octob...	Professor_Engagement_to_Be 2	Voting	Tuesday, October 31, 20...	1 unit	2 minutes	0 seconds	$0.06
	Tuesday, Octobe...	Tuesday, Octob...	Professor_Engagement_to_Be 2	Reject Decision	Tuesday, October 31, 20...	1 unit	3 minutes	0 seconds	$0.09
	Wednesday, Nov...	Wednesday, No...	Professor_Engagement_to_Be 3	Establish Table of Ele...	Wednesday, November 1...	1 unit	5 minutes	30 minutes 3 se...	$0.15
	Wednesday, Nov...	Wednesday, No...	Professor_Engagement_to_Be 3	Completion of Elector...	Wednesday, November 1...	1 unit	5 minutes	0 seconds	$0.15
	Wednesday, Nov...	Wednesday, No...	Professor_Engagement_to_Be 3	Convoke General Ass...	Wednesday, November 1...	1 unit	5 minutes	0 seconds	$0.15
	Wednesday, Nov...	Wednesday, No...	Professor_Engagement_to_Be 3	Voting	Wednesday, November 1...	1 unit	2 minutes	0 seconds	$0.06
	Wednesday, Nov...	Wednesday, No...	Professor_Engagement_to_Be 3	Publication of Decision	Wednesday, November 1...	1 unit	3 minutes	0 seconds	$0.09
	Thursday, Novem...	Thursday, Nove...	Professor_Engagement_to_Be 4	Define Electors	Thursday, November 30, ...	1 unit	10 minutes	30 minutes 3 se...	$0.30
	Thursday, Novem...	Thursday, Nove...	Professor_Engagement_to_Be 4	Convoke General Ass...	Thursday, November 30, ...	1 unit	5 minutes	0 seconds	$0.15
	Thursday, Novem...	Thursday, Nove...	Professor_Engagement_to_Be 4	Voting	Thursday, November 30, ...	1 unit	2 minutes	0 seconds	$0.06
	Thursday, Novem...	Thursday, Nove...	Professor_Engagement_to_Be 4	Publication of Decision	Thursday, November 30, ...	1 unit	3 minutes	0 seconds	$0.09
	Friday, December...	Friday, Decemb...	Professor_Engagement_to_Be 5	Define Electors	Friday, December 15, 200...	1 unit	10 minutes	30 minutes 3 se...	$0.29
	Friday, December...	Friday, Decemb...	Professor_Engagement_to_Be 5	Convoke General Ass...	Friday, December 15, 200...	1 unit	5 minutes	0 seconds	$0.14
	Friday, December...	Friday, Decemb...	Professor_Engagement_to_Be 5	Voting	Friday, December 15, 200...	1 unit	2 minutes	0 seconds	$0.06
	Friday, December...	Friday, Decemb...	Professor_Engagement_to_Be 5	Reject Decision	Friday, December 15, 200...	1 unit	3 minutes	0 seconds	$0.09
	Monday, January...	Monday, Januar...	Professor_Engagement_to_Be 6	Establish Table of Ele...	Saturday, December 30, ...	1 unit	5 minutes	9 days 30 minut...	$0.14
	Monday, January...	Monday, Januar...	Professor_Engagement_to_Be 6	Completion of Elector...	Monday, January 8, 2007...	1 unit	5 minutes	0 seconds	$0.14
	Monday, January...	Monday, Januar...	Professor_Engagement_to_Be 6	Convoke General Ass...	Monday, January 8, 2007...	1 unit	5 minutes	0 seconds	$0.14
	Monday, January...	Monday, Januar...	Professor_Engagement_to_Be 6	Voting	Monday, January 8, 2007...	1 unit	2 minutes	0 seconds	$0.06
	Monday, January...	Monday, Januar...	Professor_Engagement_to_Be 6	Reject Decision	Monday, January 8, 2007...	1 unit	3 minutes	0 seconds	$0.09
	Monday, January...	Monday, Januar...	Professor_Engagement_to_Be 8	Establish Table of Ele...	Monday, January 29, 200...	1 unit	5 minutes	30 minutes 3 se...	$0.15
	Monday, January...	Monday, Januar...	Professor_Engagement_to_Be 8	Completion of Elector...	Monday, January 29, 200...	1 unit	5 minutes	0 seconds	$0.15
	Monday, January...	Monday, Januar...	Professor_Engagement_to_Be 8	Convoke General Ass...	Monday, January 29, 200...	1 unit	5 minutes	0 seconds	$0.15
	Monday, January...	Monday, Januar...	Professor_Engagement_to_Be 8	Voting	Monday, January 29, 200...	1 unit	2 minutes	0 seconds	$0.06
	Monday, January...	Monday, Januar...	Professor_Engagement_to_Be 8	Publication of Decision	Monday, January 29, 200...	1 unit	3 minutes	0 seconds	$0.09
	Tuesday, Februar...	Tuesday, Febru...	Professor_Engagement_to_Be 9	Define Electors	Tuesday, February 13, 2...	1 unit	10 minutes	30 minutes 3 se...	$0.32
	Tuesday, Februar...	Tuesday, Febru...	Professor_Engagement_to_Be 9	Convoke General Ass...	Tuesday, February 13, 2...	1 unit	5 minutes	0 seconds	$0.16
	Tuesday, Februar...	Tuesday, Febru...	Professor_Engagement_to_Be 9	Voting	Tuesday, February 13, 2...	1 unit	2 minutes	0 seconds	$0.06
	Tuesday, Februar...	Tuesday, Febru...	Professor_Engagement_to_Be 9	Reject Decision	Tuesday, February 13, 2...	1 unit	3 minutes	0 seconds	$0.10
	Wednesday, Febr...	Wednesday, Fe...	Professor_Engagement_to_Be ...	Define Electors	Wednesday, February 28...	1 unit	10 minutes	30 minutes 3 se...	$0.32
	Wednesday, Febr...	Wednesday, Fe...	Professor_Engagement_to_Be ...	Convoke General Ass...	Wednesday, February 28...	1 unit	5 minutes	0 seconds	$0.16
	Wednesday, Febr...	Wednesday, Fe...	Professor_Engagement_to_Be ...	Voting	Wednesday, February 28...	1 unit	2 minutes	0 seconds	$0.06
	Wednesday, Febr...	Wednesday, Fe...	Professor_Engagement_to_Be ...	Publication of Decision	Wednesday, February 28...	1 unit	3 minutes	0 seconds	$0.10

Figure 114: Resources analysis of Professor_Engagement_to_Be process

Processes Duration Comparison | Sim... | Processes Cost Comparison | Simulat... | Processes Duration Comparison | Sim... | Processes Cost Comparison | Simulat... | Process Cases Summary | Simulation ... | Proce

Resource or Role Name	Allocation...	Allocati...	Allocating Process Instance ...	Allocating Activity Name	Allocat...	Quantity of Allocated Items	Allocation Duration	Shortage Duration	Allocation Cost
⊞ General Assembly ...									
⊟ Professor									
	Monday, ...	Monda...	Extraordinary_G_A_to_Be 1	Chairman Decision	Monda...	1 unit	1 minute	30 minutes 3 se...	$0.04
	Monday, ...	Monda...	Extraordinary_G_A_to_Be 1	Convoke General Assembly	Monda...	1 unit	5 minutes	0 seconds	$0.21
	Tuesday, ...	Tuesd...	Extraordinary_G_A_to_Be 2	Chairman Decision	Tuesd...	1 unit	1 minute	30 minutes 3 se...	$0.04
	Wednesd...	Wedne...	Extraordinary_G_A_to_Be 3	Chairman Decision	Wedn...	1 unit	1 minute	30 minutes 3 se...	$0.04
	Wednesd...	Wedne...	Extraordinary_G_A_to_Be 3	Convoke General Assembly	Wedn...	1 unit	5 minutes	0 seconds	$0.22
	Friday, D...	Friday,...	Extraordinary_G_A_to_Be 5	Chairman Decision	Friday...	1 unit	1 minute	30 minutes 3 se...	$0.04
	Monday, ...	Monda...	Extraordinary_G_A_to_Be 7	Chairman Decision	Sunda...	1 unit	1 minute	1 day 30 minut...	$0.04
	Monday, ...	Monda...	Extraordinary_G_A_to_Be 7	Convoke General Assembly	Monda...	1 unit	5 minutes	0 seconds	$0.21
	Monday, ...	Monda...	Extraordinary_G_A_to_Be 8	Chairman Decision	Monda...	1 unit	1 minute	30 minutes 3 se...	$0.04
	Monday, ...	Monda...	Extraordinary_G_A_to_Be 8	Convoke General Assembly	Monda...	1 unit	5 minutes	0 seconds	$0.22
	Tuesday, ...	Tuesd...	Extraordinary_G_A_to_Be 9	Chairman Decision	Tuesd...	1 unit	1 minute	30 minutes 3 se...	$0.05
	Wednesd...	Wedne...	Extraordinary_G_A_to_Be 10	Chairman Decision	Wedn...	1 unit	1 minute	30 minutes 3 se...	$0.05
⊟ Secretary									
	Monday, ...	Monda...	Extraordinary_G_A_to_Be 1	Convoke General Assembly	Monda...	1 unit	5 minutes	0 seconds	$0.14
	Wednesd...	Wedne...	Extraordinary_G_A_to_Be 3	Convoke General Assembly	Wedn...	1 unit	5 minutes	0 seconds	$0.15
	Monday, ...	Monda...	Extraordinary_G_A_to_Be 7	Convoke General Assembly	Monda...	1 unit	5 minutes	0 seconds	$0.14
	Monday, ...	Monda...	Extraordinary_G_A_to_Be 8	Convoke General Assembly	Monda...	1 unit	5 minutes	0 seconds	$0.15

