“MANAGEMENT OF ERP RESOURCES AND PROSPECTS OF IMPLEMENTATION IN THE MILITARY (LAND) FORCES - PLANNING, ACTIONS. REQUIRED MRP MATERIALS AND INVENTORY MANAGEMENT WITH THE SCOPE OF IMPROVING SUPPLY MANAGEMENT.”

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I hereby declare that the work submitted is mine and that where I have made use of another’s work, I have attributed the source(s) according to the Regulations set in the Student’s Handbook.

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Abstract

This dissertation was written as part of the MSc in Management at the International Hellenic University.

This study deals with investigating the use of ERP in the army, as a tool for improving internal and external functions. The originality of the subject relates to the lack of specialized personnel, mainly in Greece, in using IT systems in the military and especially the considered program, for which the Greek literature doesn’t provide adequate information in contrast to the foreign literature where there have been several attempts in assessing the significance of the new technologies in the smooth process of developing a competitive and well-structured army.

Aim of this dissertation is to highlight the importance of the use of an ERP system by the army and answer the key question of whether the common knowledge from businesses at the logistics sector and especially the ERP can be shared and adapted by military organizations, after having taken into account that there are no water tights between military and business environment, and common practices from military organizations are widely used in business world and vice versa.

Hopefully the conclusions that will emerge will contribute to the improvement of the existing methods and practices used by the Greek Armed Forces.
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Keywords: ERP, MRP, Army, Logistics.

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Introduction

The diversity and multiplicity of military operations necessitate the capability to plan and develop well-structured operations of Logistics. The military operations should be based on modern IT methods, making use of the competitive and well-structured operational programs such as that of ERP. The aim of using such programs is the focused provision, in terms of time and place, of the necessary materials and tools (Koutsioukis, 2014, p.56).

Before proceeding with the development of the introductory sections of this study, the following provide a comprehensive conceptual definition for the better understanding of the term ERP.

In particular, an ERP system is a sequence of directly realizable application packages that cover all functions of an organization and provides integrated IT solutions for the efficient management and planning of resources, enabling the organization to work in concert as a whole, guided by the information received from the environment (Hossain et al., 2002).

The author of this paper focused on studying this specific and novel subject, which refers to the use of ERP in the army, as a tool for improving internal and external functions. The originality of the subject, especially in Greece, relates to the lack of specialized personnel in using IT systems in the military and especially the considered program, for which the Greek literature doesn’t provide adequate information in contrast to the foreign literature where there have been several attempts in assessing the significance of the new technologies in the smooth process of developing a competitive and well-structured army.

Based on the above, it becomes understood that the purpose of this paper is to clarify and highlight the importance of the use of an ERP system by the army, with respect to its functions, its organizational structure, the broader philosophy that pervades the army, and finally in relation to the better functioning of the human resources of the armed forces.
The significance of this thesis relates to the fact that the form of the army today is changing on a global basis. More specifically, the army is being modernized at all levels of structure and operation with more competitive and well-thinking officers, through which the main objective is to provide a different approach to its operation at the level of organization, administrative functions, information systems management, inventory management, improving internal conditions etc. In Greece, things are still developing, which led the author to study this particular information system, its operation and more specifically whether it can have a substantial application in the Greek army. This paper even studied the broader function of ERP in the army with the aim to provide a number of recommendations for improvements upon the completion of the study.

In Greece there have been efforts in recent years to implement programs such as the ERP, but because of the economic crisis, the competitive external environment, the lack of qualified staff and the wider lack of knowledge, there are still some fundamental problems in its implementation.

This study tried to address all these issues using two assessment methods. On the one hand, this study sought to approach the topic under investigation through the review of the Greek and foreign literature in order to determine: (a) the conceptual content of ERP, (b) the uses of the ERP and how they are developed and implemented in the modern army, (c) its association with other IT programs, (d) and generally the need for programs such as the ERP in the modern operation of the Greek army and on the other hand, this is also a research study, since the author performed interviews with the aim to better clarify the topic under examination.

In order to provide an even better understanding of the issue, and mainly the reasons for the development of this study through the chapters that follow, there was an effort to connect each chapter of the study with the objectives of the paper in order to show that everything was based on a certain logic, and finally to prove that through this logic the main purpose of this paper was actually answered.

As mentioned above, the purpose of this study was to clarify the importance of the use of ERP by the Greek army, and to clarify its application and wider operation. Given the
above, the structure of this study is as follows.

The first chapter is an introductory section intended to provide the reader with a broader picture of what the program that the author decided to analyze is and mainly to evaluate its broader implementation in the organizational and managerial process of the operations of the Greek army.

This chapter consisted of ten sections covering the historical evolution of the ERP program, its functions, applications, use, significance, features, operational use, its associations with other relevant programs such as MRP in order to provide an overview of what this program offers.

The second chapter is an equally important chapter in relation to the aim of the study. It focused on presenting a broader picture in relation to the use and development of ERP in the private sector and more specifically in businesses in terms of their organizational and functional development.

This chapter sought to address the objective of the study that refers to the clarification of the use of ERP through a comparison of its use in the business world, since the ERP was first implemented and used by companies in the market, while over the years it found its way in the public sector, and even in special settings such as the armed forces.

The third chapter acts like a guide for the research part of the study. In this chapter the research population was defined, the final research sample was determined, and also information was provided on the sampling process, the analysis method used and finally it provided a broader picture of the research process and where this study aimed to lead. The author used the method of the interviews as the research tool aiming at obtaining mainly qualitative data that would lead to reliable conclusions.

Through this research paper and in combination with the theory, the author was led to the final findings in the fourth chapter from the investigation and drew in the fifth chapter useful conclusions and recommendations for the better, more competitive and more effective use of the ERP program by the Greek armed forces.
Chapter 1 – Enterprise Resource Planning (ERP) Systems

“There is nothing so common as to find consideration of supply affecting the strategic lines of a campaign and a war”.

Karl Von Clausewitz, On War, 1832.

1.1. Historical Approach of the ERP Systems

In the 1960s, the international organizations focused their attention on the computerized support of their complex functions. Specifically, specialized computer information packages were developed involved in assisting key processes of financial management, such as accounting and payroll, as well as specialized ‘technical’ applications, which facilitated the implementation of analytical methods (Gkagiali, 2008).

In the late 1960s and early 1970s the MRP systems (Material Requirements Planning) were introduced, which showed some degree of integration since they could render the Master Production Schedule of the finished products in time distributed sub-assemblies and components production requirements, and raw material supply requirements (Drexl & Kimms, 2013).

With the introduction of the MRP-II (Manufacturing Resources Planning) in the late 1970s, the MRP system connected the circuits of the production planning, the production control, the cost accounting, and the procurement (Fawcett, Ellram & Ogden, 2014).

