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MASTER IN SCIENCE IN  
TELECOMMUNICATION & AUTOMATION SYSTEMS

**BUSINESS PROCESS ANALYSIS IN A TELECOMMUNICATIONS  
HARDWARE BASE FACTORY AND PRODUCTION PROCESS  
MODELING**

THESIS

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Chania, November 2023

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HARDWARE BASE FACTORY AND PRODUCTION PROCESS MODELING**

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## **ABSTRACT**

This Thesis' subject is the analysis of 306 Telecommunications Hardware Base Factory's (306 THBF) operations, the only support and maintenance unit of Hellenic Army for electronic and telecommunication systems.

First, historical data, the structure and organization of the factory are presented, in order to understand its mission and operation.

Then, the most basic modeling and simulation procedures are presented, while particular emphasis is placed on the ADONIS software, which is chosen for the modeling of the production process.

In closing, the conclusions drawn from the study, its benefits for the Hellenic Army and the 306 THBF, as well as suggestions for future research are presented.

## ΠΕΡΙΛΗΨΗ

Αντικείμενο της Διπλωματικής Εργασίας αποτελεί η ανάλυση της λειτουργίας του 306 Εργοστασίου Βάσεως Τηλεπικοινωνιών (306 ΕΒΤ), του μοναδικού επισκευαστικού κλιμακίου που διαθέτει ο Ελληνικός Στρατός (ΕΣ) για την επισκευή των ηλεκτρονικών συστημάτων τηλεπικοινωνιών που χρησιμοποιεί.

Αρχικά, παρουσιάζονται ιστορικά στοιχεία, η δομή και η οργάνωση του εργοστασίου, με σκοπό να γίνει κατανοητή η αποστολή και η λειτουργία του.

Στη συνέχεια, παρουσιάζονται οι βασικότερες διαδικασίες μοντελοποίησης και προσομοίωσης, ενώ δίδεται ιδιαίτερη έμφαση στο λογισμικό ADONIS, το οποίο επιλέγεται για τη μοντελοποίηση της παραγωγικής διαδικασίας.

Κλείνοντας, καταγράφονται τα συμπεράσματα τα οποία προέκυψαν από τη μελέτη, τα οφέλη αυτής για τον Ελληνικό Στρατό και το 306 ΕΒΤ, καθώς και προτάσεις για μελλοντική έρευνα.

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## **LIST OF ACRONYMS AND ABBREVIATIONS**

306 THBF	306 Telecommunications Hardware Base Factory
BMS	Business Management System
BPEL	Business Process Execution Language
BPM	Business Process Management
BPMN	Business Process Model and Notation
BPMS	Business Process Management Software
DMS	Distributor Management Systems
ERP	Enterprise Resource Planning
H.A.G.S	Hellenic Army General Staff
IS	Information System
NSPA	NATO Standard and Procurement Agency
SC	Surveillance Camera

## **ACKNOWLEDGMENTS**

I would like to express my gratitude to my thesis advisor, Dr Anastasia Katsamaki, for it was under her encouragement that I was motivated to undertake this thesis research. I really appreciate her support, the trust that she showed me and the valuable advice and guidance she provided me during the entire process of our flawless cooperation.

Also, I would like to thank my family who raised me and established the foundations for this achievement. My beloved wife, Georgia, and my precious children, Theodora-Zoi and Georgios: I am thankful for the patience and support they provided me during the challenging and constant efforts to achieve my goals, but most of all because they are my continuous inspiration of my life.

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## **I. PRELUDE**

### **A. MOTIVATION**

As an Officer of Hellenic Army, specialized in maintenance and support, i found many times myself in a position in which I had to come up with solutions that sometimes were “out of the box”, in order to find the best possible way to solve a problem or bypass an obstacle. These situations showed to me that, in most cases, the biggest problem comes from the wrong business and process management, as it has been used from the beginning in order to define a procedure and organize the maintenance.

In most cases, the best and final solutions came when I decided to intervene and change the maintenance procedure in an early stage. These changes provided a different path in the maintenance system and prevented recurrences of failures and damages in the Army materials.

This was my motivation to do my research for this Thesis. I chose to present the 306 Telecommunications Hardware Base Factory (306 THBF), the only support and maintenance unit of Hellenic Army for electronic and telecommunication systems. This uniqueness gives the opportunity to present the factory’s business process analysis and provide some solutions, in order to maximize its performance and efficiency.

### **B. PROBLEM STATEMENT**

As referred before, the uniqueness of 306 THBF provides a great field of research. The problems of factory’s working line must be solved immediately, as there is no other maintenance unit to provide an alternative.

There are no prior analyses of 306 THBF production process. In my work, I analyze the 306 THBF business process and recommend some solutions, in order to improve the factory’s performance.

Much information about the 306 THBF is classified and forbidden to publish. Therefore, the whole approach is general, in order not to disclose by mistake any of it. This Thesis is the base for a more detailed and classified research. As a result, many statistical data have been collected, but cannot be used.

Due to the nature of the 306 THBF as an Army Organization, but also of the problem statement itself and its specific features, it is not easy to find suitable academic references to link this research with previous attempts. So, the whole approach focuses on more practical solutions, taking into account that this procedure is actually going to be followed.

### **C. RESEARCH QUESTIONS**

This research focuses on production process analysis of 306 THBF. It uses ADONIS Business Process Management (BPM) and provides a formal proof of the results. The attempt is to answer questions such as what changes could be made so as to improve the efficiency and productivity of the factory.

### **D. THESIS ORGANIZATION**

In Chapter II, background information about 306 THBF is provided, its history, organization, mission and description. In Chapter III, basic information of Business Process Management Systems are presented. Chapter IV contains information about the most commonly used process modeling tools, such as BONITA, PROCESSMAKER, ARIS EXPRESS, INTALIO, BISAGI MODELER and VISIO. Chapter V contains ADONIS CE PROCESS MODELING description. It also represents the 306 THBF process modeling. Finally, Chapter VI contains the conclusion of the analysis that took place as well as ideas for completion and possible future work.

In this chapter, is presented what led to the construction of this research. Based on this data, related concepts are analyzed afterwards in more depth.

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## **II. BACKGROUND**

### **A. HISTORY OF 306 TELECOMMUNICATIONS HARDWARE BASE FACTORY**

In the context of the rapid development of the telecommunications means carried out by the application of the technology evolving over time, after the end of the Second World War, the need was presented to create a single Complex - Telecommunication Base Factory (according to the standards of the American Depots), which would serve all the telecommunications of the Greek Army.

The 306 EBT was formed in 1953, by order of the Hellenic Army General Staff (H.A.G.S), from the Telecommunication Workshop of the 301 Base Factory and the 339 Telecommunication Equipment Repair Workshop, stationed at the "PAPADOGONA" camp in Goudi. On October 21, 1961, it moved from Goudi to its current location near the Municipality of Acharnes.