Figure 115: Resources analysis of Extraordinary_G_A_to_Be process

Process Cost | Simulation result Monday, October 16, 2006 1:53:07 PM EEST | Application_Announcement_to_Be Monday, October 16, 2006 1:50:21 PM EEST | 1:16:14 PM EEST

Process Duration | Simulation result... | Process Duration | Simulation result... | Processes Duration Comparison | Si... | Processes Duration Comparison | Si... | Processes Cost Comparison | Simul

Case Name	Distribution	Success Status	Average Revenue	Average Processing Cost	Average Idle Cost	Average Allocated Resource Cost	Average Total Cost	Average Profit
Case 1	20.00%	Succeeded	$0.00	$0.00	$0.00	$212.62	$212.62	($212.62)
Case 2	20.00%	Succeeded	$0.00	$0.00	$0.00	$201.84	$201.84	($201.84)
Case 3	10.00%	Succeeded	$0.00	$0.00	$0.00	$210.48	$210.48	($210.48)
Case 4	10.00%	Succeeded	$0.00	$0.00	$0.00	$200.41	$200.41	($200.41)
Case 5	20.00%	Succeeded	$0.00	$0.00	$0.00	$21.84	$21.84	($21.84)
Case 6	10.00%	Succeeded	$0.00	$0.00	$0.00	$212.86	$212.86	($212.86)
Case 7	10.00%	Succeeded	$0.00	$0.00	$0.00	$208.67	$208.67	($208.67)
Weighted Average			$0.00	$0.00	$0.00	$170.50	$170.50	($170.50)

Figure 116: Process cost analysis of Application_Announcement_to_Beprocess

Process Cost | Simulation result Mo... | Process Cases Summary | Simulatio... | Process Cases Summary | Simulatio... | Resource Usage | Simulation result ... | Process Cost | Simulation result Mo

Case Name	Distribution	Success Status	Average Revenue	Average Processing Cost	Average Idle Cost	Average Allocated Resource Cost	Average Total Cost	Average Profit
Case 1	20.00%	Succeeded	$0.00	$0.00	$0.00	$2.14	$2.14	($2.14)
Case 2	30.00%	Succeeded	$0.00	$0.00	$0.00	$2.70	$2.70	($2.70)
Case 3	40.00%	Succeeded	$0.00	$0.00	$0.00	$1.83	$1.83	($1.83)
Case 4	10.00%	Succeeded	$0.00	$0.00	$0.00	$1.98	$1.98	($1.98)
Weighted Average			$0.00	$0.00	$0.00	$2.17	$2.17	($2.17)

Figure 117: Process cost analysis of Chairman_Election_to_Be process

Sl... | Processes Cost Comparison | Simul... | Process Cases Summary | Simulatio... | Process Cases Summary | Simulatio... | Resource Usage | Simulation result ... | Process Cost | Simulation result M

Case Name	Distribution	Success Status	Average Revenue	Average Processing Cost	Average Idle Cost	Average Allocated Resource Cost	Average Total Cost	Average Profit
Case 1	40.00%	Succeeded	$0.00	$0.00	$0.00	$0.41	$0.41	($0.41)
Case 2	40.00%	Succeeded	$0.00	$0.00	$0.00	$0.05	$0.05	($0.05)
Case 3	20.00%	Succeeded	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Weighted Average			$0.00	$0.00	$0.00	$0.18	$0.18	($0.18)

Figure 118: Process cost analysis of Extraordinary_G_A_to_Be process

Process Cost | Simulation result Monday, October 16, 2006 1:44:14 PM EEST | Professor_Engagement_to_Be Monday, October 16, 2006 12:32:55 PM EEST | 12:53:31 PM EEST

Process Cost | Simulation result Mo... | Process Cost | Simulation result Mo... | Process Duration | Simulation result... | Resource Usage | Simulation result ... | Process Cost | Simulation result Mo

Case Name	Distribution	Success Status	Average Revenue	Average Processing Cost	Average Idle Cost	Average Allocated Resource Cost	Average Total Cost	Average Profit
Case 1	20.00%	Succeeded	$0.00	$0.00	$0.00	$4.67	$4.67	($4.67)
Case 2	30.00%	Succeeded	$0.00	$0.00	$0.00	$8.56	$8.56	($8.56)
Case 3	20.00%	Succeeded	$0.00	$0.00	$0.00	$4.83	$4.83	($4.83)
Case 4	20.00%	Succeeded	$0.00	$0.00	$0.00	$8.75	$8.75	($8.75)
Case 5	10.00%	Succeeded	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Weighted Average			$0.00	$0.00	$0.00	$6.22	$6.22	($6.22)

Figure 119: Process cost analysis of Professor_Engagement_to_Be process

5.8.6.4 Process Cost

The process cost analysis shows the average and weighted average costs and revenue for all process instances in each case of the simulation results shown in **Figure 116**, **Figure 117**, **Figure 118** and **Figure 119**. During this simulation we see that:

- The Application_Announcement_to_Be future process cost have come down to 170.50 € from the 253 € for the Application_Announcement_as_Is current process. The average costs for the Application_Announcement_to_Be seven case processes are ranging from 21.84 € to 212.86 €.
- The Chairman_Election_to_Be future process cost have come down to 2.17 € from the 8.22 € for the Chairman_Election_as_Is current process. The average costs for the Chairman_Election_to_Be four case processes are ranging from 1.83 € to 2.7 €.
- The Extraordinary_G_A_to_Be future process cost have come down to 0.18 € from the 5.1 € for the Extraordinary_G_A_as_Is current process. The average costs for the Extraordinary_G_A_to_Be three case processes are ranging from 0.00 € to 0.41 €.
- The Professor_Engagement_to_Be future process cost have come down to 6.22 € from the 45.7 € for the Professor_Engagement_as_Is current process. The average costs for the Professor_Engagement_to_Be five case processes are ranging from 0.00 € to 8.75 €.

5.9 Processes Comparison Analysis

We have also run process comparison reports and have compared the results of the revised processes with those of the current processes to ensure that the revisions we have made are achieving the desired objectives. We perform several kinds of analysis to compare the weighted average analysis results for two simulated processes that use the same input parameters.

To perform a comparison analysis, select one of the simulation results that we want to analyze and *Dynamic Analysis → Processes Comparison Analysis* and then one of the following choices:

- Processes Duration Comparison
- Processes Cost Comparison

A dialog opens where we select the second simulation results that we want to compare with the first results.

5.9.1 Processes Duration Comparison

This analysis compares the weighted average duration results for two process simulations that use the same input parameters. For each processes considered in the comparison, this analysis displays the information shown in **Figure 120**, **Figure 121**, **Figure 122** and **Figure 123**.

Calculated values are based on weighted average values calculated according to the process duration analysis. The following information is displayed in the process duration comparison:

- Simulation Result Name - The name and the time stamp of the simulation result to which the process belongs.
- Process Name - The name of the process.
- Weighted Average Elapsed Duration - Weighted average elapsed duration of the process SUM (case Average Elapsed Duration * case Distribution / cases total Distributions) for all cases.
- Weighted Average Throughput - Weighted average throughput of the process SUM (case Average Throughput * case Distribution / cases total Distributions) for all cases.
- Difference - Calculated as: first process value - second process value
- Percentage change - Calculated as: (difference / first process value) * 100

These reports show a large improvement in the process duration metrics for the Future versus Current processes:

- The Difference and the Percentage change for Weighted Average Elapsed Duration and Weighted Average Throughput between Application_Announcement_to_Be and Application_Announcement_as_Is are:
    - -13 days 12 hours 10 minutes and 41.2 seconds and -77.75%,
    - 0.009 work items / hour and 450.00%.
- The Difference and the Percentage change for Weighted Average Elapsed Duration and Weighted Average Throughput between Chairman_Election_to_Be and Chairman_Election_as_Is are:
    - -23 hours 14 minutes and 15 seconds and -48.36%,
    - 0.019 work items / hour and 90.48%.
- The Difference and the Percentage change for Weighted Average Elapsed Duration and Weighted Average Throughput between Extraordinary_G_A_to_Be and Extraordinary_G_A_as_Is are:
    - -22 hours 34 minutes and 10.5 seconds and -88.79%,
    - 0.312 work items / hour and 800.00%.