In the early 1980s a research effort was initiated for the business integration, which used the databases as technological background and tried to unify key business processes with key priority the financial management circuit and the production circuit. The result of this effort was the emergence of the Enterprise Resource Planning systems in the late 1980s, which integrated, in addition to the Financial Management and Production circuit, other key business processes, such as Human Resource Management, the Sales circuit etc (Madapusi, & D'Souza, 2012).
Therefore, the ERP systems are integrated computer information systems, covering all functional areas of a business to meet its objectives by integrating all processes (See Figure 1.1 and Figure 1.2).

Figure 1.1 - Historical development of the ERP systems

Figure 1.2 - The development of IT Systems
1.2. Analysis of the ERP Systems

The ERP systems are integrated IT systems that manage and coordinate all functions and processes occurring in an organization and every kind of resources (financial, human etc.) required for executing them (Sommer, 2011).

The term ERP comes from the initials of the English words Enterprise Resource Planning. An ERP system is a sequence of directly realizable application packages that cover many business functions and have the necessary dynamics to be adapted to the requirements and changes that occur in it (Staehr, Shanks & Seddon, 2012).

The ERP systems provide integrated IT solutions for the better and more efficient management and planning of resources, while giving the opportunity to an organization to work in concert as a whole, driven by the information it receives from the environment. The objectives of the ERP systems refer to the following areas (Aslan, Stevenson & Hendry, 2015): (a) improving the quality of the provided products-services, (b) reduction of costs in a variety of supply chain operations, (c) use of databases and integration of other processes of the organization, (d) better customer service, efficacy at the level of coordination of the various actions developed in an organization, such as demand, production, supply, and finally the ERP system helps in the optimal inventory management.

1.3. Characteristics of the ERP Systems

The investment for the introduction of an IT system in the processes of an organization is great. Most ERP systems are inherently generic. They largely suggest procedures resulting from the business expertise in which they have been installed. The promotional companies of the ERP systems enforce procedures through their model practices that are embedded in their systems, to clients and suppliers on a European and global scale (harmonized procedures, an information base). The promotional companies also define sectoral standards, such as the Baan for the Aerospace Industry, the SAP for the Oil and Gas Industry, etc (Aslan, Stevenson & Hendry, 2015).

The implementation of ERP systems is the result of a compromise between the way the company wishes to operate and the way the system allows it to operate. The
implementation of systems enforces changes across the company and requires large investment in software, equipment, cost of direct deployment and user training.

The introduction of the ERP system is an opportunity for the radical redesign of existing effective procedures. Changes after the implementation of the system are usually not desirable. The implementation of the ERP systems requires the participation of specialists in ERP and management issues. The cost of the redesign is usually very high and for this reason the company management tends to avoid it.

ERP systems should be based on absolutely accurate data. Due to their integrated logic if someone enters the wrong information, these are transmitted across the enterprise as a domino. It is a priority to train the users as to the integrity and accuracy of the data. The working environment of the modern ERP systems is very close to the windows environment and therefore it does not present a particular difficulty for users who are accustomed to windows applications (Koutsiouki, 2014).

The operational areas that can be covered by an ERP system are quite extensive thus enabling the computerization of practically every process of an organization. However, it is very rare for a company to choose and implement all the applications an ERP system provides. One of the most important failure factors of such systems is the inability to select the suitable applications to be implemented in the company, to the extent that the company itself will be able to operate and support (Wei & Ma, 2014).

The majority of the Greek public organizations, including the Armed Forces, have installed the basic applications of ERP systems, namely Accounting & Financial Management, the Commercial Application, the Materials Management & Procurement Support and the basic functionality of the Production Planning & Control. Organizations usually dare to expand the installed functionality after an adequate period of time, which allows them to become familiar with the IT system and ensures the possibility of adopting new practices, while they rarely install the whole set of functions (See Figure 1.3) (Koutsiouki, 2014).
1.4. The Use of the Supply Chain Management

The supply chain of businesses is a network of autonomous and semi-autonomous business units that produce physical goods and services for consumers through different business processes and activities. In this way the businesses are able to add value to the consumer. Also, the supply chain management has to do with the integration of materials and information and their flow (Dyckhoff, Lackes & Reese, 2013).

Companies such as IKEA have a large number of suppliers that can even reach thousands. This means that someone has to monitor and coordinate the actions of the supply chain and distribution of the company and this can take place through the supply chain management. This process has to do with sales, operations, management
of materials, the total quality management, the distribution of finished goods, the transportation and the planning on the basis of demand and supply and in large companies that means a few thousand partners- suppliers (Hellström & Nilsson, 2011).

Consequently there must be an integrated management system that can create a supply chain that will bring the company considerable competitive advantages that will affect the entire business strategy. For example, information such as the ability to receive the required materials at the expected delivery times and at the same time to find suppliers with low costs can help the company to become very competitive and certainly these also affect its other operations. Of course, in order to accomplish this, appropriate systems and practices have been developed to enable companies to make flexible chain management and be able to gain competitive advantages in this way (Hellström & Nilsson, 2011).

A research study conducted by the Council of Logistics Management (CLM) showed that the logistics practices of large enterprises have changed from the bureaucratic function that they were characterized a few years ago, they have tended to become an internal business operation that can give maximum satisfaction to the consumer. The findings of this research showed that the most successful companies tend to use their supply chain management as a strategic weapon in order to gain competitive advantage and become competitive. Businesses try to add value to their goods and support their objectives with the help of the logistics. In addition, companies have designed strategic plans for their logistics and have official plans in place for their logistics strategy in combination with their general business strategy (Simchi-Levi, Chen & Bramel, 2013).

A study by KPMG International Cooperative showed that the greatest strategic value to enterprises of retail is the design and execution of the official logistics strategies. The same author states that the proper management of logistics is important for all businesses in order to become competitive (Srabotic & Ruzzier, 2012).

The logistics strategies should be integrated with production, marketing and the general business strategy. The integration of logistics with other departments of the
company will allow them to gain a competitive advantage over their competitors. Also, the strategic integration of logistics with other activities will bring about a reduction in costs and improvement in the quality of the services the company provides to its customers (Rantasila & Ojala, 2012).

Information technology and information systems play a significant role in improving the flexibility of the supply chain of a company. IT systems should be at the heart of the supply chain and should be the function that will help the company to consolidate strategically the logistics department with the production and marketing departments in order to achieve a competitive advantage (Quinn, Doorley & Paquette, 2013).

Quinn, Doorley & Paquette (2013) classified the logistics technology into two basic categories. In particular there is the software for those who take the strategic decisions and the software to integrate one department with other departments.

Another way for the proper development strategy is outsourcing. The reasons that push companies to outsource to third companies the accounting management have to do with that there are companies with great expertise in the strategic planning for the management of the supply chain, their experience in JIT systems, their high specialization in new supply chain management technologies and other factors that may convince a business to outsource the management of the supply chain to another company (Peng, 2012).

The logistics support by another company (outsourcing) can have benefits such as the better financial management of the supply chain, the better control and quality services and that someone who has experience in these matters will take over the supply chain management strategy. This results in some initial conclusions. These are that the new market needs have upgraded the importance of logistics in the global market and it is essential for the company managers to consider them as a key strategic tool (Sheikh & Rana, 2014).