The main "Γ"-shaped factory was built in 1961, and its "Π"-shaped extension and configuration, as well as the facilities of the auxiliary administration and administrative departments, were progressively built at the expense of the Greek public. Expansions of the factory were also made in the period 1982-1990 with the construction of the building of the Construction Workshop, the Inspection and Quality Control Directorate and the Spare Parts Platoon (Internal Operations Organization of 306 THBF, 2017).

### **B. ORGANIZATION**

The typical structure of a Military Factory includes the following:

- a. Staff [(Four Offices (1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>)].
- b. Two Directorates.



- c. Two Administrations.
- d. Health and Safety Office.
- e. One Company of Special Materials.

The 306 THBF does not follow the typical structure of a Hellenic Army Unit. Its particular organization chart demands high quality and special trained personnel, in order to accomplish its mission.

Staff is divided in four different Offices, each one of them with different mission.

1<sup>st</sup> Office is responsible for 306 THBF's personnel, both military and civilian. Its mission is to provide solutions and suggestions in every aspect of personnel's personal and professional concerns. With its subsections, it handles matters concerning personnel's problems that affect their performance, such as family affairs, financial problems, etc.

2<sup>nd</sup> Office, with its subsections, is responsible for all the camp's safety matters, military information, public relations, communication with other public organizations, etc. Its critical and most important mission is to organize the camp's defence against a possible invader and provide all the necessary tools to accomplish this mission.

3<sup>rd</sup> Office mission is to prepare, during the peace time, the 306 THBF's contribution to a possible war conflict, by handling the war operation plans that evolves the Factory. Another critical mission is the 306 THBF's training program. Every year, by order of the H.A.G.S, 306 THBF runs the annual training program of new military technicians and engineers, specialized in telecommunication materials. The Factory's mission is one of the most important, as it provides Hellenic Army with new specialized and trained personnel, securing the continuity in the whole maintenance procedure.

4<sup>th</sup> Office is responsible for the Factory's military logistics. The Office has a key role to the Factory's operation. It is responsible for every aspect of military logistics, such as Factory's annual budget, supply of materials, electrical and mechanical equipment, machines, tools, etc. It is no exaggeration to say that the 4<sup>th</sup> Office is the "heart" of the Factory, because its operation affects all other operations.

306 THBF has two Directorates. Directorate of Studies and Research, with its subsections, is responsible for the technical studies concerning telecommunication equipment, as well as the development of new operational uses of it. Its mission is very important, regarding the technology's progress in military field.

Directorate of Inspection and Quality Control has also a very important mission. With its subsections, it provides the final inspection and tests to the equipment that has been repaired, before its return to use. Its personnel is amongst the most experienced and capable, due to the significance of its mission.

There are two Administratives in 306 THBF. Management of Production Department commands the whole repairing procedure, via its Sections and Supporting Crews. In this department all the main repairing procedures take place, it is the Factory's main section that every other unit supports.

Administrative Management's main mission is to support in practice the Factory's internal procedures. It is responsible for vehicles' and buildings' maintenance, as well as Factory's electrical, electronic and mechanic equipment in general.

Health and Safety Office's mission is to inspect and control all the aspects of Factory's procedures and secure that these are in line with the laws and directions. Health and Safety is a vital component of Factory's operation and a key factor to its mission, due to the nature of the processes carried out in it and the risk involved.

Finally, Company of Special Materials is basically a different Unit inside the Factory. Its mission is the inspection and maintenance of special army materials, such as anti – tank weapons, anti – aircraft weapons, etc. Its mission differs from the main 306 THBF's one and this Thesis does not examine it.

Figure 1 shows the 306 THBF organization chart.

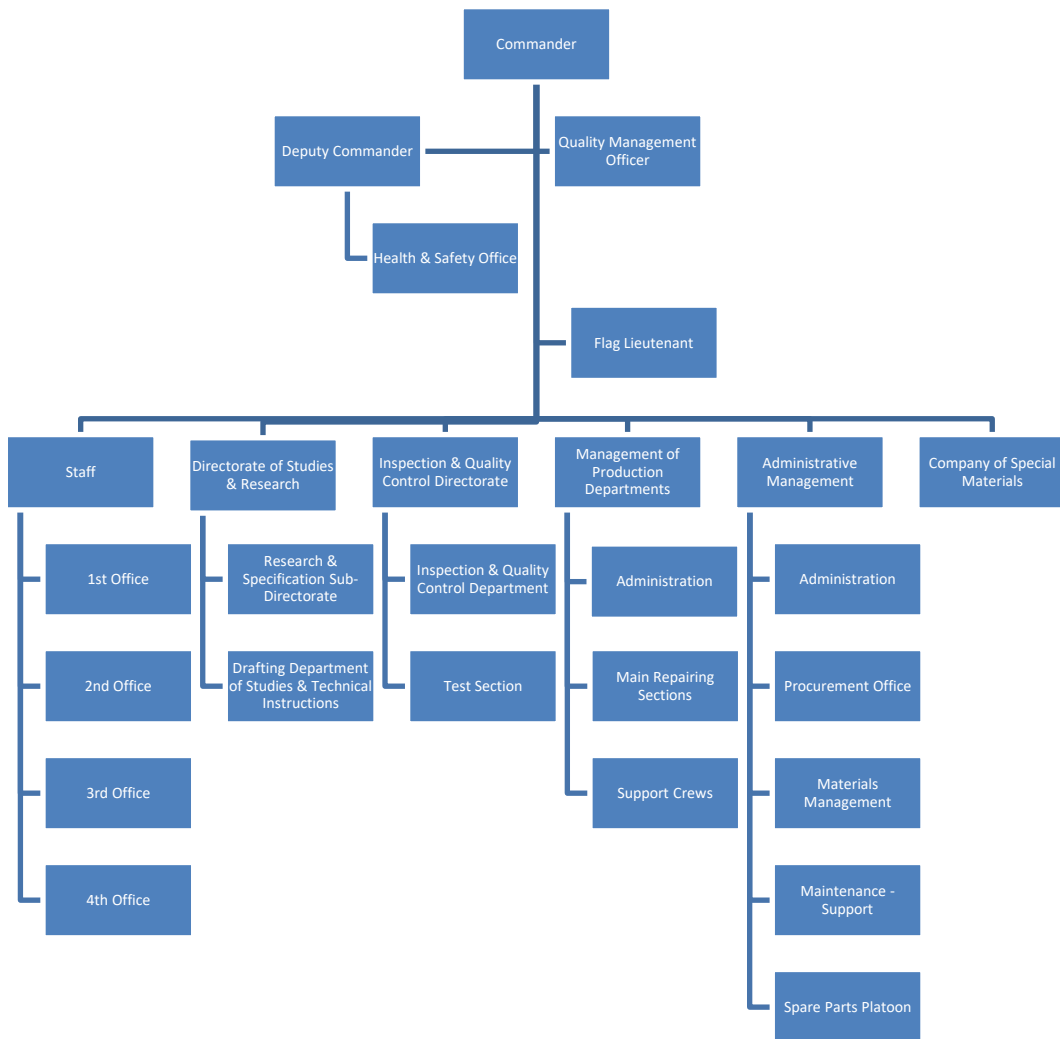


Figure 1. 306 THBF Organization Chart

### C. MISSION

As part of its mission the 306 THBF has, as main project, the technical support of Electronic-Telecommunication Systems and High Technology Surveillance Systems (SC) of the Army. Quality, as provided by 306 THBF's services, is the main goal of the Administration.