Process Duration | Simulation result Monday, October 16, 2006 1:... | Process Duration | Simulation result Monday, October 16, 2006 1:... | Processes Du

	Simulation Result Name	Process Name	Weighted Average Elapsed Duration	Weighted Average Throughput
	Simulation result Mo...	Application_Announcement_as_Is	17 days 7 hours 52 minutes 26.8 ...	0.002 work items / hour
	Simulation result Mo...	Application_Announcement_to_Be	3 days 19 hours 41 minutes 45.2 ...	0.011 work items / hour
Difference			13 days 12 hours 10 minutes 41....	- 0.009 work items / hour
Percentage Change			77.95%	-450.00%

Figure 120: Comparison: Process duration between Application_Announcement_as_Is & Application_Announcement_to_Be processes

Processes Duration Comparison | Simulation result Monday, October 16, 2006 12:24:30 PM EEST | Chairman_Election_as_Is Saturday, October 14, 2006

	Simulation Result Name	Process Name	Weighted Average Elapsed Duration	Weighted Average Throughput
	Simulation result Mon...	Chairman_Election_as_Is	2 days 2 minutes 54 seconds	0.021 work items / hour
	Simulation result Mon...	Chairman_Election_to_Be	1 day 48 minutes 39 seconds	0.040 work items / hour
Difference			23 hours 14 minutes 15 seconds	- 0.019 work items / hour
Percentage Change			48.36%	-90.48%

Figure 121: Comparison: Process duration between Chairman_Election_as_Is & Chairman_Election_to_Be processes

Processes Duration Comparison | Simulation result Monday, Octob... | Processes Cost Comparison | Simulation result Monday, October 1... | Proces

	Simulation Result Name	Process Name	Weighted Average Elapsed Duration	Weighted Average Throughput
	Simulation result Mo...	Extraordinary_G_A_as_Is	1 day 1 hour 25 minutes 3.4 seco...	0.039 work items / hour
	Simulation result Mo...	Extraordinary_G_A_to_Be	2 hours 50 minutes 53 seconds	0.351 work items / hour
Difference			22 hours 34 minutes 10.4 seconds	- 0.312 work items / hour
Percentage Change			88.79%	-800.00%

Figure 122: Comparison: Process duration between Extraordinary_G_A_as_Is & Extraordinary_G_A_to_Be processes

Processes Duration Comparison | Simulation result Monday, October 16, 2006 1:42:03 PM EEST | Professor_Engagement_as_Is Saturday, October 14, 2006 10

... | Process Duration | Simulation result... | Resource Usage | Simulation result ... | Process Cost | Simulation result Mo... | Process Cases Summary | Simulat

	Simulation Result Name	Process Name	Weighted Average Elapsed Duration	Weighted Average Throughput
	Simulation result Mo...	Professor_Engagement_as_Is	2 days 39 minutes 53.7 seconds	0.021 work items / hour
	Simulation result Mo...	Professor_Engagement_to_Be	22 hours 21 minutes 7.5 seconds	0.045 work items / hour
Difference			1 day 2 hours 18 minutes 46.2 se...	- 0.024 work items / hour
Percentage Change			54.07%	-114.29%

Figure 123: Comparison: Process duration between Professor_Engagement_as_Is & Professor_Engagement_to_Be processes

- The Difference and the Percentage change for Weighted Average Elapsed Duration and Weighted Average Throughput between Professor_Engagement_to_Be and Professor_Engagement_as_Is are:
    - -1 day 2 hours 18 minutes and 46.2 seconds and -50.07%,
    - 0.024 work items / hour and 114.29%.

5.9.2 Processes Cost Comparison Analysis

This analysis compares the weighted average cost and revenue results for two process simulations that use the same input parameters.

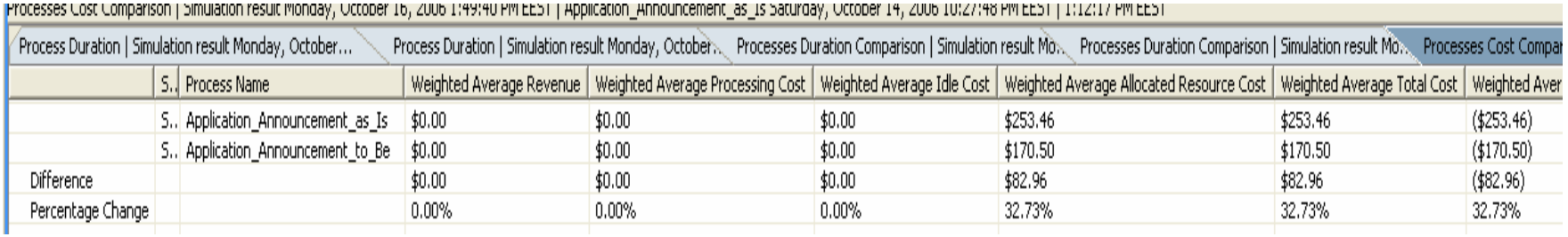
For each process considered in the comparison, this analysis displays the information shown in **Figure 124**, **Figure 125**, **Figure 126** and **Figure 127**. Calculated values are based on weighted average values calculated according to process cost analysis.

For each column that displays a numerical result, the following comparative information is also displayed:

- Difference - Calculated as: first process value - second process value
- Percentage change - Calculated as: (Difference / first process value) * 100

These reports show an improvement in the process cost metrics for the Future versus Current processes

- The Percentage change for Weighted Total Cost between Application_Announcement_to_Be and Application_Announcement_as_Is is -32.73%.
- The Percentage change for Weighted Average Total Cost between Chairman_Election_to_Be and Chairman_Election_as_Is is -73.61%.
- The Percentage change for Weighted Average Total Cost between Extraordinary_G_A_to_Be and Extraordinary_G_A_as_Is is -96.43%.
- The Percentage change for Weighted Average Total Cost Professor_Engagement_to_Be and Professor_Engagement_as_Is is -86.45%.

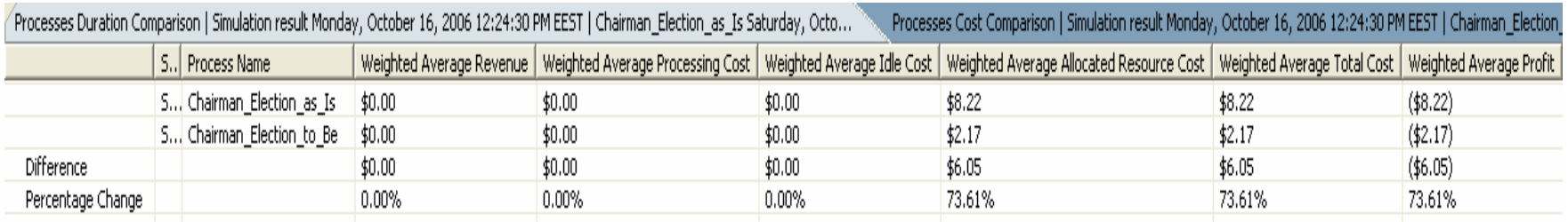


Processes Cost Comparison | Simulation result Monday, October 16, 2006 1:49:40 PM EEST | Application_Announcement_as_Is Saturday, October 14, 2006 10:27:48 PM EEST | 1:12:17 PM EEST

Process Duration | Simulation result Monday, October... | Process Duration | Simulation result Monday, October... | Processes Duration Comparison | Simulation result Mo... | Processes Duration Comparison | Simulation result Mo... | Processes Cost Compar

	S..	Process Name	Weighted Average Revenue	Weighted Average Processing Cost	Weighted Average Idle Cost	Weighted Average Allocated Resource Cost	Weighted Average Total Cost	Weighted Aver
	S..	Application_Announcement_as_Is	$0.00	$0.00	$0.00	$253.46	$253.46	($253.46)
	S..	Application_Announcement_to_Be	$0.00	$0.00	$0.00	$170.50	$170.50	($170.50)
Difference			$0.00	$0.00	$0.00	$82.96	$82.96	($82.96)
Percentage Change			0.00%	0.00%	0.00%	32.73%	32.73%	32.73%