Managing the supply chain is even more important when it is integrated with other strategic functions such as marketing, production and strategic planning of the company. An alternative solution to make the logistics department more competitive
is to outsource the management to a third party and it is useful in cases where the company doesn’t have the capabilities to develop its logistics department with the aim of making it a source of the competitive advantage and therefore the company requires the help of a company that has great expertise in this field (Sheikh & Rana, 2014). Generally, the supply chain is the basis of development of the operation of an organization since it determines all its activities, helps in terms of growth and covers all the steps up to the final delivery of a product or service to the final recipient, which is the customer (See Figure 1.4).

![Material and Information Flow in the Supply Chain](image-url)

**Figure 1.4 - Material and Information Flow in the Supply Chain.**
Source: Koutsiouki, N. (2014)

According to Sandberg and Abrahamsson (2011) achieving improvements in the efficiency of the supply chain is referred to as a fundamental growth factor for the competitive advantage for any organization that focuses on the following: (a) the reduction in production, warehousing and distribution costs, (b) the improvement of the service levels of customer, partners and resellers, (c) the improvement of the inventories and the reduction, and if possible the elimination of overstocking, (d) the reduction of time to introduce new products on the market.
1.5. Current System of Supply in the Greek Armed Forces

1.5.1. Army

The operational and functional requirements for fulfilling the mission of the Army are met with an organized Logistics System (LS), which includes a grid areas and axes, in which the LS facilities checked and the movements of supplies are, materials, fill and evacuations.

The wider areas of the army are divided into the following two sectors, through which the formations-units are developed and operated and all supplies and materials of all classes are stored. The above system consists of two areas (Koutsiouki, 2014):

(a) Base Area (BA), which is administered by the Support Command Base (SCB), which is developed and operated in areas of geographical departments of Attica, Mainland Greece and Peloponnese.

(b) Conservation Area (CA), which is administered by the Division support, which is developed and operated in areas of geographical departments of Epirus, Thessaly and Macedonia.

1.5.2 Navy

Responses are required on LS issues of all Navy activities carried out by Navy Management Logistics (NML). The mission of the Logistics Management of the Navy is the organization, administration, training, maintenance, safety and readiness of services and auxiliary vessels to cover in terms of LS, all activities and businesses arising from the mission of the Navy.

The main implementation body of the Hellenic Navy (HN) logistics program is the Navy Supply Centre (NSC), which controls the level of stocks of materials and supplies using modern electronic means.

Also, the support ship in the Greek sea area is implemented through the following logistics network: Dockyard in Salamis and Crete, Naval Sea administrations in Northern Greece and the Ionian Sea, Marine basis of Leros, Mariners and stations.
1.5.3 Air Force

Responses are required on LS issues of all Hellenic Air Force (HAF) activities are carried out by the following administrations:

(a) The Administration of Air Support (AAS) in the areas of supply, maintenance and transportation. The AAS provides logistical support to the units and services through the 201 Aviation Supply Centre (AVS), which manages, stores, and distributes the bulk material of the Air force.

(b) The Management of the Fuel Pipeline, for supplying the units with fuel. Offers logistics centres which are part of the stocks to be opened, dispersion and safety.

1.6 Model Application of ERP by NATO (North Atlantic Treaty Organization)

For the logistics support of the NATO countries, the NSPA organization (NATO Support Agency) is used. The information system supporting the NSPA is an ERP system based on the ECC6 platform. This system is the basis of development of the architecture for implementing support from Information Systems and integrates data, financial, logistics, procurement and human resources management in a single platform, as further shown in Figure 1.5 (NATO, 2015).

Figure 1.5 - The trade-central Information System of the NSPA. Source: NATO. (2015) Corporate Information System.

The supply of the NSPA refers to specific actions regarding the maintenance, storage, transportation, procurement, finance, human resource management.
The organizational procedures are fully automated since the commencement of the process until its completion, which is expressed in the final pricing. All the actions are depicted in Figure 1.6. Specifically these are the following (NATO, 2015):

(a) ECIS (Electronic Customer Information System): Provision of information relating to commercial transactions of the SAP-ERP28 of the NSPA and associates.

(b) NLSE (NATO Logistics Stock Exchange): Sales system of usable spare parts with direct price negotiations between countries.

(c) NMBS (NATO Mailbox System): Electronic exchange of data between departments of the NSPA, and business contacts.

(d) NMCRL (NATO Master Catalogue of References for Logistics): A database with coded materials & serial number NSN (STANAG 2185, 2015)

(e) EBid (Electronic Bidding): For electronic purchases.

(f) NDSS (NATO Depot and Support System): Warehouse management and supplies system.

The procedures for the standardization of the various NSPA data processes focus on and develop the data exchange between member countries and the NATO, and enables updates in relation to the progress of various procedures through the national Radio Frequency Identification Systems (RFID) and other Automatic Identification Technologies (AIT) (See Figure 1.6) (NATO, 2015).

Figure 1.6- The features of the ePortal of NSPA.
This platform was created by the Aerospace and Defense Industry and is supported by the Steering Committee S200M. The ASD 2000M platform focuses on developing standards based on which the materials management takes place, while providing data to be used by business partners to exchange information in the following areas: (a) Supply planning and needs provision by providing information on the sales, the pricing, the supplies, etc., (b) Development and management of orders, (c) Billing and invoicing products, (d) Coverage of repairs, order management and consumption monitoring, (e) Provision of guidance (NATO, 2015).

The NATO Support Agency as the NATO’s Supply Center focuses on an integrated accounting tool for the support of the NATO Depot and Support System, which is used in strategic NATO centers, for the better supply and wider good function. It focuses on the supply of strategic actions and works with 58 operators in 28 different geographic areas.

Finally the NDSS interfaces with other important NATO ERP systems and logistics support tools such as the SAP@NSPA, financial services like the CNAFS-FinS (CNAFS - FinS: Commander, Naval Air Forces - Financial System) and the ICTC system (Interim Consignment Tracking Capability) enabling the continuous traceability with the use of the Radio Frequency Identification Technology (NATO, 2015).

1.7 ERP Systems of the US Army

The Army’s high end ERP programs have separate purposes that are crucial to the economical management of the services. In time ERP has experienced a development in terms of goals, strategy and execution as the US Army wants to revise its programs and unify operations.

The programs’ updates are of great significance since the Defense Department is working towards the financial management transformation and audit- promptness. The Army’s ERPs have a significant role in aiding Defense Department meeting such prerequisites, and drives the service far from inheritance systems (Rachuri, Foufou & Kemmerer, 2006).
The Army’s General Fund Enterprise Business System (GFEBS), Army Contract Writing System (ACWS), Global Combat Support System-Army (GCSS-Army) and Logistics Modernization Program (LMP) may conduct the Army’s operations at the back office but all of them are central to service wide operations the Department of Defense operations.