The major components of 306 THBF mission are as follows:

- Maintenance of all telecommunications - electronic - electro-sanitary materials.
- Modernization of devices or part of them, telecommunication and electronic materials.
- Manufacture - utilization of various spare parts, accessories and printed circuits of the above materials.
- Preparation of studies and drafting of technical specifications and technical instructions for materials of its competence.
- Performing quality control of each electronic material, the supply of which conducted by the Directorate of Procurement of the Army General Staff.
- Control and calibration of electronic measuring instruments.

The production phases of the factory are:

- Troubleshoot of devices.
- Import spare parts from warehouse or private markets.
- Repairing the damages.
- Regulation.
- Final quality control.

#### **D. DESCRIPTION OF FACTORY'S SYSTEM**

306 THBF follows a simple and clear factory system, in order to repair a technical material. As seen in Figure 2, a technical material follows a standard procedure until it is ready again for use. These processes and stages of decisions help the technical staff to gain time and enable the administration to organize the production in the best possible way.

Figure 2 shows the 306 THBF repairing system flow chart.

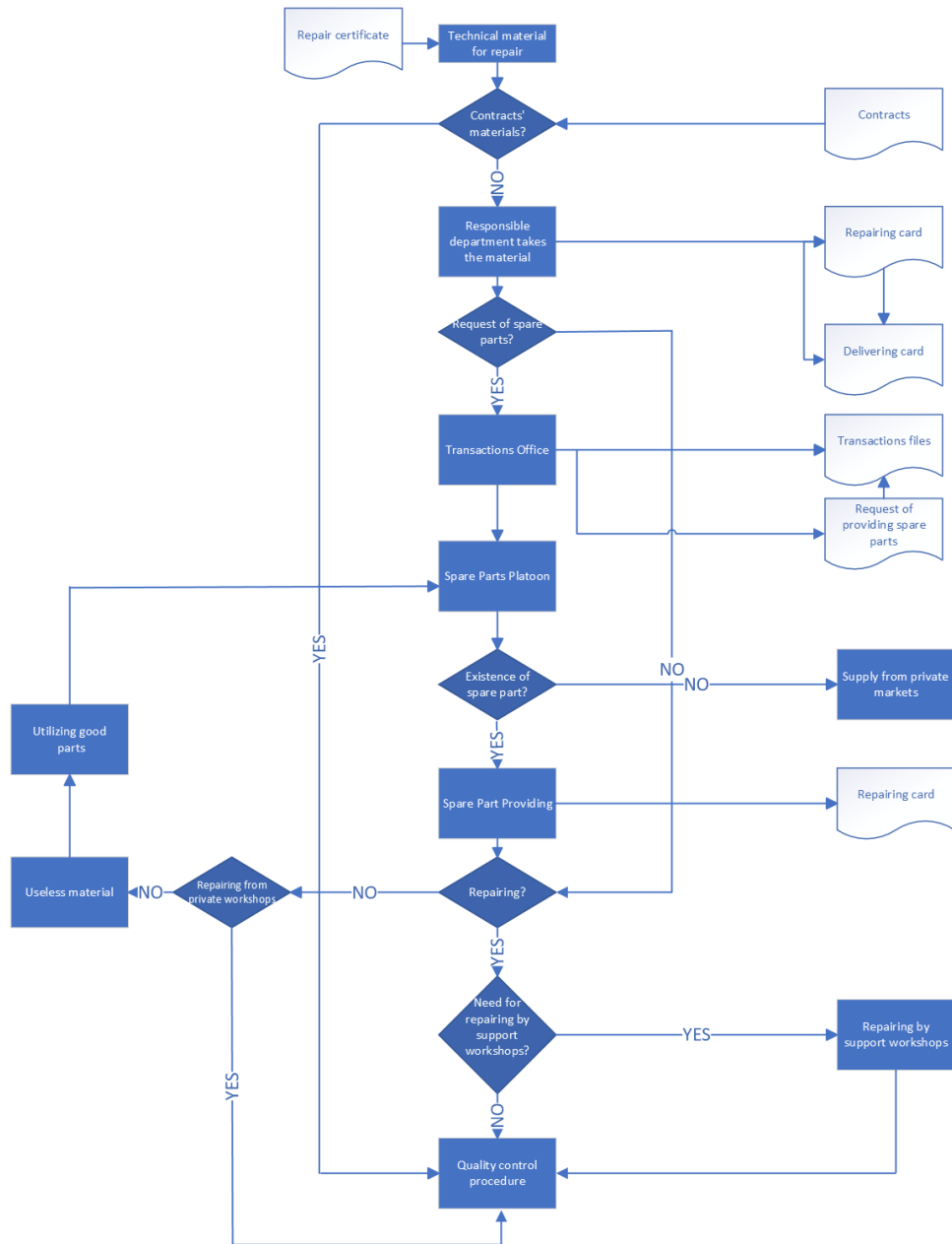


Figure 2. 306 THBF Repairing System Flow Chart

The factory uses the Hellenic Army's Enterprise Resource Planning (ERP), which is the Logistic system that is being used, with minor differences, by all the NATO members.

It is based on the instant support and uses all the available resources in personnel, equipment and materials, in order to achieve the best possible outcome.

As seen in Figure 2, a damaged telecommunication material (f.e a helicopter's intercom set) is entered to Factory to be repaired. If this material's maintenance is based on an active contract with a freelance (via NATO Standard and Procurement Agency, NSPA), it is shipped to the contractor for repair. When it comes back, Quality Control takes place and if it fits the Standards, it is shipped to the Unit that is belonged via Army's vehicles.

On the other hand, for the most Hellenic Army's telecommunication materials that are in use, there are no contracts with freelances. In that case, the maintenance procedure follows the Factory's system. For example, a tank's intercom set needs to be repaired. In that case, there is no active contract, so the whole maintenance procedure takes place in the Factory. First of all, the material is accompanied by its documents, the repair certificate. This certificate provides the necessary information about the material's current situation, as well as the possible damage that has. In that case, the responsible department receives the material, followed by its delivery card, proof that the material has been received. If spare parts are needed, a standard procedure is followed, which includes the Transactions Office and the spare parts Platoon. In the last step, a quality control procedure takes place, in order to ensure that the material is for use. The whole repairing procedure takes place at main repairing sections, subsections of Management of Production Departments.