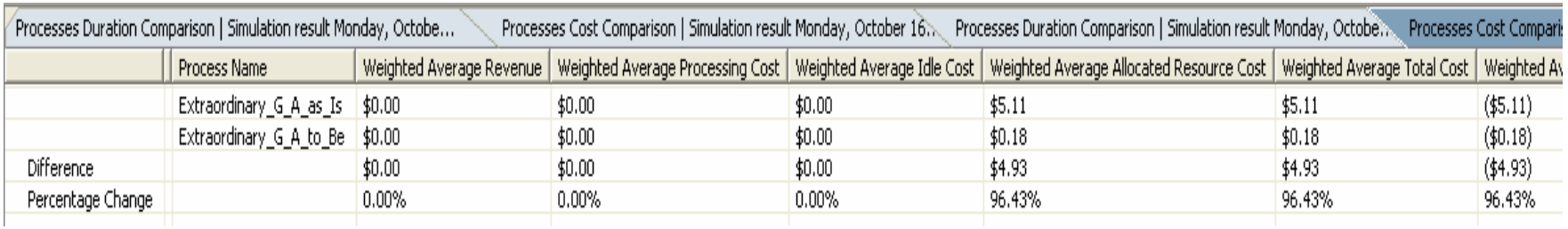
Figure 124: Comparison: Process cost between Application_Announcement_as_Is &Application_Announcement_to_Beprocesses



Processes Duration Comparison | Simulation result Monday, October 16, 2006 12:24:30 PM EEST | Chairman_Election_as_Is Saturday, Octo... | Processes Cost Comparison | Simulation result Monday, October 16, 2006 12:24:30 PM EEST | Chairman_Election_

	S..	Process Name	Weighted Average Revenue	Weighted Average Processing Cost	Weighted Average Idle Cost	Weighted Average Allocated Resource Cost	Weighted Average Total Cost	Weighted Average Profit
	S...	Chairman_Election_as_Is	$0.00	$0.00	$0.00	$8.22	$8.22	($8.22)
	S...	Chairman_Election_to_Be	$0.00	$0.00	$0.00	$2.17	$2.17	($2.17)
Difference			$0.00	$0.00	$0.00	$6.05	$6.05	($6.05)
Percentage Change			0.00%	0.00%	0.00%	73.61%	73.61%	73.61%

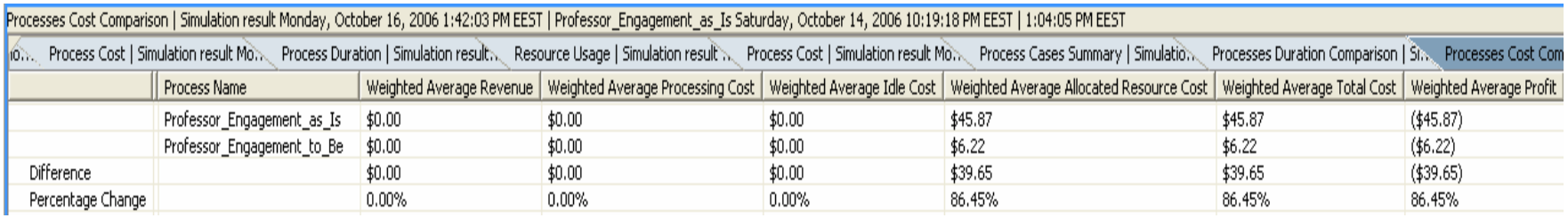
Figure 125: Comparison: Process cost between Chairman_Election_as_Is & Chairman_Election_to_Be processes



Processes Duration Comparison | Simulation result Monday, Octobe... | Processes Cost Comparison | Simulation result Monday, October 16... | Processes Duration Comparison | Simulation result Monday, Octobe... | Processes Cost Compari

	Process Name	Weighted Average Revenue	Weighted Average Processing Cost	Weighted Average Idle Cost	Weighted Average Allocated Resource Cost	Weighted Average Total Cost	Weighted Av
	Extraordinary_G_A_as_Is	$0.00	$0.00	$0.00	$5.11	$5.11	($5.11)
	Extraordinary_G_A_to_Be	$0.00	$0.00	$0.00	$0.18	$0.18	($0.18)
Difference		$0.00	$0.00	$0.00	$4.93	$4.93	($4.93)
Percentage Change		0.00%	0.00%	0.00%	96.43%	96.43%	96.43%

Figure 126: Comparison: Process cost between Extraordinary_G_A_as_Is & Extraordinary_G_A_to_Be processes



Processes Cost Comparison | Simulation result Monday, October 16, 2006 1:42:03 PM EEST | Professor_Engagement_as_Is Saturday, October 14, 2006 10:19:18 PM EEST | 1:04:05 PM EEST

io... | Process Cost | Simulation result Mo... | Process Duration | Simulation result... | Resource Usage | Simulation result ... | Process Cost | Simulation result Mo... | Process Cases Summary | Simulatio... | Processes Duration Comparison | Si... | Processes Cost Com

	Process Name	Weighted Average Revenue	Weighted Average Processing Cost	Weighted Average Idle Cost	Weighted Average Allocated Resource Cost	Weighted Average Total Cost	Weighted Average Profit
	Professor_Engagement_as_Is	$0.00	$0.00	$0.00	$45.87	$45.87	($45.87)
	Professor_Engagement_to_Be	$0.00	$0.00	$0.00	$6.22	$6.22	($6.22)
Difference		$0.00	$0.00	$0.00	$39.65	$39.65	($39.65)
Percentage Change		0.00%	0.00%	0.00%	86.45%	86.45%	86.45%

Figure 127: Comparison: Process cost between Professor_Engagement_as_Is & Professor_Engagement_to_Be processes

6 Conclusions

This thesis focused on the use of Business Process Management techniques in E-Government. Business Process Management offers the promise of improved performance, greater efficiency, lower costs, and greater competitiveness. Today's Business Process Management solutions are *business*-centric, supporting the needs of the government agency in achieving organizational goals.

Business Process Management is fundamentally a management philosophy underpinned by a comprehensive process oriented infrastructure. If approached properly, it provides a powerful weapon for achieving and sustaining a competitive advantage. Instead of always playing catch-up, Business Process Management technology provides not only the vehicle but also the throttle and levers to really drive performance.

Rather than managing via the rear view mirror (looking at what happened in the past), the real requirement is for visibility into the day-to-day operations and, where necessary, the ability to take action, intervening in real time and forecasting impacts. This means changing the way a case is handled or redeploying resources to deal with the problem. To do that we need a process engine, a content repository, appropriate integration mechanisms, sophisticated alert and escalation mechanisms, and robust analytics.

Process Management has nowadays become *the* most important trend in modern business. It is often dressed up as many other things, but in the end, whether a business, delivers value depends on the operational effectiveness of its processes. These processes include not only those that create customer value, but also those supporting processes and governing processes that are used to manage the organization. ***Success requires the ability to set the right balance between efficiency and flexibility, control and adaptability, compliance and nimbleness.*** Effective Business Process Management technology enables the organization, usually operating in a rapidly changing

environment, to adopt a more flexible and agile stance, evolving its technology infrastructure and business processes as they develop winning business capabilities. These new capabilities will be based on new processes which deliver reduced cost and faster responses while at the same time ensuring a consistent customer experience and more effective regulatory compliance.

Our study considers the case of the General Assembly of the Department of Computer Science of the University of Crete, as a paradigm, which we use to demonstrate the validity of the Business Process Management methodology and the associated techniques, as well as the benefits their application can bring to an organization.

The processes of the General Assembly are modelled, designed and analysed, aiming first to locate any dysfunctions and fragmentation problems that may exist and then to propose appropriate solutions. Solutions should be such, that the de-fragmentation and automation of the processes will become possible as well as the communication of these processes with processes in other systems. For the concretisation of these, we use the IBM WebSphere Business Integration Modeler tool.

After modelling and simulation, during the analysis of the simulation results, we detected abnormal behaviours and bottlenecks. The average throughput and the average elapse duration of activities or processes appeared to be rather high. We analyzed the worst case scenarios to figure out the resource allocationproblem. We also detected that there were some heavy, time-consuming activities. The delays in these activities were caused by other processes using resources for long periods of time. Finally, we found there was overbooking of some resources which resulted in resource shortage durations.

Improvements to the current process models had to be made in order to eliminate bottlenecks, increase the average throughput of activities or processes, reduce their average elapse duration and avoid overbooking of resources.

The following revisions were applied to the process model:

- Resource items revisions.
    - Transfer activities from resources to the General Assembly Application.
- Define Global tasks to replace local tasks.
- Define reusable Global processes to replace subprocesses of the current processes.
- Recreate current processes according to changes in the law.
- Redesign the current processes.