Moreover they are going through a new period of evolution since the Army modernizes their management, together with bringing all ERP programs under one central Army Enterprise Systems Integration Program (AESIP).

Since AESIP is the enterprise core for the logistics of the Army the economical ERP business systems, one more attempt for concentration, the Army Shared Services Center Organic System Integrator, moves the responsibility for architecture engineering, development and sustainment of the enterprise system under the management of the state.

The aim is to include more ERP expertise in the state so to provide the Army with more elasticity, reduced costs and more stability for operations in the future, as officials say.

By offering more comprehensible insight into the Army business operations and logistics, ERPs and their update are taking the service to a new period of management in general. In order to reach that, the Army has to move further than the divided and expensive legacy systems that belong to another era.

The General Fund Enterprise Business System (GFEBS) for instance is taking the Army towards a rather financially responsible state of managing costs and expenditures.

From the year 2012 and on, GFEBS has extended its reach and is now accountable for the attainment life cycle supervision of GFEBS, but also a financial management system for confidential information, and for the Army Contract Writing System too. The General Fund Enterprise Business System has been completely deployed to over 58,000 end users at 227 sites in 71 countries. This success remains to be matched in the Department of Defense (Rachuri, Foufou & Kemmerer, 2006).
1.8 Opportunities for Implementation in the Greek Armed Forces

The armed forces in Greece are using many applications and IT systems without though having ever attempted a synchronized effort in order to achieve interoperability. Of course centralization of such services must not be confused with the necessity that each sector has for specialized information so that its operations and use of means is put to practice and executed in a right way.

Moreover there are some sectors in defense that they are not to be centralized in a bisectoral manner. In a way this may imply even less benefits than the profit that they intend to reach. This is why tests and feasibility studies are needed before such systems and tactics are put into practice.

Some systems though can be unified and actually produce benefits for the special units of the Greek army such as: budgeting and finances, supplies, technical support, material withdrawal, management information and control information systems.

The ability to exchange information among sectors and systems about the control, management of resources and decision making are crucial for a unified platform of ERP systems. According to the example of the US Army seen above, the creation of unity among the systems requires long-term planning and strategic management on behalf of the leadership.

1.9 Material Requirements Planning (MRP)

1.9.1 MRP Development

The overall aim of material requirements planning is to provide an effective, flexible, and disciplined method for determining Material Enterprise Requirements. If used correctly, the material requirements planning can serve both as a method of communication as well as a design tool, allowing various minor parts of the company to operate within one common, single design (Louly, Dolgui & Hnaien, 2008).

Specifically, the goal of MRP systems is no other than the main objective of all stock management systems that ensure availability of materials, parts and products, to retain the lowest inventory level and schedule the activities of generation, mission
schedules and procurement procedures. Essentially, given a basic schedule of production, planning material requirements attempts to answer the questions: what material is required; when required; how much needed to be done and to be ordered. In summary, the goal of an MRP system is to minimize the inventory level and to maximize the efficiency of the production operation with the aim of improving customer service (Dolgui & Prodhon, 2007).

MRP systems are used in various kinds of businesses, which basically have a job-shop production systems. In these systems each client instructs the system to produce a number of products whose requirements have been determined by themselves or in cooperation with the system. The system has a number of machines, entrusted with the execution of orders. The MRP is hampered by the fact that demand for materials is not formed randomly, as in the case of mass independent demand products on the market, but secondarily, from the schedules of production of finished products (Louly, Dolgui & Hnaien, 2008).

1.9.2 Manner of Operation of MRP Systems

The planning required materials used for operation of the stock status file, the main production schedule (MPS) and the status file materials. From the main production schedule all the finished products to be produced are shown at various times. The description of these products and sub-assemblies and components needed to produce them are at the material status file (Dolgui & Prodhon, 2007).

Finally, the status file stocks are known quantity in stocks of finished products, but also for each subset or component required, as well as the possible orders of these, which are received from suppliers or produced by the system itself at known times in future. By using this file, and knowing through the material state file exact number of required parts of the final product can be calculated the amount of each subset or equipment required to meet the demand of the final product and to arrange the order of the appropriate time, so that it is available when it takes taking account a tolerable time of receipt (Louly, Dolgui & Hnaien, 2008).

For the operation of the MRP system it is required to be known from the basic production schedule what should be produced and when. Then, the material status file
will determine which components should be produced and when. It also takes into account the inventory status file and how many of these materials are already in inventory and how many have already been programmed to be ordered or already ordered and awaiting receipt.

MRP in order to give a reference for what to buy and when to buy and when to be processed, be canceled and be increased or orders fall, will be performing the process of the explosion and the process of networking, always compensating them acceptable delivery times. MRP uses the data for the independent demand of the final product, determined in the basic timing, and generates the requirements during periods of time for the various components, using the state materials compensated by their acceptable delivery times. Then, the net requirement of each material is calculated as follows:

\[
\text{Net requirement} = \text{Mixed material requirement of materials} - \text{Available reserves (available at the beginning of the period)} - \text{envisaged receipts of orders (or scheduled deliveries)} \quad (D'Avino, De Simone & Schiraldi, 2014).
\]

Planned receipts are new orders that have not yet been given to the plant or the supplier for execution. Planned receipts are orders placed but not executed yet. Programming receipt of these new orders prevents the soft available balance falls below a desired level of stocks which is called safety stock. The buffer is a reserve and is not available for the current year.

The batch size is the minimum order quantity that can be ordered. The planned receipt indicating the quantity to be ordered or begun to be produced in each period to be available. This entire process results in changes in inventories data (orders given, changes to orders and so on), used by informing the stock status file (Louly, Dolgui & Hnaien, 2008).

Regarding the initial available balance, that is given by the following equation:

\[
\text{Available stock (available at the beginning of the next period) = Internal stock - Safety Inventory - Inventories allocated to other uses}
\]

Finally, the available storage in each subsequent period is given by the following relationship (D'Avino, De Simone & Schiraldi, 2014):
Available stock = Available stock + Planned receipts + Scheduled Receipts orders - Gross claims

Planned receipts are the receipts of orders that have been given in the past and carried out the given period, while planned order receipts are receipts orders arising after the calculation of the required materials and taking account of the tolerable time delivery of materials (D’Avino, De Simone & Schiraldi, 2014).

1.9.3 Advantages and Disadvantages of MRP

Implementing MRP system in a company can bring several positive results. As shown the advantages of MRP are very important. The greatest ones amongst them include (Jacobs, 2007):

(a) Better production control
(b) More accurate and more timely information
(c) Fewer stocks
(d) Ordering in time phases
(e) Smaller obsolete inventory
(f) Greater reliability
(g) Greater responsiveness to market demands
(h) Better customer service
(i) Possibility for most competitive prices
(j) Reduction of production costs
(k) Ability to modify the master schedule
(l) Reducing idle time in production

As shown, the advantages of the implementation of ERP are important and addressing different areas of the production process. Nevertheless some disadvantages are observed when applying. It was observed that since the aim of MRP is to keep inventories low, forcing the company to make supplies materials too often and in
smaller quantities, this increases the ordering costs, transportation costs and generally the unit cost of the purchased material.