One of the main goals of this Thesis is to suggest a new Repairing System, which will cost less in human sources and time.

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### **III. PROCESS MODELING TOOLS**

#### **A. GENERAL ABOUT BUSINESS PROCESS MANAGEMENT SYSTEM (BPMS)**

A connection between the Factory's Organization System and the foundations of BPMS is necessary, in order to connect the theoretical background with 306 THBF's system.

According to Chang (2006), *Process Management, based on a view of an organization as a system of interlinked processes, involves concerted efforts to map, improve, and adhere to organizational processes.*

As we can see, 306 THBF's repairing system flowchart (Figure 2), contains all the basic principles of this definition as almost all of its internal procedures are interlinked. This Thesis' main goal, as it has already been mentioned, is to map and improve them.

There are several modeling tools which can be used in order to modelize the factory's workflows. In the next subchapters some basic information about the most commonly used are provided.

#### **B. BONITA**

The working environment for Bonita Open Solution consists of Solution 5.9.1. This tool contains all the necessary parts for the overall Business Process Management Software (BPMS) solution it offers and includes the following three built-in sections:

- Bonita Studio
- Bonita Forms
- Bonita User Experience



This suite offers a set of features at every step of management business process. In summary, for each step, the characteristics are:

- Design phase: offers a central memory for organizing and storing process diagrams, the ability to export the diagrams in various formats documents such as pdf, jpeg, etc. and the ability to import diagrams from other BPM tools.
- Development: data management, data connection, fully manufacturability functional diagrams in a few steps.
- Execution: event Processing, migration tools, access and execution from above users, scalable, synchronous and asynchronous execution.
- In terms of the user: multilingual support, easy assimilation familiarization, innovative interfaces, remote control capability.
- Supervision: user and rights management, full lifecycle management business processes, data management (Bonita Open Solution, 2023).

### **C. PROCESSMAKER**

ProcessMaker is an open source business process management tool (BPM) and workflow management that offers a drag-and-drop interface for analysts to configure workflows based on valid procedures. This tool helps organizations' design, automation and development of business processes of different scales. The ProcessMaker includes a document builder used to create electronic receipts, letters, confirmations, invoices and contracts.

ProcessMaker provides a drag and drop process modeling tool cloud-based, which allows users to create and process diagrams that have been developed using Business Process Model and Notation (BPMN) standards. The designer resizes and highlights all process elements and allows input and process export in BPMN format. The designer allows users to create multilingual forms and subforms without programming knowledge.

The tool provides offline access, which allows users to fill the forms on the go and later sync the data after their internet access. ProcessMaker provides an activity dashboard that gives users the ability to view how processes and employees are performed. The tool

creates personalized dashboards based on process efficiency index and employee efficiency index. It is available on a monthly subscription basis (Software – Advice, 2023).

#### **D. ARIS EXPRESS**

ARIS Express is a lightweight business process configuration tool from IDS Scheer. In addition to standard modeling functions, ARIS Express offers additional benefits especially for BPM beginners.

Smart design allows model builders to capture quickly and easily their business information based on the computer view sheet. Users can focus on the content and don't have to take care of modeling patterns or correct placement of objects. The model is produced immediately after the necessary data is placed and can be changed again.

ARIS Express is based on proven ARIS methodology and standards' sector. The intuitive user interface and the latest enhancements in utilities modeling allow immediate results. This free version is for universities and vocational schools, as well as for beginners and casual users of BPM. ARIS Express is not a limited trial or trial version, but a free modeling software that is a reasonable replacement for other drawing tools.

ARIS Express has the following advantages:

- It is free of charge.
- Perfect tool for casual users and beginners with business management procedures.
- Dynamic user interface - modelers can work productively from the beginning.
- Models for organizational structures, processes, application systems, data and more.
- Study with free educational material available in the ARIS Community.
- All results can be reused and improved through SAP Enterprise Modeling by IDS Scheer (Rosenberg, 2010).

#### **E. INTALIO**

It is based on prevailing and evolving standards (BPMN, BPEL, SOAP, XFORMS) and open components (Apache Geronimo, Derby, Orbeon, Eclipse).

It is a tool of low cost and little risk of being unsupported. It includes:

- Intalio Form Designer: Designs human interfaces, using XForms technology.
- Intalio Server: Manages the execution of Business Processes.
- Intalio Engine (Apache ODE): Business Process execution engine. Provides operations to create snapshots of Business Processes and manages the lifecycle of these snapshots. Additionally, it provides an interface (Intalio Administration Console) to view all the Operational Procedures during their execution.
- Intalio Workflow Engine (Intalio Tempo): Human lifecycle management tasks engine.

Additionally, Intalio BPMS Server provides a Human Resources Management Interface (Intalio Tempo User Interface), through which a user can see and execute the tasks assigned to him during the execution of an Operational Process (Intalio, 2023).

## **F. BIZAGI MODELER**

Bizagi Modeler is more than just a Business Process Modeling (BPM) tool. It is also an app design tool that can create apps for the automation of processes and operations. The advanced modeling software of Bizagi processes, the powerful mechanism and intuitive transfer interface and drop can be used by anyone in the organization, regardless of his programming skills.

At its simplest level, Bizagi Modeler is a simple process management system workflow. It processes by using its simple interface to create process flow charts. However, after each step is added in the process, the process can be converted into an automated form that is linked to another software, such as personnel and accounting and communicates with downloaders decisions via e-mail and creates a documentation trail based on the cloud.

Once each form is filled out correctly, the program can be set up to fully operate to automate the process. Bizagi is connected to all the systems of the plant, so as to be an integral part of ERP system (Enterprise Resource Planning).

Bizagi Modeler goes beyond its brief form as a simple modeling system. Its ability to create automated template templates that can run in order to run each process, makes it an excellent system. It is easy to be used and has an excellent value for money (Bizagi, 2023).

## **G. VISIO**

Microsoft Visio is a software for drawing various diagrams. It includes flowcharts, organization charts, building plans, floor plans, data flow diagrams, process flow diagrams, modeling business process diagrams, swim charts, 3D maps and more. It is a Microsoft product, which is sold as an add-in to MS Office. Visio 2023, the latest version, is available in three editions: Visio Standard, Visio Professional and Visio Pro for Office 365.

All versions share functionality with MS Office Word and Excel, such as options about text and color, allowing data to be fed directly from MS Excel and Access. As with other diagramming software, Visio provides a library of templates and shapes for various types of diagrams to help anyone to start. Note: Microsoft Visio is not affiliated with Vizio Inc. (with a "z"), which does television and other consumer electronics.