After the above changes took place, all processes cases run significantly faster and the average task delay was near zero. Also, all processes cases were now successful. Therefore, the new General

Assembly Application, which replaced other resources in many activities, relieved the resource allocation problem, resolved the resource shortage duration issues of the current processes and on top of that, it can be constantly available on a 24/7 basis.

The comparison reports show a large improvement, in terms of process duration metrics, of the Future processes compared to the Current processes. The metrics used were the Difference and the Percentage of Weighted Average Elapsed Duration and Weighted Average Throughput. Also the comparison reports show an improvement in terms of process cost metrics of the Future processes compared to the Current processes. The metrics used here were the Difference and the Percentage of Weighted Total Cost.

Our results show that, following the methodology we described in this thesis, we achieved many important goals for the organization we studied:

- greater efficiency,
- improved effectiveness,
- reduced administrative burden and
- reduced lead times for adopting new legislations.

These are important goals of E-Government and we showed, using a case study, how they can be achieved. The methodology we followed here is not limited to specific types of businesses and can be applied to many organizations and government agencies, in various levels, in order to achieve similar E-Government goals.

An obvious conclusion of this thesis is that government agencies which embrace business process management solutions face unprecedented opportunities to achieve higher levels of efficiency, build collaborative processes, and share mission critical information in real time. As a result, they gain control and proactively drive internal and external processes, and are able to respond rapidly to government mandates and public demands.

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Appendix A

Role – Resource Matrix for Current Processes

Resources/ Activity	Cost EUR per month	Proclamation	Convoke G.A. Session for Election	Define Electors Body	Recommendatory Committee	Convoke G.A. Session for Election Voting	Undergraduate Recommendation	Election Voting	Publication Election proceedings	Submit Election Decision to Ministry of N. E.& R.
Assistant Professor	1.203,00	0	0	0	0	0	0	0	0	0
Associate Professor	1.422,00	0	0	0	0	0	0	0	0	0
Dean	1.641,00	0	0	0	0	0	0	0	0	0
Lecture	1.094,00	0	0	0	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0	0	0	0	0
Professor	1.641,00	0	1	0	0	1	0	0	0	0
Secretary	1.100,00	0	1	0	0	1	0	0	1	1
Special Administrative - Technical Personnel	1.070,00	0	0	0	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0	2	0	0	0

Table 20: Role – Resource Matrix for Application_Anouncement_as_Is process

Resources/ Activity	Cost EUR per month	Define Rank & Sector	Send Request to Ministry	Decision of proclamation the place	Decision of not proclamation the place	Notification to National Academy of Letters and Sciences	Send Proclamation to Newspapers
Assistant Professor	1.203,00	4	0	0	0	0	0
Associate Professor	1.422,00	5	0	0	0	0	0
Dean	1.641,00	0	0	0	0	0	0
Lecture	1.094,00	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0	0
Professor	1.641,00	9	0	1	1	0	0
Secretary	1.100,00	1	1	1	1	1	1
Special Administrative - Technical Personnel	1.070,00	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0	0

Table 21: Role – Resource Matrix for Proclamation embedded process

Resources/ Activity	Cost EUR per month	Define Electors	Establish Table of Electors	Send Request to Ministry	Ministry of National Education & Religions Actions	Completion of Electors Body	Send G.A. Decision to Electors
Assistant Professor	1.203,00	4	4	0	0	4	0
Associate Professor	1.422,00	5	5	0	0	5	0
Dean	1.641,00	0	0	0	0	0	0
Lecture	1.094,00	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0	0
Professor	1.641,00	9	9	0	0	9	0
Secretary	1.100,00	1	1	1	0	1	1
Special Administrative - Technical Personnel	1.070,00	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0	0

Table 22: Role – Resource Matrix for Define Electors Body embedded process

Resources/ Activity	Cost EUR per month	Composition of three-member recommendatory committee	Candidates Applications from Secretariat	Evaluation - Classification of Candidates	Submit Evaluation Report to Candidates	Submit Evaluation Report to GA	Submit Evaluation Notification to GA
Assistant Professor	1.203,00	4	0	0	0	0	0
Associate Professor	1.422,00	5	0	0	0	0	0
Dean	1.641,00	0	0	0	0	0	0
Lecture	1.094,00	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0	0
Professor	1.641,00	9	0	3	3	3	3
Secretary	1.100,00	1	0	0	0	0	0
Special Administrative - Technical Personnel	1.070,00	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0	0

Table 23: Role – Resource Matrix for Recommendatory Committee embedded process

Resources/ Activity	Cost EUR per month	Revision Request	Revision – Voting	Reject Revision Request	Request to and Answer from N.A.L.S.	Reject Election	Election Decision
Assistant Professor	1.203,00	4	4	4	0	4	4
Associate Professor	1.422,00	5	5	5	0	5	5
Dean	1.641,00	0	0	0	0	0	0
Lecture	1.094,00	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0	0
Professor	1.641,00	9	9	9	0	9	9
Secretary	1.100,00	0	0	1	0	1	1
Special Administrative - Technical Personnel	1.070,00	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0	0

Table 24: Role – Resource Matrix for Election Voting embedded process

Resources/ Activity	Cost EUR per month	Create Request	Send request to National Academy of Letters and Sciences	National Academy of Letters and Science Actions	Voting
Assistant Professor	1.203,00	4	0	0	4
Associate Professor	1.422,00	5	0	0	5
Dean	1.641,00	0	0	0	0
Lecture	1.094,00	0	0	0	0
Postgraduate Student	0	0	0	0	0
Professor	1.641,00	9	0	0	9
Secretary	1.100,00	1	1	0	0
Special Administrative - Technical Personnel	1.070,00	0	0	0	0
Undergraduate Student	0	0	0	0	0

Table 25: Role – Resource Matrix for Request to and Answer from N.A.L.S. embedded process

Resources/ Activity	Cost EUR per month	Send Application for Chairman Election	Dean's Actions	Convened Electors Body	Candidates Applications	Vote
Assistant Professor	1.203,00	0	0	0	0	0
Associate Professor	1.422,00	0	0	0	0	0
Dean	1.641,00	0	0	1	0	0
Lecture	1.094,00	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0
Professor	1.641,00	0	0	0	2	0
Secretary	1.100,00	1	0	1	0	0
Special Administrative - Technical Personnel	1.070,00	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0

Table 26: Role – Resource Matrix for Chairman_Election_as_Is process

Resources/ Activity	Cost EUR per month	Voting	Repeat Voting	Chairman Election Decision	Decision of not election	Definition of new date of election
Assistant Professor	1.203,00	4	4	0	0	0
Associate Professor	1.422,00	5	5	0	0	0
Dean	1.641,00	0	0	1	1	1
Lecture	1.094,00	0	0	0	0	0
Postgraduate Student	0	14	14	0	0	0
Professor	1.641,00	9	9	0	0	0
Secretary	1.100,00	1	1	1	1	1
Special Administrative - Technical Personnel	1.070,00	1	1	0	0	0
Undergraduate Student	0	1	1	0	0	0

Table 27: Role – Resource Matrix for Vote embedded process

Resources/ Activity	Cost EUR per month	Chairman Decision	Reject the Request	Convoke General Assembly	Send Chairman Decision to Dean	Dean's Actions
Assistant Professor	1.203,00	0	4	0	0	0
Associate Professor	1.422,00	0	5	0	0	0
Dean	1.641,00	0	0	0	0	0
Lecture	1.094,00	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0
Professor	1.641,00	1	9	1	0	0
Secretary	1.100,00	0	1	1	1	0
Special Administrative - Technical Personnel	1.070,00	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0

Table 28: Role – Resource Matrix for Extraordinary_G_A_as_Is process

Resources/ Activity	Cost EUR per month	Reject the Engagement	Define Electors Body	Convoke G.A. Session for Engagement	Engagement Voting
Assistant Professor	1.203,00	4	0	0	0
Associate Professor	1.422,00	5	0	0	0
Dean	1.641,00	0	0	0	0
Lecture	1.094,00	0	0	0	0
Postgraduate Student	0	0	0	0	0
Professor	1.641,00	9	0	1	0
Secretary	1.100,00	1	0	1	0
Special Administrative - Technical Personnel	1.070,00	0	0	0	0
Undergraduate Student	0	0	0	0	0

Table 29: Role – Resource Matrix for Professor_Engagement_as_Is process

Resources/ Activity	Cost EUR per month	Define Electors	Establish Table of Electors	Send Request to Ministry	Ministry of National Education & Religions Actions	Completion of Electors Body	Send G.A. Decision to Electors
Assistant Professor	1.203,00	4	4	0	0	4	0
Associate Professor	1.422,00	5	5	0	0	5	0
Dean	1.641,00	0	0	0	0	0	0
Lecture	1.094,00	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0	0
Professor	1.641,00	9	9	0	0	9	0
Secretary	1.100,00	1	1	1	0	1	1
Special Administrative - Technical Personnel	1.070,00	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0	0

Table 30: Role – Resource Matrix for Define Electors Body embedded process

Resources/ Activity	Cost EUR per month	Voting	Revision Professor Engagement	Revision - Voting	Reject Revision Request	Request to and Answer from N.A.L.S.	Reject Election	Engagement Decision
Assistant Professor	1.203,00	0	4	4	4	0	4	4
Associate Professor	1.422,00	0	5	5	5	0	5	5
Dean	1.641,00	0	0	0	0	0	0	0
Lecture	1.094,00	0	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0	0	0
Professor	1.641,00	9	9	9	9	0	9	9
Secretary	1.100,00	0	0	0	1	0	1	1
Special Administrative - Technical Personnel	1.070,00	0	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0	0	0

Table 31: Role – Resource Matrix for Election Voting embedded process

For Role-Resource matrix for ***Request to and Answer from N.A.L.S*** embedded processes see **Table 25** correspondingly.