Also keeping a small amount of stock is greater risk of delay or interruption in production due to lack of materials. Of course, it must be emphasized that the MRP takes into account the safety reserves, which provide some protection to the system (Jacobs, 2007).

Finally, some problems have occurred during system operation. More specifically, correct function requires continuous updating of material status files stocks and the basic production schedule. By incomplete update these files may lead to erroneous results system. A malfunction has also been observed in terms of system flexibility. When the system creates a specific pattern of orders, it is very difficult to adapt to a possible change in the input data (D’Avino, De Simone & Schiraldi, 2014).

The main disadvantages of MRP then are summarized below (Jacobs, 2007):

(a) The materials have to be purchased more frequently and in fewer quantities since the stocks are kept at low levels, resulting in increased cost per order, transport cost and cost per unit.

(b) There is also the risk of delay or interruption of the production due to lack of resources or factors outside the enterprise. (e.g. strikes).

1.10 Business Applications

1.10.1 Introduction to JIT (Just-In-time) Method

The term Just-In-Time (JIT) describes a typical management style production that includes a set of objectives, techniques and methods, whose roots come from the Japanese culture, history and geography.

The methodology (almost philosophy) of JIT was developed through efforts during World War II as a result of the collective campaign of the Japanese industry to compete with the West and especially the US industry. Critical factor in the development of the JIT production was Taiichi Ohno in Toyota automotive company (Monden, 2011).
The main objective of Ohno at Toyota was based on the principle: *The time required* (Just-in-Time). The vision here was to achieve a productive environment that simulates the super market. The final customer is able to find instant it wants whenever it wants and quantity that is desirable.

The ratio in production environment is that a work station obtains the necessary materials for the execution of a production activity to the desired time and in the desired amount of another workstation that is running previous activities of the production process.

The JIT vision requires an environment running smoothly, without interruption. When the materials required by a workstation are not available, then the entire system can be disturbed.

One of the conditions for the implementation of such an environment is the second principle of JIT (Monden, 2011): Automation with a human face (Automation). The basic idea here is to develop machines that (a) are automated so that an employee is capable of operating multiple machines simultaneously and (b) be able to diagnose (automatically) any problems.

The principles were developed by Toyota multiple methods, techniques, tools, appliances, devices and systems that have made this company but also the Japanese industry in general, which is leading worldwide.

Because of the Japanese origins, the JIT mode of production has developed synthetic approach from top to bottom (top down). Therefore, objectives, underlying methodology, aims, play a crucial role in the development of JIT. According to Edwards these objectives can be summarized as “7 zeros” (See Appendix 2) (Aksoy & Öztürk, 2011).

These objectives are of course ideal. But their value is that: (a) determine the policy to which it should be oriented an efficient production system, (b) demonstrate the value of continuous improvement, a productive environment, and (c) serve as evaluation indicators of a production system (continuous improvement).
The implementation of JIT production method requires certain conditions. If these conditions are met, then the techniques and tools of the JIT lead to an efficient production system (Aksoy & Öztürk, 2011).

The JIT requires a smooth production program. Of course, it is possible to smooth the demands of customers, which are independent (external) demands. The sequence of production needs to be identical to the sequence of customer orders. Therefore, the normalization of requirements can be realized through adequate management of the Main Production Program (MPS).

The peaks in the periods of a smooth MPS smoothed are based on two simple steps (Aksoy & Öztürk, 2011): (a) Smoothing requirements in short sub and (b) Developing uniform production sequence (See Appendix 3).
Chapter 2 – Common Practices

«The only thing harder than getting a new idea into the military mind is to get an old one out»

Sir Basil Henry Liddell Hart.

2.1 Codification

Coding is the process of identifying a material (or stores) with a name, symbolic or numeric code. It is the basis of modern logistical operations (logistics).

The main forms of codification concern: retail marketing units, Units wholesale marketing, accounting Units.

The need for coding due to reasons such as the effective management and classification of materials, standardization of forms and applications for orders, supplies carrying speed, placement of orders and their follow up as well as IT management. Codification has to be simple, unique, consistent, relevant, and flexible to enable it to meet future needs.

There are many coding systems, such as:

(a) Numeric coding systems: Define a numeric code for each material, the digits of which are usually grouped into 4 groups. This category includes the military material coding systems such as NATO Codification System (NCS).

(b) Arbitrary coding systems: based on unique material number (part number), conferred by the production operator.

(c) Systems of mnemonic or alphanumeric coding: are similar to the figures, but both letters

2.2 The NATO Codification System (NCS)

The NATO Codification System (NCS) is a uniform and common system for the identification, classification and performance number nominal supply materials to user countries. It is designed to achieve maximum effectiveness in logistics support and
facilitate data management of materials. The Coding System has been accepted by all member countries and with cooperating non-NATO countries for use in the identification of supplied materials.

The main documentation of the System is the Allied Codification Publication No. 1 (ACodP-1), also known as Manual NATO Codification, which describes the operation of the System process (Church, 1990).

The military application of this system works through two (2) NATO Standardization Agreements (STANAGs): STANAG 3150 (Uniform Material Classification System) and STANAG 3151 (Uniform Material Identification System). This system, which is based on the Federal cataloging system of the United States, is also used by civilian agencies of some countries-NATO members. Administered by the National Directors Group Codification (AC/135) and the responsibility for applying in the countries that use it have the National Desks Coding (NCB).

The main objectives of the System are:

(a) The effective cooperation between the countries-users.

(b) Increasing the effectiveness of country-user management systems.

(c) Facilitating the handling of data.

(d) Minimizing administrative costs of countries-users.

(e) Increasing the effectiveness of country-users in hardware management functions

The establishment, operation and support of the NATO Codification System, provides a uniform identification language for use both in national activities (eg supply management, standardization etc.) and among member countries, including non-NATO countries that are collaborating Members of the NATO Codification System (NCS).

The use is based on the principle that the responsibility for coding a material supply within the country of manufacture of the material, even if the equipment is not used in this country. In such cases the supply country must apply to the coding of the material in the producer country. For coding supply materials produced by manufacturers outside NATO countries or partner, level 2 (Tier 2), special procedures apply.
2.2.1 Benefits of the NATO Codification System

The NATO Codification System provides accurate information on the identity of a material supply and allows recording of the sources of supply. It facilitates solution management problems, providing users with instant access to a simple and constantly updated source of information (Eddy & Arnett, 2003).

To achieve maximum benefit from NATO Coding System in force internationally agreed methods and procedures to facilitate the regular exchange of data and coding services among member countries. Standard methods for data exchange using telecommunications have been established and experts input codes - output and forms agreed. NATO countries and their partners, exchange National data Manufacturers related names, addresses, phones, faxes, e-mail, and industrial classification codes for all registered manufacturers and suppliers (Eddy & Arnett, 2003).