Visio originated in the 1990s as a product of Shapeware Corp., first as a release before version .92 and then as version 1.0 released in 1992. The product quickly gained recognition and in 1995, the company was renamed Visio Corp. In 2000, Microsoft bought Visio and rebranded it to the MS Office family. However, Visio, along with MS Project, has always been maintained as a standalone market, separate from the MS Office Suite packages (LucidChart, 2023).

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## **IV. ADONIS CE PROCESS MODELING**

### **A. CHARACTERISTICS**

ADONIS is a product of BOC GmbH (which also includes ADOScore, ADolog, and ADOit) for the comprehensive management of strategy, operational processes, of human resources and organizations' information systems (IT).

The ADONIS tool contributes to continuous and effective improving of the performance of business processes with successful construction of an integrated and effective system of their management, so it is possible to provide transparent and correct information for effective making business decisions. The ADONIS tool supports achieving an effective planning, proper documentation, efficient reorganization and the simultaneous reduction of time and cost required for the correct and efficient operation of the company's business processes.

It is based on the Business Process and Systems Management (BPMS) framework. The design of the ADONIS tool is based on the different phases identified through the constant and permanent review of all procedures in order to achieve the effective optimization.

The ADONIS tool provides the expertise and supports business needs for effective achievement of its objectives. At the same time, through the simulation of different scenarios related to the implementation of business processes, the choice of the optimal solution is given to maximize the production processes of the businesses that use it. ADONIS' offered scripts can visualize and simulate the full range of possibilities of a business and ensure successful and efficient Business Process Management. (BOC-GROUP, 2023).

The features of ADONIS that make it a very good modeling tool for procedures are as follows:

- Easy and intuitive handling; this tool consists of a modern, electronic format, with a clear structure, personalized program and a modeling tool that covers every need. ADONIS ensures focus on the essentials processes.
- More than just modeling; extensive functionality for process analysis and graphical representations, integrated Distributor Management Systems (DMS), release mechanisms and interfaces for the application and process development. This enables the user to evaluate the processes and structures and optimize process efficiency in a more sustainable way.
- Group management of processes; The tool is customized for all roles and access is feasible from the office or online. Collaborative Process Management enables immediate involvement of all stakeholders: process experts, business analysts, process managers and all employees who are involved in the development and execution of the processes.

It is the right tool, with adequate (competitive) support and consulting service world class. It is globally recognized in all sectors, on all continents, with more than 30,000 installations. Available for more than 20 years, bringing experience in business process management.

## **B. FACTORY'S SECTIONS**

We have already seen the 306 THBF's organization chart and analyzed the factory's system. In this subchapter, 306 THBF's organization chart is presented, in order to clarify the internal procedures and present the factory's subsections. ADONIS:CE, via its free version, is used to make all the charts and diagrams. This procedure is essential and provides the best possible information about the factory, as well as the changes that are going to be suggested, in order to maximize its efficiency and productivity.

In Figure 3, 306 THBF's product sections and subsections are presented.

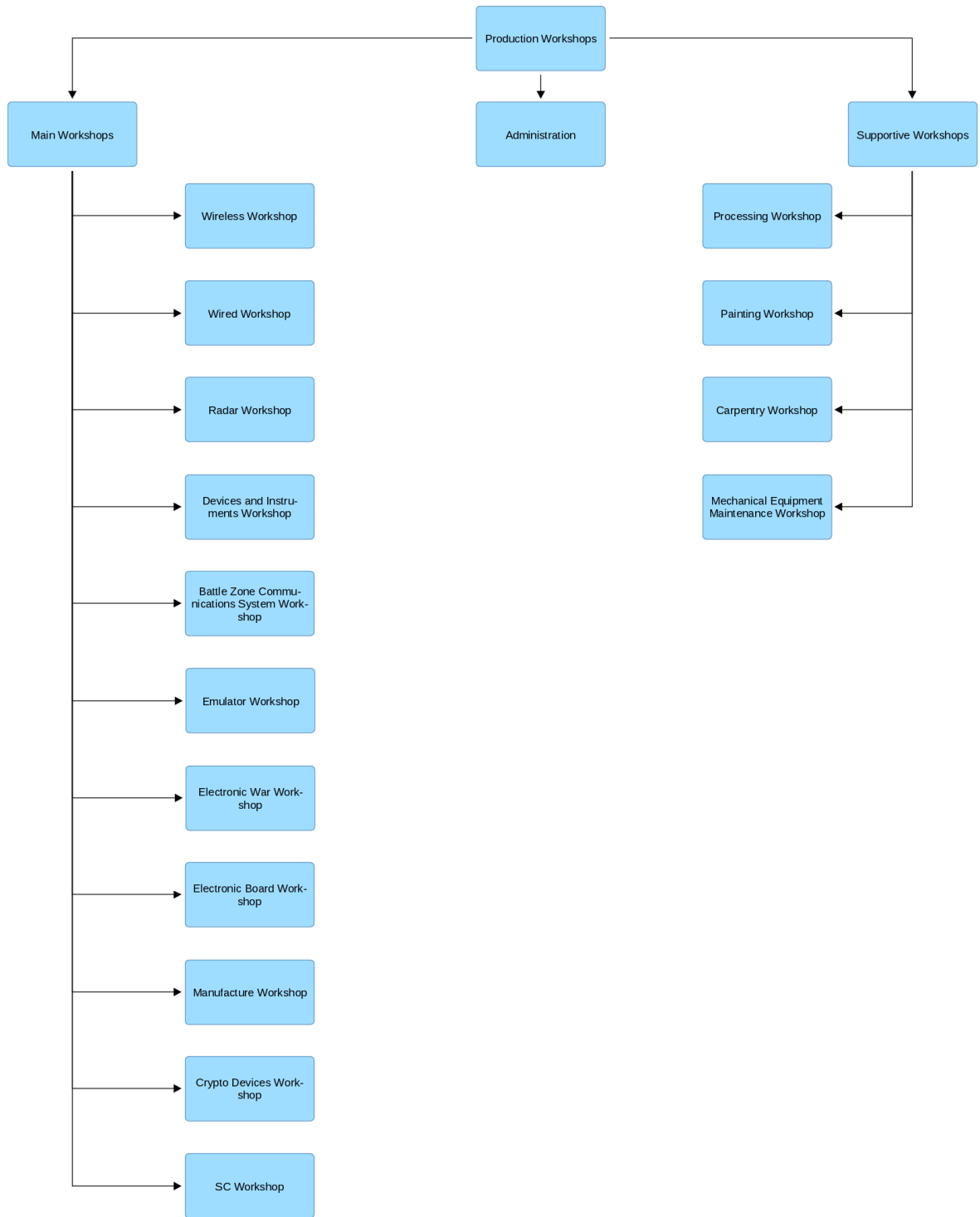


Figure 3. 306 THBF's Product Sections and Subsections



The already existed product sections and subsections cover most of the telecommunication technical equipment that is used by the Hellenic Army. However, the recent equipment programs require technical support for the newly introduced weapons systems, therefore new workshops need to be made with the proper equipment and the appropriately trained personnel. This procedure is not part of this research, however it is mentioned since it is a very important factor that is going to change the factory's system in the next few years.