Availability Matrix for Current Processes

Resources/Timetable	Day Shift
Assistant Professor	1
Associate Professor	1
Dean	1
Lecture	1
Postgraduate Student	1
Professor	1
Secretary	1
Special Administrative - Technical Personnel	1
Undergraduate Student	1

Table 32: Availability Matrix for Roles & Resources

Duration Matrix for Current Processes

	Proclamation	Define Electors Body	Convoke G.A. Session for Election	Recommendatory Committee	Convoke G.A. Session for Election Voting	Undergraduate Recommendation	Voting	Election Voting	Publication Election proceedings	Submit Election Decision to Ministry of N. E.& R.
Resources/ Activity										
Assistant Professor	0	0	0	0	0	0	0	0	0	0
Associate Professor	0	0	0	0	0	0	5*10 min	0	0	0
Dean	0	0	0	0	0	0	0	0	0	0
Lecture	0	0	0	0	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0	0	0	0	0
Professor	0	0	1*1 hour	0	1*1 hour	0	9* 10 min	0	0	0
Secretary	0	0	1*1 hour	0	1*1 hour	0	1*15 min	0	1*30 min	1*30 min
Special Administrative - Technical Personnel	0	0	0	0	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	2*20 min	0	0	0	0

Table 33: Duration Matrix for Application_Anouncement_as_Is process

	Define Rank & Sector	Send Request to Ministry	Decision of proclamation the place	Decision of not proclamation the place	Notification to National Academy of Letters and Sciences	Send Proclamation to Newspapers
Resources/ Activity						
Assistant Professor	4*30 min	0	4*20 min	4*20 min	0	0
Associate Professor	5*30 min	0	5*20 min	5*20 min	0	0
Dean	0	0	0	0	0	0
Lecture	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0
Professor	9*30 min	0	9*20 min	9*20 min	0	0
Secretary	1*30 min	1*30 min	1*20 min	1*20 min	1*30 min	1*30 min
Special Administrative - Technical Personnel	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0

Table 34: Duration Matrix for Proclamation embedded process

	Define Electors	Establish Table of Electors	Send Request to Ministry	Ministry of National Education & Religions Actions	Completion of Electors Body	Send G.A. Decision to Electors
Resources/ Activity						
Assistant Professor	4*20 min	4*30 min	0	0	4*15 min	0
Associate Professor	5*20 min	5*30 min	0	0	5*15 min	0
Dean	0	0	0	0	0	0
Lecture	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0
Professor	9*20 min	9*30 min	0	0	9*15 min	0
Secretary	1*20 min	1*30 min	1*30 min	0	1*15 min	1
Special Admin-Technical Personnel	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0

Table 35: Duration Matrix for Define Electors Body embedded process

	Composition of three-member recommendatory committee	Candidates Applications from Secretariat	Evaluation - Classification of Candidates	Submit Evaluation Report to Candidates	Submit Evaluation Report to GA	Submit Evaluation Notification to GA
Resources/ Activity						
Assistant Professor	4*15 min	0	0	0	0	0
Associate Professor	5*15 min	0	0	0	0	0
Dean	0	0	0	0	0	0
Lecture	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0
Professor	9*15 min	0	3*25 hours	0	3*10 min	3*10 min
Secretary	1*15 min	0	0	1*30 min	0	0
Special Admin. Technical Personnel	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0

Table 36: Duration Matrix for Recommendatory Committee embedded process

	Revision Request	Revision - Voting	Reject Revision Request	Request to and Answer from N.A.L.S.	Voting	Reject Election	Election Decision
Resources/ Activity							
Assistant Professor	4*15 min	4*1 min	4*10 min	0	4*1 min	4*10 min	4*10 min
Associate Professor	5*15 min	5*1 min	5*10 min	0	5*1 min	5*10 min	5*10 min
Dean	0	0	0	0	0	0	0
Lecture	0	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0	0
Professor	9*15 min	9*1 min	9*10 min	0	9*1 min	9*10 min	9*10 min
Secretary	0	1*5 min	1*10 min	0	1*5 min	1*10 min	1*10 min
Special Admin. - Technical Personnel	0	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0	0

Table 37: Duration Matrix for Election Voting embedded process

	Create Request	Send request to National Academy of Letters and Sciences	National Academy of Letters and Science Actions	Voting
Resources/ Activity				
Assistant Professor	4*15 min	0	0	4*1 min
Associate Professor	5*15 min	0	0	5*1 min
Dean	0	0	0	0
Lecture	0	0	0	0
Postgraduate Student	0	0	0	0
Professor	9*15 min	0	0	9*1 min
Secretary	1*15 min	1*30 min	0	1*5 min
Special Administrative - Technical Personnel	0	0	0	0
Undergraduate Student	0	0	0	0

Table 38: Duration Matrix for Request to and Answer from N.A.L.S. embedded process

	Send Application for Chairman Election	Dean's Actions	Convened Electors Body	Candidates Applications	Vote
Resources/ Activity					
Assistant Professor	0	0	0	0	0
Associate Professor	0	0	0	0	0
Dean	0	0	1*30 min	0	0
Lecture	0	0	0	0	0
Postgraduate Student	0	0	0	0	0
Professor	0	0	0	2*15 min	0
Secretary	1*30 min	0	1*30 min	0	0
Special Administrative - Technical Personnel	0	0	0	0	0
Undergraduate Student	0	0	0	0	0

Table 39: Duration Matrix for Chairman Election process

	Voting	Repeat Voting	Chairman Election Decision	Decision of not election	Definition of new date of election
Resources/ Activity					
Assistant Professor	4*1 min	4*1 min	0	0	0
Associate Professor	5*1 min	5*1 min	0	0	0
Dean	0*1 min	0	1*30 min	1*30 min	1*30 min
Lecture	0	0	0	0	0
Postgraduate Student	14*1 min	14*1 min	0	0	0
Professor	9*1 min	9*1 min	0	0	0
Secretary	1*5 min	1*5 min	1*30min	1*30min	1*30min
Special Administrative - Technical Personnel	1*1 min	1*1 min	0	0	0
Undergraduate Student	1*1 min	1*1 min	0	0	0

Table 40: Duration Matrix for Vote embedded process

	Chairman Decision	Reject the Request	Convoke General Assembly	Send Chairman Decision to Dean	Dean's Actions
Resources/ Activity					
Assistant Professor	0	4*15 min	0	0	0
Associate Professor	0	5*15 min	0	0	0
Dean	0	0	0	0	0
Lecture	0	0	0	0	0
Postgraduate Student	0	0	0	0	0
Professor	1*20 min	9*15 min	1*1 hour	0	0
Secretary	0	1*15 min	1*1 hour	1*30 min	0
Special Administrative - Technical Personnel	0	0	0	0	0
Undergraduate Student	0	0	0	0	0

Table 41: Duration Matrix for Extraordinary General Assembly process

	Reject the Engagement	Define Electors Body	Convoke G.A. Session for Engagement	Engagement Voting
Resources/ Activity				
Assistant Professor	4*10 min	0	0	0
Associate Professor	5*10 min	0	0	0
Dean	0	0	0	0
Lecture	0	0	0	0
Postgraduate Student	0	0	0	0
Professor	9*10 min	0	1*1 hour	0
Secretary	1*10 min	0	1*1 hour	0
Special Administrative - Technical Personnel	0	0	0	0
Undergraduate Student	0	0	0	0

Table 42: Duration Matrix for Professor_Engagement_as_Is process

	Voting	Revision Professor Engagement	Revision - Voting	Reject Revision Request	Request to and Answer from N.A.L.S.	Reject Engagement	Engagement Decision
Resources/ Activity							
Assistant Professor	0	4*10 min	4*1 min	4*10 min	0	4*10 min	4*10 min
Associate Professor	0	5*10 min	5*1 min	5*10 min	0	5*10 min	5*10 min
Dean	0	0	0	0	0	0	0
Lecture	0	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0	0
Professor	9*1 min	9*10 min	9*1 min	9*10 min	0	9*10 min	9*10 min
Secretary	1*5 min	0	1*5 min	1*10 min	0	1*10 min	1*10 min
Special Administrative - Technical Personnel	0	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0	0

Table 43: Duration Matrix for Election Voting embedded process

For Duration matrix for ***Define Electors Body*** and ***Request to and Answer from N.A.L.S*** embedded processes see **Table 35** and **Table 38** correspondingly.