2.3 Third Party Logistics (3PL)

The development of 3PL services in Greece was placed in time in the early 1990s, when a relevant EU regulation that allowed the substitution of public bonded warehouses, leading companies dealing with forwarding to exploit areas of temporary storage of Community goods to provide storage and distribution services (Hamdan & Rogers, 2008).

The forwarding business, anticipating market needs and the prevailing trends in foreign markets, wanted to expand the range of services to cover the largest possible part of the needs of their customers. Corresponding expansion services was performed by companies that worked only on rent warehouses and cold rooms. The establishment of companies with an exclusive focus on providing integrated 3PL services is a more recent development.

The logistics services providers (ThirdParty Logistics-3PL) have become an important link in the whole supply chain. Such companies provide services that enable the individual undertakings to cede part of management procedures, production, packaging, storage, distribution of products (Hamdan & Rogers, 2008).
The development of the 3PL sector has led companies to become more frugal in their structure, reducing their assets and equipment and allows them to focus on other core business processes.

The 16th Annual Third Party Logistics Study conducted in mid-2011 in addition to documenting the continuing evolution of the sector of Third Party Logistics, still showed a special care for the following three directions:

(a) Logistics is now starting to be used in developing-new markets. They start finding applications in most areas more or less.

(b) Important basis is given in the supply chain needs of the market of electronics. There are significant challenges in this area.

(c) For the first time in the history of these studies relied upon the talent and the impact it has in the process of Supply Chain Management (logistics management) between 3PL and businesses that use them.

Hertz and Alfredsson (2003) divide 3PL into four categories:

(a) the standard third-party providers (standard 3PL providers),

(b) providers who undertake the development of services (service developers),

(c) providers that undertake the study of logistics customer processes and

(d) providers that globally carry out the logistics processes.

The first category offers traditional services storage, distribution, collection, packaging, etc.

The second category differentiates itself, providing value added services such as packaging based on individual needs, short storage (crossdocking), monitoring and tracing of freight (ANS trace), etc. Often, developing information systems supporting customer activities to achieve economies of scale and scope.

The third category shall act on logistics customer processes, without, however, making their possible upgrading. Optimum practices are to undertake a limited number of customers, as required in-depth study of the processes.
Finally, the fourth category approaches the concept of 4PL service providers, and requires their integration with the clients globally the logistics processes.

2.4 Party Logistics vs. Third Party Logistics

Often the concept of 4PL is being confused with the one of 3PL, as 3PL is constantly expanding its portfolio of services, integrating ever more enhanced services, such as planning and coordinating the logistics chain (Jung & Hen, 2007), obtaining a more comprehensive role.

Van Hoek (2008) made a comparison of the two entities in order to settle the issue of identification. Regarding the sealing of cooperation, synergy with a 3PL based on the existence of a quoted contract (negotiated contract), whereas in synergy with 4PL, syntax exclusive contracts (dedicated contract) is a strategic horizon. In terms of level of knowledge the services provided by 3PL include standard tasks that do not require specialized knowledge. Instead, the 4PL exercise coordination and management of supply chain processes that require deep knowledge of the conditions.

Additionally, the two providers differentiate and utilized capital. Operation of 3PL is capital intensive, as opposed to 4PL is technology intensive, mainly the presence of information systems and communication systems, through which facilitate and sharing information among supply chain parties.

In the case of 3PL, by contrast, it does not emphasize the flow of information, as it focuses on proper execution of individual functions. Finally, the performance of 4PL services is measured based on the results of the supply chain of customers, while the performance of 3PL refers to tangible benefits and results.

The correlations of Hoek are also adopted by Win (2008), who adds an element of responsibility, where the 4PL assume overall responsibility for the successful operation of logistics chain as unifier (integrator), unlike 3PL, as the focal company interacts with more than one 3PL. The performance of 4PL is assessed by value creation for the organization, while the performance of 3PL is assessed on strict cost elements.

On the occasion of the comparison of the two entities, Win (2008) also opposes the logic that wants the 3PL to be the most competent provider to evolve into 4PL, as
targets of 3PL conflict with those of 4PL. The 3PL focuses on maximizing the return on own funds invested on behalf of shareholders. Therefore, the assumption 4PL duties will prevent them from using their own facilities over competing as well, too, and will not make the search or obtain competitive bids from other 3PL companies. This conclusion contradicts the role of 4PL, which aims to use the ideal combination of resources and partners.

As mentioned earlier, the capacities of 4PL providers in the field of logistics are considered knowledge-intensive to offer advice based on extensive research customers for improved supply chain performance. Based on their skills make the planning and implementation of new practices. A typical example is multinational corporations that are committed to strategic alliances and partnerships with 4PL providers, aiming at the joint development of new products and processes.

Additionally, the processes of (de) concentration can be upgraded in terms of speed and significance as the 4PL favor a decision-making process with respect to (a) the functions carried out in the supply chain, (b) the number and type of entities involved in these functions, (c) the type of relationships that develop between members of the supply chain, (d) the location of installation of the members, (e) the need for physical, organizational and cultural proximity among members, (f) ways to connect members, through physical transport, IT systems and payment systems (Visser. et al. 2004).

2.5 Warehouse Management Systems (WMS)

Warehouse Management System (WMS) is a software application that supports the daily operations of a warehouse. The WMS systems permit central task management, such as monitoring the stock levels and placing them in the "right place" in the store. These systems can be standalone applications or part of the "internalize" planning system (ERP) (Autry et al, 2005).

The first warehouse management systems could provide only simple functions, such as managing storage locations. Current WMS applications can be so complex and data is provided as information for the general management of a warehouse, so there is a need for properly trained staff to support it. More sophisticated systems can include monitoring and management functions through the use of RFID or "voice recognition"
Independent of how simple or complex the application is, the objective of a warehouse management system remains the same - to provide management with the information needed to effectively control the movement of materials within a warehouse.

In many warehouses a single computer with the right software has been installed. In the warehouse office responsible usually installed one computer with appropriate program that makes effective management of stored products. Such simple systems typically find application in small family and other enterprises because the quantities and numbers of codes are too small. Essentially, with this system is achieved an improvement in the storage processes because of the basic drawbacks it presents (Helo & Szekely, 2005):

(a) A main drawback is the wrong code entry as you type.
(b) It is not possible to achieve effective control over whether made all the instructions given.
(c) There is a delay in updating the database, which leads to problems in replenishments of stocks and the response times of the different changes in the storage material.
(d) Because proprietary programs are used, they cannot accept change.

Very often a computer network is installed in warehouses. An operation of a local computer network in the warehouse is a more sophisticated automated storage system. The network server is connected with other activities. Although that with this system the communication and information between departments is achieved in order to have better organization, there is a serious drawback for supporting important activities of the warehouse, as the fringes docking, the flow of stored products, etc. These results in the occurrence of surplus stock as information changes at a rate which may take from two to twenty-four hours (Patterson, Grimm & Corsi, 2003).