In the following subchapters, ADONIS:CE is used for the depiction of the most common procedures that 306 THBF follows, in order to repair a technical material of Hellenic Army. By experience, these procedures are not as efficient as needed. This Thesis tries to locate the problems and suggest solutions for them.

### C. INSPECTION AND REPAIR OF HARDWARE

In Figure 4, inspection and repair of hardware chart is presented.

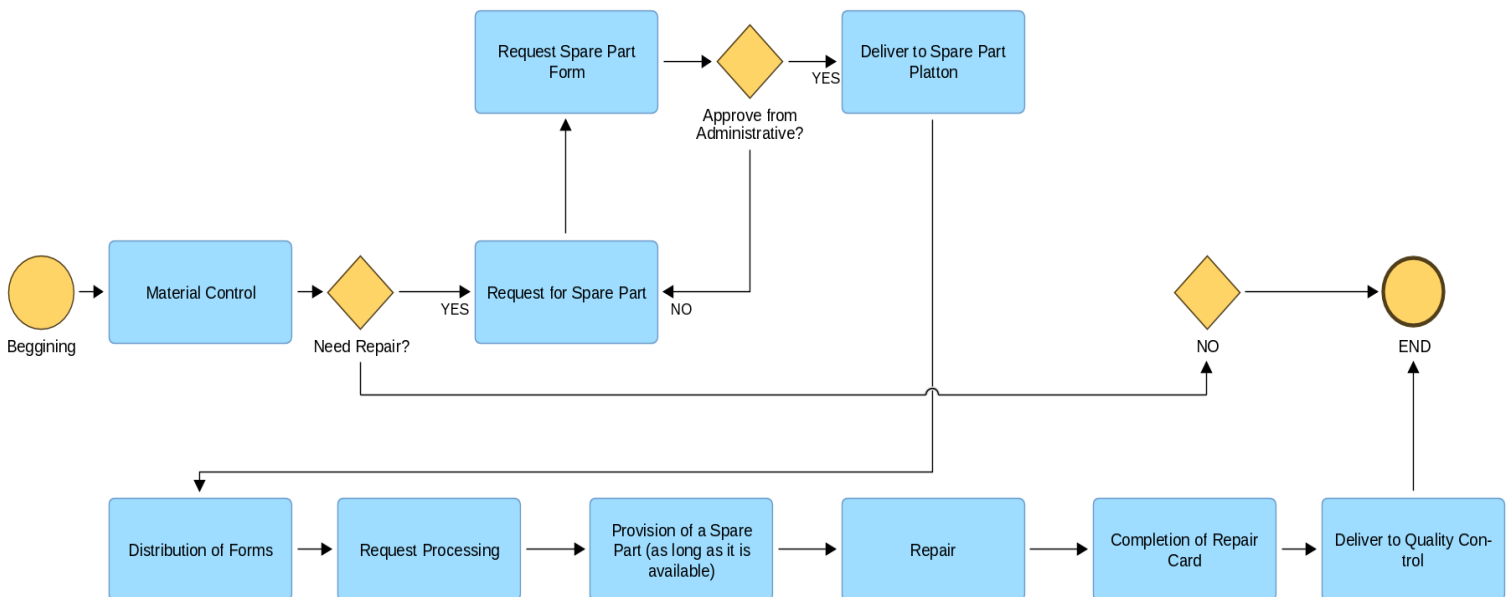


Figure 4. Inspection and Repair of Hardware Chart

As we see in Figure 4, there is a big time “gap” between the inspection of the technical part and the beginning of the repairing tasks. This process is based on a previous US Army system for repairing and manufacturing, which has been abandoned. The biggest problem is located between the request of spare part and the provision of it. This procedure is manual and uses paper forms. There is no automated electronic procedure which can be used, in order to save time. There is also a big problem about the spare parts availability. It is not possible for the technician to know if the spare part exists in the spare parts’ platoon, before the delivery of the spare part is requested. This procedure costs time, is not effective and does not improve the factory’s productivity.

All these problems can be solved by using a Material Requirement Planning System (MRP). An MRP system provides statistical data about previous failures and the availability of the spare parts needed. In that case, the technician knows which are the most common failures of a system that need to be repaired and the availability of the spare part that should be replaced. Therefore, the technician is in position that can prioritize the production, by choosing to repair a technical part that needs available spare parts. In the meantime, he is able to request the spare parts needed for the rest of the technical parts. In this way, the productivity is significantly increased, by reducing the time “gaps” between the inspection and repair of the material.

The same procedure is followed by almost all the other subsections. It is the standard procedure for every technical material that needs to be repaired.

#### **D. INTERNAL MATERIAL HANDLING PROCESS**

As it has already been mentioned, the key factor is the minimization of time “gaps” between the inspection of a technical material and the beginning of the repair. In this subchapter, the analysis is focused on the internal material handling process, another internal procedure that costs in time and needs to be improved. This procedure describes how a technical material from a Hellenic Army’s Unit is proceeds for repair and the “path” that follows inside the Factory, till the workshop that is responsible for it.

In Figure 5, internal material handling process is presented.

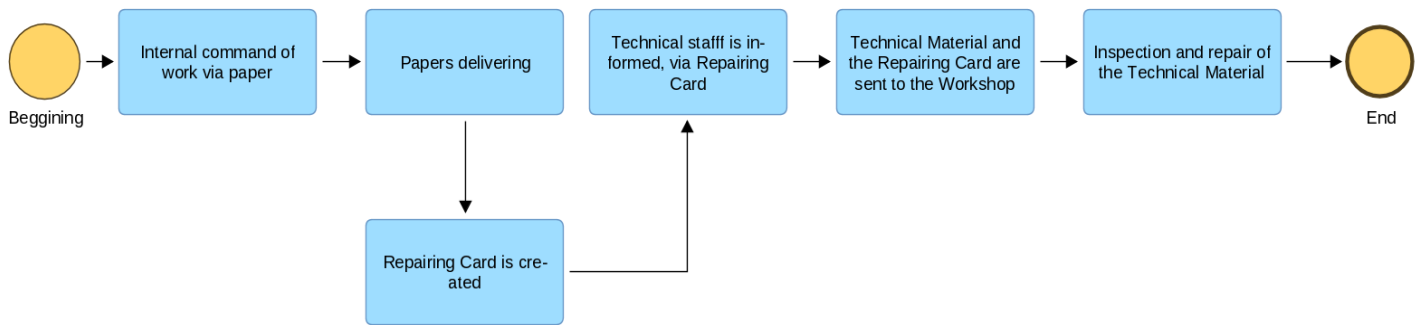


Figure 5. Internal Material Handling Process Chart

This internal procedure is the definition of the so called “Army bureaucracy”. It contains a lot of paperwork, which in most cases requires not only a computer system, but also copies of scripts, stamps, etc. It is necessary to change this procedure, in order to maximize the productivity. Also in that case, an MRP system could be used in order to replace the papers that are used and provide the necessary signatures and authorizations electronically. In this scenario, Hellenic Army has the expertise to make a proper system, based on its needs.