Role – Resource Matrix for Future Processes

Resources/ Activity	Cost EUR per month	Define Rank & Sector	Send Request	Decision of not proclamation the place	Proclamation	Define Electors Body	Recommendatory Committee	Convoke General Assembly	Undergraduate Recommendation	Election Voting	Publication Election proceedings	Send Decision
Assistant Professor	1.203,00	4	0	4	0	0	0	0	0	0	0	0
Associate Professor	1.422,00	5	0	5	0	0	0	0	0	0	0	0
Dean	1.641,00	0	0	0	0	0	0	0	0	0	0	0
Lecture	1.094,00	0	0	0	0	0	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0	0	0	0	0	0	0
Professor	1.641,00	9	0	9	0	0	0	1	0	0	0	0
Secretary	1.100,00	1	0	1	0	0	0	1	0	0	1	0
Special Administrative - Technical Personnel	1.070,00	0	0	0	0	0	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0	0	0	2	0	0	0
General Assembly Application	1	1	1	1	0	0	0	1	0	0	0	1

Table 44: Role – Resource Matrix for Application_Anouncement_to_Be process

Resources/ Activity	Cost EUR per month	Decision of proclamation the place	Send Decision	Send Decision:2	Convoke General Assembly	Send Decision:3
Assistant Professor	1.203,00	4	0	0	0	0
Associate Professor	1.422,00	5	0	0	0	0
Dean	1.641,00	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0
Professor	1.641,00	9	0	0	1	0
Secretary	1.100,00	1	0	0	1	0
Special Administrative - Technical Personnel	1.070,00	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0
General Assembly Application	1	0	1	1	1	1

Table 45: Role – Resource Matrix for Proclamation embedded process

Resources/ Activity	Cost EUR per month	Define Electors	Establish Table of Electors	Send Request	Ministry of National Education & Religions Actions	Completion of Electors Body	Send Decision
Assistant Professor	1.203,00	4	4	0	0	4	0
Associate Professor	1.422,00	5	5	0	0	5	0
Dean	1.641,00	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0	0
Professor	1.641,00	9	9	0	0	9	0
Secretary	1.100,00	1	1	0	0	1	0
Special Administrative - Technical Personnel	1.070,00	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0	0
General Assembly Application	1	1	1	1	0	1	1

Table 46: Role – Resource Matrix for Define Electors Body process

Resources/ Activity	Cost EUR per month	Composition of three-member recommendatory committee	Candidates Applications from Secretariat	Evaluation - Classification of Candidates	Send Decision	Send Decision
Assistant Professor	1.203,00	4	0	0	0	0
Associate Professor	1.422,00	5	0	0	0	0
Dean	1.641,00	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0
Professor	1.641,00	9	0	3	0	0
Secretary	1.100,00	1	0	0	0	0
Special Administrative - Technical Personnel	1.070,00	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0
General Assembly Application	1	1	0	1	1	1

Table 47: Role – Resource Matrix for Recommendatory Committee embedded process

Resources/ Activity	Cost EUR per month	Revision Request	Revision – Voting	Reject Application	Request to and Answer from N.A.L.S.	Reject Decision	Election Decision
Assistant Professor	1.203,00	4	4	0	0	0	04
Associate Professor	1.422,00	5	5	0	0	0	0
Dean	1.641,00	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0	0
Professor	1.641,00	9	9	0	0	0	0
Secretary	1.100,00	0	1	0	0	0	0
Special Administrative - Technical Personnel	1.070,00	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0	0
General Assembly Application	1	1	1	1	0	1	1

Table 48: Role – Resource Matrix for Election Voting embedded process

Resources/ Activity	Cost EUR per month	Create Request	Send Request	National Academy of Letters and Science Actions	Voting
Assistant Professor	1.203,00	4	0	0	4
Associate Professor	1.422,00	5	0	0	5
Dean	1.641,00	0	0	0	0
Lecture	1.094,00	0	0	0	0
Postgraduate Student	0	0	0	0	0
Professor	1.641,00	9	0	0	9
Secretary	1.100,00	1	0	0	1
Special Administrative - Technical Personnel	1.070,00	0	0	0	0
Undergraduate Student	0	0	0	0	0
General Assembly Application	1	1	1	0	1

Table 49: Role – Resource Matrix for Request to and Answer from N.A.L.S. embedded process

Resources/ Activity	Cost EUR per month	Send Decision	Dean's Actions	Convened Electors Body	Candidates Applications	Vote
Assistant Professor	1.203,00	0	0	0	0	0
Associate Professor	1.422,00	0	0	0	0	0
Dean	1.641,00	0	0	1	0	0
Lecture	1.094,00	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0
Professor	1.641,00	0	0	0	2	0
Secretary	1.100,00	0	0	1	0	0
Special Administrative - Technical Personnel	1.070,00	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0
General Assembly Application	1	1	0	1	0	0

Table 50: Role – Resource Matrix for Chairman_Election_to_Be process

Resources/ Activity	Cost EUR per month	Voting	Repeat Voting	Publication of Decision	Reject Decision	Definition of new date of election
Assistant Professor	1.203,00	4	4	0	0	0
Associate Professor	1.422,00	5	5	0	0	0
Dean	1.641,00	0	0	0	0	1
Lecture	1.094,00	0	0	0	0	0
Postgraduate Student	0	14	14	0	0	0
Professor	1.641,00	9	9	0	0	0
Secretary	1.100,00	1	1	0	0	1
Special Administrative - Technical Personnel	1.070,00	1	1	0	0	0
Undergraduate Student	0	1	1	0	0	0
General Assembly Application	1	1	1	1	1	1

Table 51: Role – Resource Matrix for Vote embedded process

Resources/ Activity	Cost EUR per month	Chairman Decision	Reject Application	Convoke General Assembly	Send Decision	Dean's Actions
Assistant Professor	1.203,00	0	0	0	0	0
Associate Professor	1.422,00	0	0	0	0	0
Dean	1.641,00	0	0	0	0	0
Lecture	1.094,00	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0
Professor	1.641,00	1	0	1	0	0
Secretary	1.100,00	0	0	1	0	0
Special Administrative - Technical Personnel	1.070,00	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0
General Assembly Application	1	1	1	1	1	0

Table 52: Role – Resource Matrix for Extraordinary_G_A_to_Be process

Resources/ Activity	Cost EUR per month	Reject Application	Define Electors Body	Convoke General Assembly	Engagement Voting
Assistant Professor	1.203,00	0	0	0	0
Associate Professor	1.422,00	0	0	0	0
Dean	1.641,00	0	0	0	0
Lecture	1.094,00	0	0	0	0
Postgraduate Student	0	0	0	0	0
Professor	1.641,00	0	0	1	0
Secretary	1.100,00	0	0	1	0
Special Administrative - Technical Personnel	1.070,00	0	0	0	0
Undergraduate Student	0	0	0	0	0
General Assembly Application	1	1	0	1	0

Table 53: Role – Resource Matrix for Professor_Engagement_to_Be process

Resources/ Activity	Cost EUR per month	Voting	Revision Professor Engagement	Revision - Voting	Reject Application	Request to and Answer from N.A.L.S.	Reject Decision	Publication of Decision
Assistant Professor	1.203,00	0	4	4	4	0	0	0
Associate Professor	1.422,00	0	5	5	5	0	0	0
Dean	1.641,00	0	0	0	0	0	0	0
Lecture	1.094,00	0	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0	0	0
Professor	1.641,00	9	9	9	9	0	0	0
Secretary	1.100,00	1	0	0	1	0	0	0
Special Administrative - Technical Personnel	1.070,00	0	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0	0	0
General Assembly Application	1	1	1	1	0	0	1	1

Table 54: Role – Resource Matrix for Election Voting embedded process

For Role-Resource matrix for ***Request to and Answer from N.A.L.S*** embedded processes see **Table 49** correspondingly.