The most modern form of information storage system is the installation of a computer network with wireless communication (RF). In the modern field of logistics prevailing direct customer service with as little cost and with daily increasing competition, it is necessary to install automated IT systems in large distribution centers.
The benefits offered by the installation and operation of these information systems are generally the following (Patterson, Grimm & Corsi, 2003):

(a) Significant reduction of errors observed in the reception and dispatch of goods.

(b) They give the possibility to be checked and updated by introducing multi-information.

(c) They use the full potential of automated machines such as portable scanners, special vehicles (lift truck), etc.

(d) Easy definition of procedures which will optimize and automate the operation of the warehouse.

(e) They give the opportunity to put direct materials on the shelves of the store and removed.

(f) There is the ability to manage more effectively the various storage processes.

(g) The wireless capability allows correct data entry.

(h) Reduced inventory loss

(i) Timely and efficient recall of defective batches.

(j) Construct loading and unloading of stored materials the right way.

(k) The information storage system, given the possibility of classifying stocks right in the ABC analysis.

(l) They offer the possibility to be made combined warehousing processes.

(m) Finally, it is possible to obtain important information on the movements of goods, the productivities of users, times of works, the use of machinery etc.
Chapter 3 – Research Methodology

The framework of the research to be carried out relates to the deductive approach. The collection of information will take place through primary and secondary research. The methodological approach of the primary research will be the qualitative research.

3.1 Qualitative Method

Qualitative research seeks to explore and explain the meaning and not the incidence of certain phenomena. The qualitative techniques are interested in explaining what people think rather than how many people that interests the quantitative research (Petrakis, 2006). According to Petrakis (2006), the objectives of qualitative research are:

(a) To discover new ideas
(b) To investigate the opinion of respondents on a specific issue
(c) To provide assistance to the researcher for the compilation of the questionnaire
(d) To confirm the information obtained from the quantitative research

3.1.1 Population

The population of the research consists of the military personnel in procurement and organization departments, responsible for the technology in the corresponding departments of the army.

3.1.2 Sample Selection – Sample Size

The sample to be used in the qualitative research will be a non-probability sample and more specifically, the method will be purposive sampling. The researcher will use a purposive sample since the sample of people chosen consists of those who accept, understand and relate to the purpose of this study. According to the purpose, and the data that define the method, the researcher excludes a number of people that are not relevant to the subject matter of the research (Lisa, 2008).
The size of the sample that will be used in this research will be ten (10) military individuals who are well aware of their units’ ERP issues. Their answers will help the development of the research and the objectivity of the results.

3.2 Quality Research Tool

The tool to be used for conducting qualitative research will be the in-depth interview with the help of semi-structured interviews, which will follow some lines of discussion. The lines of discussion are the data for the development of the interviews to be held with the participants of the research, and are also the analysis fields of the responses. ERP in general can be defined as the lines of discussion, the connection of ERP with the needs of the army and the units and its impact with negative or positive effects (Palys, 2010).

Despite the relevance of the data, the qualitative data approach has its weaknesses and limitations. Initially, the collection and analysis of the qualitative data is demanding and takes too much time, because many forms of data can be collected and the researcher is overwhelmed by their volume (Miles, 1999).

Secondly, the boundaries of the various quantitative data analysis methodologies haven’t been established well, and finally, the researchers that use the qualitative methodology are usually criticized that the results of their qualitative analysis cannot be generalized to a broader population because the sample of people is usually small and participants are not selected randomly (Hancock et al., 2007).

The main advantages and disadvantages of a qualitative research are shown in Table 3.1.

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
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<tr>
<td>• Investigation characterized by detail and depth</td>
<td>• Usually employs small samples</td>
</tr>
<tr>
<td>• Can lead to the investigation of phenomena, processes and behaviors that were not</td>
<td>• Characterized by relatively limited possibilities for generalization and comparison</td>
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<td>• Depends greatly on the personal</td>
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anticipated
• Investigation of the experience of the social subjects. The interviewer “sees” and understands the world through the eyes and perception of the social subjects
• There is an attempt to avoid a priori judgments

<table>
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<tr>
<th>Perceptions and communication qualities of the researcher</th>
</tr>
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<tbody>
<tr>
<td>• The participation or involvement of the researcher may alter the characteristics of the studied social phenomenon or process</td>
</tr>
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Table 3.1: Advantages and Disadvantages of qualitative research.

3.3 Data Collection and Coding

The collection of information will be carried out at the workplace of the participants where the interviews will also take place. The coding of data will be carried out using the intercoders reliability and through the process of data decoding. The degree of agreement and disagreement of the results of the analysis to be carried out, will determine the reliability of the Qualitative Research. Between the two coding methods - a priori and emergent - the a priori method was chosen. The a priori method is an open coding method, with no restrictions and is performed by applying the process of attention, collection and deliberation, unlike the emergent coding method used to more emergency coding procedures that take place mainly under pressure. In the present case, the intention is to perform a careful and well organized coding of the data (Siskou, 2003).

3.4 Quality Analysis Method

The methodology of the qualitative analysis to be used is content analysis. This type of analysis refers to and records the exact information provided by the sample surveyed (Petrakis, 2006). Content analysis is a quantitative method for study of texts, the analysis of texts, as to the presence and frequency of certain terms, narratives or concepts. It can include measuring/listing the number of lines or the amount of space
that various issues occupy. Content analysis converts secondary material of qualitative nature in the form of quantitative data (Petrakis, 2006).

All respondents have been informed on their protection of rights in terms of anonymity and that their answers will remain undisclosed. All interviewees participated voluntarily. For the particular study a sample of 10 participants have been selected.
Chapter 4 – Results

Regarding the first question which investigated whether “the use of the ERP program is mandatory or optional”, the answer, according to the overall perception of the issue by the respondents is that it is mandatory.

What was particularly established through the answers given by all respondents, as mentioned above, is that the use of the ERP is mandatory and normally all units should be using it as a guide in their operations, but this is not always possible.

One of the respondents said that “This tool is unique to coordinate internal operations, procurement, management, and the economic function”. Another respondent said that “In order for the army to be competitive, it should focus on technological improvement, strengthening of its functions, and its greater effectiveness, so ERP can help in these areas, can help the army to become competitive at the global level”.

Most respondents agreed that despite the mandatory implementation of ERP, as in general the implementation of similar technological means, the financial crisis, the broader budget cuts, the lack of education, lack of skilled staff and generally the poor management function, all hinder the application of the specific program, leading to inability to use it.

One important thing, which has also derived from the theory (Aksoy & Öztürk, 2011), is the need for a coordinated effort by all the parties involved in order for the ERP to be implemented successfully and without restrictions.