#### E. SPARE PARTS PLATOON OPERATING PROCEDURE

As we have already seen, 306 THBF has a solid organizational chart and internal procedures to accomplish its mission. Following the repairing procedure step by step and knowing that the Factory is basically an Army Unit with strict organization, the analysis performed focus on these procedures that can easily change. The key factor that is easy to change and its operation affects the productivity, is the Spare Parts Platoon. It has already been presented that the spare parts’ availability is crucial for repairing procedure. Figure 6, I presents the internal procedures of 306 THBF’s Spare Platoon.

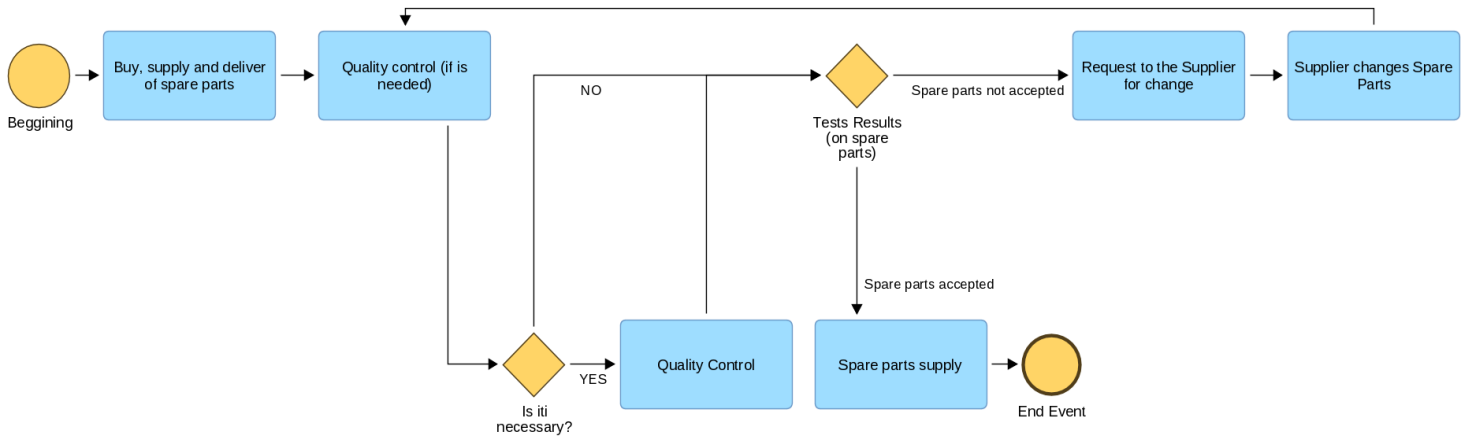


Figure 6. Internal Procedure of 306 THBF's Spare Platoon

As we see, there is also a time “gap” in the internal procedure of the Spare Part Platoon. Most of the times, a request of a spare part cannot be granted, because this specific spare part does not exist in the Spare Parts Platoon’s facility. Therefore, a procedure begins, in which the needed spare part is bought from the private market. In this case and according to legislation, quality control is may or may not be needed. Most of the times, if the number of the spare parts is big and therefore, the total amount that has been spent, according to the law, quality control is mandatory. If the spare parts are accepted, either from the quality control or simple tests regarding f.e the compatibility with the main device, then the supply is completed. If and the spare parts are not accepted because of the legislation and Army rules, Factory does not have the right to cancel the supply, therefore asks from the supplier to change the provided spare part. It is easy to understand that the duration of this procedure is long, sometimes even years. There is also another major factor that affects this procedure, that is Factory’s budget.

The technical materials that are used by Hellenic Army are more or less the same the last twenty years. By experience, technicians know which are the most common failures. Therefore, it is easy for them to record the spare parts that are needed the most for every failure of every technical material. In this way, it is easy to predict the spare parts' need and supply them either via Army's procedures or from free market. A stock of spare parts, based on most common failures and controlled from an MRP system, is the key that simplifies the other procedures and enables the technicians to overcome the difficulties and erase the time 'gaps'. This system, as already mentioned, shrinks the Factory's internal procedures. This internal process will not change by the use of a sytem like this, but it will minimize the required time to get the essential spare parts from the freemarket.

In the next subchapters, are presented the new internal procedures that are proposed, after the installation of a suitable MRP system.

#### **F. PROPOSED INSPECTION AND REPAIR OF HARDWARE PROCEDURE**

In this subchapter, is presented a new inspection and repair of hardware procedure, by using an MRP system. In Figure 7, the proposed inspection and repair of hardware chart is presented.