Availability Matrix for Future Processes

Resources/ Timetable	Day Shift	Online Application
Assistant Professor	1	0
Associate Professor	1	0
Dean	1	0
Lecture	1	0
Postgraduate Student	1	0
Professor	1	0
Secretary	1	0
Special Administrative - Technical Personnel	1	0
Undergraduate Student	1	0
General Assembly Application	0	1

Table 55: Availability Matrix for Roles & Resources

Duration Matrix for Future Processes

	Define Rank & Sector	Send Request	Decision of not proclamation the place	Proclamation	Define Electors Body	Recommendatory Committee	Convoke General Assembly	Undergraduate Recommendation	Election Voting	Publication Election proceedings	Send Decision
Resources/ Activity											
Assistant Professor	4*20 min	0	4*10 min	0	0	0	0	0	0	0	0
Associate Professor	5*20 min	0	5*10 min	0	0	0	0	0	0	0	0
Dean	0	0	0	0	0	0	0	0	0	0	0
Lecture	0	0	0	0	0	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0	0	0	0	0	0
Professor	9*20 min	0	9*10 min	0	0	0	1*5 min	0	0	0	0
Secretary	1*20 min	0	1*10 min	0	0	0	1*5 min	0	0	1*15 min	0
Special Administrative - Technical Personnel	0	0	0	0	0	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0	0	2*10 min	0	0	0
General Assembly Application	1*1 min	1*3 sec	1*30 sec	0	0	0	1* 1 min	0	0	1*1 min	1*3 sec

Table 56: Duration Matrix for Application_Anouncement_as_Is process

	Decision of proclamation the place	Send Decision	Convoke General Assembly	Send Decision:2
Resources/ Activity				
Assistant Professor	4*10 min	0	0	0
Associate Professor	5*10 min	0	0	0
Dean	0	0	0	0
Postgraduate Student	0	0	0	0
Professor	9*10 min	0	1*5 min	0
Secretary	1*10 min	0	1*5 min	0
Special Administrative - Technical Personnel	0	0	0	0
Undergraduate Student	0	0	0	0
General Assembly Application	1*30 sec	1*3 sec	1*1 min	1*3 sec

Table 57: Duration Matrix for Proclamation embedded process

	Define Electors	Establish Table of Electors	Send Request	Ministry of National Education & Religions Actions	Completion of Electors Body	Send Decision
Resources/ Activity						
Assistant Professor	4*10 min	4*5 min	0	0	0	0
Associate Professor	5*10 min	5*5 min	0	0	0	0
Dean	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0
Professor	9*10 min	9*5 min	0	0	0	0
Secretary	1*10 min	1*5 min	0	0	1*5 min	0
Special Admin-Technical Personnel	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0
General Assembly Application	1*1 min	1*1 min	1*3 sec	0	1*1 min	1*3 sec

Table 58: Duration Matrix for Define Electors Body process

	Composition of three-member recommendatory committee	Candidates Applications from Secretariat	Evaluation - Classification of Candidates	Send Decision	Send Decision:2
Resources/ Activity					
Assistant Professor	4*10 min	0	0	0	0
Associate Professor	5*10 min	0	0	0	0
Dean	0	0	0	0	0
Postgraduate Student	0	0	0	0	0
Professor	9*10min	0	3*20 hours	0	0
Secretary	1*10 min	0	0	0	0
Special Admin. Technical Personnel	0	0	0	0	0
Undergraduate Student	0	0	0	0	0
General Assembly Application	1* 1 min	0	1*1 hour	1*3 sec	1*3 sec

Table 59: Duration Matrix for Recommendatory Committee embedded process

	Revision Request	Revision - Voting	Reject Application	Request to and Answer from N.A.L.S.	Voting	Reject Decsion	Publication of Decision
Resources/ Activity							
Assistant Professor	4*5 min	4*5 min	0	0	4*1 min	0	0
Associate Professor	5*5 min	5*5 min	0	0	5*1 min	0	0
Dean	0	0	0	0	0	0	0
Postgraduate Student	0	0	0	0	0	0	0
Professor	9*5 min	9*5 min	0	0	9*1 min	0	0
Secretary	0	1*2 min	0	0	1*2 min	1*3 min	1*3 min
Special Admin. - Technical Personnel	0	0	0	0	0	0	0
Undergraduate Student	0	0	0	0	0	0	0
General Assembly Application	1*30 sec	1*10 sec	1*5 sec	0	1*10 sec	1*5 sec	1*15 sec

Table 60: Duration Matrix for Election Voting embedded process

	Create Request	Send request to National Academy of Letters and Sciences	National Academy of Letters and Science Actions	Voting
Resources/ Activity				
Assistant Professor	0	0	0	4*1 min
Associate Professor	0	0	0	5*1 min
Dean	0	0	0	0
Lecture	0	0	0	0
Postgraduate Student	0	0	0	0
Professor	0	0	0	9*1 min
Secretary	1*5 min	0	0	1*2 min
Special Administrative - Technical Personnel	0	0	0	0
Undergraduate Student	0	0	0	0
General Assembly Application	1*1 min	1*3 sec	0	1*10 sec

Table 61: Duration Matrix for Request to and Answer from N.A.L.S. embedded process

	Send Decision	Dean's Actions	Convened Electors Body	Candidates Applications	Vote
Resources/ Activity					
Assistant Professor	0	0	0	0	0
Associate Professor	0	0	0	0	0
Dean	0	0	0	0	0
Lecture	0	0	0	0	0
Postgraduate Student	0	0	0	0	0
Professor	0	0	0	2*10 min	0
Secretary	0	0	1*2 min	0	0
Special Administrative - Technical Personnel	0	0	0	0	0
Undergraduate Student	0	0	0	0	0
General Assembly Application	1*3 sec	0	1*1 min	0	0

Table 62: Duration Matrix for Chairman_Election_to_Be process

	Voting	Repeat Voting	Publication of Decision	Reject decision	Definition of new date of election
Resources/ Activity					
Assistant Professor	4*1 min	4*1 min	0	0	0
Associate Professor	5*1 min	5*1 min	0	0	0
Dean	0*1 min	0	0	0	1*5 min
Lecture	0	0	0	0	0
Postgraduate Student	14*1 min	14*1 min	0	0	0
Professor	9*1 min	9*1 min	0	0	0
Secretary	1*2 min	1*2 min	1*3min	1*3min	1*5 min
Special Administrative - Technical Personnel	1*1 min	1*1 min	0	0	0
Undergraduate Student	1*1 min	1*1 min	0	0	0
General Assembly Application	1*10 sec	1*10 sec	1*15 sec	1*5 sec	1*5 sec

Table 63: Duration Matrix for Vote embedded process

	Chairman Decision	Reject Application	Convoke General Assembly	Send Decision	Dean's Actions
Resources/ Activity					
Assistant Professor	0	0	0	0	0
Associate Professor	0	0	0	0	0
Dean	0	0	0	0	0
Lecture	0	0	0	0	0
Postgraduate Student	0	0	0	0	0
Professor	1*1 min	0	1*5 min	0	0
Secretary	0	0	1*5 min	0	0
Special Administrative - Technical Personnel	0	0	0	0	0
Undergraduate Student	0	0	0	0	0
General Assembly Application	1*5 sec	1*5 sec	0	1*5 sec	0

Table 64: Duration Matrix for Extraordinary_G_A_to_Be process

	Reject Application	Define Electors Body	Convoke General Assembly	Engagement Voting
Resources/ Activity				
Assistant Professor	0	0	0	0
Associate Professor	0	0	0	0
Dean	0	0	0	0
Lecture	0	0	0	0
Postgraduate Student	0	0	0	0
Professor	0	0	1*5 min	0
Secretary	0	0	1*5 min	0
Special Administrative - Technical Personnel	0	0	0	0
Undergraduate Student	0	0	0	0
General Assembly Application	1*5 sec	0	1*1 min	0

Table 65: Duration Matrix for Professor_Engagement_to_Be process

	Voting	Reject Decision	Publication of Decision
Resources/ Activity			
Assistant Professor	0	0	0
Associate Professor	0	0	0
Dean	0	0	0
Lecture	0	0	0
Postgraduate Student	0	0	0
Professor	9*1 min		
Secretary	1*2 min	1*3 min	1*3 min
Special Administrative - Technical Personnel	0	0	0
Undergraduate Student	0	0	0
General Assembly Application	1*10 sec	1*10 sec	1*15 sec

Table 66: Duration Matrix for Election Voting embedded process

For Duration matrix for ***Request to and Answer from N.A.L.S*** embedded processes see **Table 61** correspondingly.