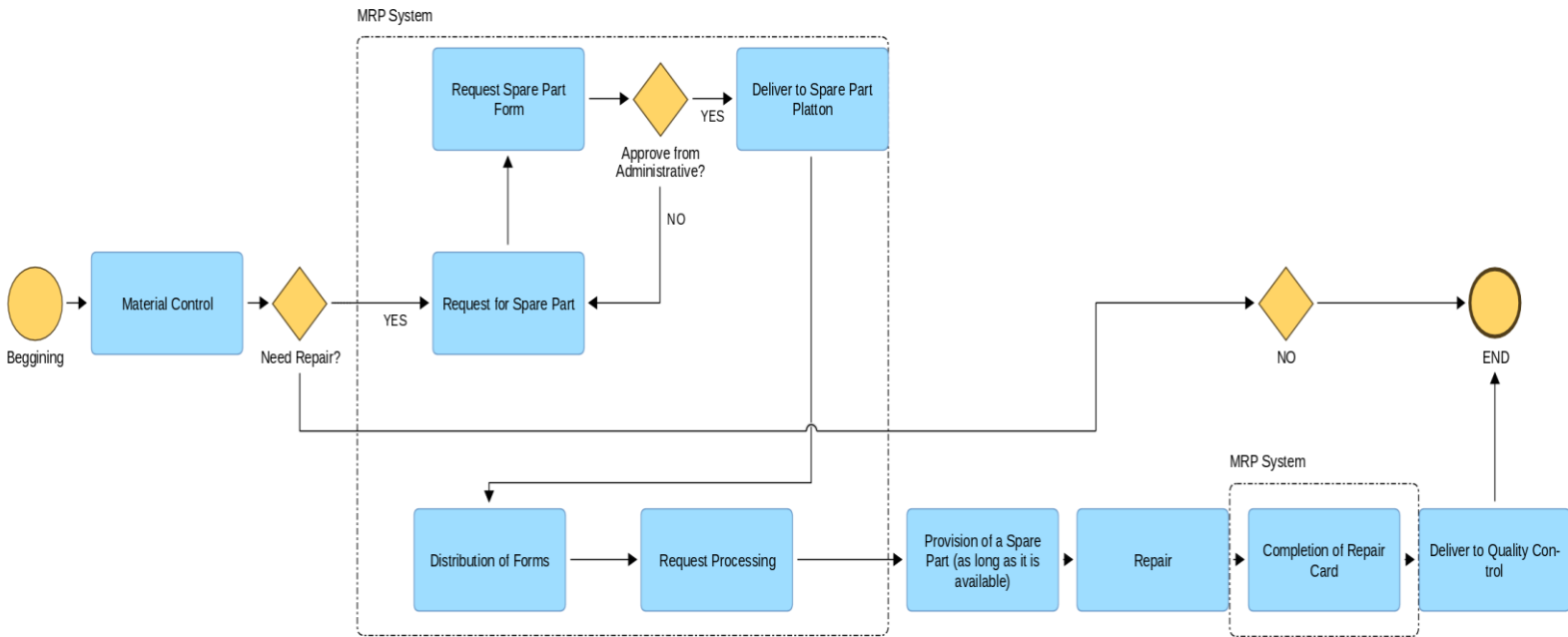


Figure 7. Proposed Inspection and Repair of Hardware Chart

It is quite impressive that a lot of procedures were needed to be done previously, have been simplified by the use of an MRP system. This simplification abolishes in practise a lot of internal paperwork which costs in time and personnel. As said before, by using an MRP system, technical staff and their commanders know the availability of spare parts and are able to prioritize the production and avoid unnecessary actions, while at the same time they follow directly the strict Army rules.

#### G. PROPOSED INTERNAL MATERIAL HANDLING PROCESS

In this subchapter, is suggested a new internal material handling process, also by using an MRP system. In Figure 8, the proposed internal material handling process chart is presented.

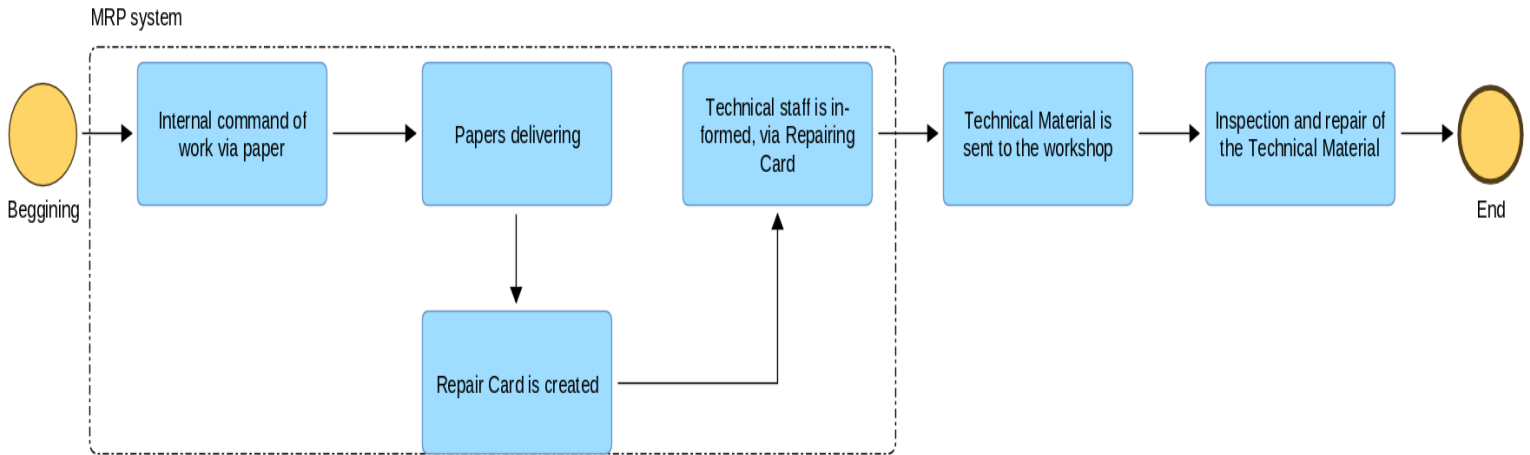


Figure 8. Proposed Internal Material Handling Process

An MRP system replaces the Internal Command of work from the Administrative, the Repairing Card. All these procedures are processed through documents. This procedure has a lot of disadvantages.

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## **V. CONCLUSION AND FUTURE WORK**

### **A. CONCLUSION**

This Thesis is the beginning of a new research on the Hellenic Army's repairing procedures in general. Focus on 306 THBF's internal procedures was chosen, due to the relative simplicity of them, comparing with other Army's Factories. Because of Thesis' nature, it was not able to examine in depth the Factory's internal procedures, because in that case, classified information would reveal anything, something that is not allowed.

Regardless of that, useful conclusions were drawn about the 306 THBF's repairing procedures. First of all, Factory's basic internal procedures were modeled. This was the necessary first step, in order to focus on these procedures that affect Factory's productivity. It is well known that Army's bureaucracy in general is something that cannot be avoided entirely. Nevertheless, there are ways to minimize it. This Thesis comes up with the solution that many Factory's internal procedures which require paperwork, authorization of different levels of administration and data entry in general, could be replaced by an MRP system. This could save human resources, hidden cost of paperwork process, but also a lot of time between these procedures. It is estimated that this change would increase Factory's productivity and effectiveness and therefore, contribute decisively to the accomplishment of its main mission.

Finally, an MRP system could provide statistical data about the most common failures of Hellenic Army's technical materials. This is crucial for spare parts availability, as it could forecast the future needs, based on previous failures and therefore, succeed to supply them on time.

### **B. FUTURE WORK**

Based on this Thesis, I intend to the future to suggest the introduction of a new MRP system in 306 THBF. The necessity of this system is supported by statistical results about repair waiting times and human resources that handle these procedures that are going to

be replaced by it. Unfortunately, as it is said before, these data cannot be used in this Thesis.

Finally, at an academic level, I hope to improve the whole approach on matters concerning productivity's improvement, by learning to use and apply more methods, especially the Six Sigma Methodology.

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