The implementation of ERP alone cannot bring changes and progress in the functioning of the army, but today, coordination is deemed necessary to achieve the desired improvement and more widely to allow the ERP, apart from its installation as a program, to be also used properly by everyone involved in all processes referred to the overall functioning of the army in Greece.

In the next question, the author tried to determine, through the discussion he had with respondents, whether the implementation of the ERP system helps in decision making. The answers showed that indeed ERP systems are valuable in decision making.
Specifically, all respondents reported that the army as an organization deals with many major incidents. Especially the higher-ranking officers have to make decisions in order to be able to successfully deal with these critical incidents and to avoid any negative impact they are required to have all the appropriate and necessary information, which can be provided through the use of the ERP, since it is a tool that gives many possibilities in terms of information in all areas of the army, fact that is confirmed by the theory (Autry et al, 2005).

ERP can assist in terms of economics, the operation of the depots that is important in the military, with procurement, personnel management and in relation to the payrolls. Generally, all the above are influential information for the functioning of the army, both in terms of branches and as a whole.

Regarding the usability of the ERP system to all the functions of the army, all the respondents replied that in relation to their unit the specific program is functional, but above all, it reduces bureaucracy, reinforces participation, helps in resolving errors and through all these procedures, the army can save money and improve the levels of the wider economic functioning of the army as a whole and of course per department.

Certainly, a significant problem as evidenced by all respondents is that many commanders, due to their age, knowledge, experience and mentality in general, are negative towards any adoption of new programs - tools, mainly because they are afraid that they will not be able to operate successfully. Unfortunately, as mentioned by the respondents, this leads some departments to a deadlock.

In relation to the question about the operations in which the ERP can assist the army, all respondents noted that because it can integrate key operational activities and produce and share real time data, both internally, and to external partners, it should be used in these areas so as to optimize resources and considerable operating costs. In addition, it should be applied to the consolidation of these systems to a single platform covering different functional requirements at the tactical, operational and base support level.

It was observed through the theory (Dolgui & Prodhon, 2007) that without proper and coordinated training of personnel involved in the use of ERP, there is the risk for its
ineffective application, and failure of the whole process. Respondents identified indications that the training process followed is not well structured and that there is a crucial need for the implementation of corrective actions to improve the whole process.

The respondents who had previous experience with such programs reported that the training processes that preceded the implementation of ERP, are summarized in the following: (a) information from the unit for the importance of the program, (b) senior officers were requested to provide their written suggestions on how to organize the training after the implementation, (c) collaborations were performed with external trainers, who trained the officers internally to become trainers themselves, (d) there was an evaluation after the end of the training program and a subsequent evaluation of the final program.

According to all the respondents, the application areas are the accounting department, the warehouses, the production processes, the administrative function etc. Possible problems, as stressed in the theory (Drexl & Kimms, 2013) and also through the interviews, are the following: (a) problems in information sharing between the different departments of the same unit, (b) data redundancy, (c) need for researching in multiple databases (d) system dissimilarity, (e) maintenance difficulties and costs of the different systems, (f) data likely to be useful were not used, (g) poor quality of information.

Afterwards the respondents were asked to identify the advantages and disadvantages of implementing the ERP system. As a whole and in combination with the theory (Fawcett et al., 2014), respondents answered as follows:

(a) Overall view of financial data: Financial data and relevant information are introduced to the system from all departments. This data is collected and processed as a single unit and provide direct information to users who have access to such information.

(b) Organization of the procedures and operations of the department: ERP is the backbone of the functioning of the organization that implements it since it is based on the automation of processes and functions. The processes are
simplified, official, clear and stable for each department of the body and for each member of the personnel.

(c) Reduces the time required for the data entry: The information is entered once and is used by the entire body.

(d) Easier compliance to mandatory or optional standards: A common phenomenon is the weakness in adopting various standards, such as the quality assurance standards ISO9002, IAS etc. A well-organized ERP system, through its modeling possibilities, is able to make this transition easy and safe.

(e) Reduction of errors: It is a factor that is considered relatively easy to be measured and directly affects many others, such as the satisfaction of the personnel, the reduction of the operating costs, etc.

In contrast, the disadvantages reported by the respondents are the following:

a) The adaptation to the specific needs and the operating mode of a military unit, which often requires numerous initializations, interfaces to other systems and modifications of the chosen ERP system.

b) In many cases, the subsequent support and maintenance of the ERP system are highly costly.

c) Every military camp doesn’t have an expert to implement and operate it and this makes it difficult to expand its implementation and the wider coordination.

d) The installation and deployment of an ERP system can bring about major changes in the organization and operation, some of which are likely to be forced to the unit in order to be able to adapt to the ERP system.

Respondents were also asked if the administrative military personnel have the appropriate knowledge level to use the ERP system. Most answered negatively considering that there aren’t enough people who actually know and can operate it successfully. They suggested that the army personnel should be further trained to specialize in using the program and achieve an improved level in operating the program in the future.
In connection with the impact of ERP in the operation of the procurement department and the personnel training, all respondents said that they consider the ERP system as a tool with its main application areas to be the above two areas. However, they said that in order to achieve even better results, further financial resources are required, additional staff training, and better internal and external operation of the army in this field.

In addition respondents believe that the army makes many efforts to improve at the technological level but to a large extent falls behind when compared to the international standards.

Specifically, as reported by respondents, all units abroad operate on the basis of modern technological standards, but in order for this to happen, the governments invest in this area, unlike the Greek State due to the economic crisis and the recession period which is currently running.

Greek Armed Forces do everything they can with the available resources, but this is not enough, and as the respondents said, it is important to make changes as soon as possible because in order for a modern army to be competitive, they should be enhanced not only with the ERP, but also with additional technological solutions. According to the respondents the ERP in the army is only used in combination with the MRP program and with simple programs directly related to the operation of the economic departments primarily and the procurement departments.
Chapter 5 – Conclusions

Through the above analysis it is evidenced that an ERP system automates the core operational activities and shares real-time data, thus optimizing the resources and significantly reducing the operating costs of each organization.

It was found from the present study that programs such as the ERP and other relevant and related programs such as MRP can significantly reduce the production costs, the investments in stocks and improve the performance of the finished products in terms of delivery, since it is responsible for planning the production and assembly of the individual components.

All these applications today become important and directly realizable throughout the private and the public sector, and also to organizations such as the armed forces.

It was also found that the armies around the world are pursuing the implementation of ERP, and also the broader integration of their operations through the use of IT systems and systems like the ERP.

Through the use of various software programs, on the one hand the armies seek to improve their internal operations and on the other to achieve a more direct and more effective problem-solving process and more generally a process to manage potential crises. The area that receives little attention is that of the management of their financial, human, operational, and organizational resources.

Based on the above, and the wider analysis, it was established that the ERP technology is significant in the operations of the army. It is critical in the designing and implementation of the strategies for the supply chain management system and facilitates the process of achieving the goals in terms of costs and profits.

It is clear through the theoretical and practical analysis of the topic that the ERP can help the army to become more competitive with the use of the recent technological improvements. But for that reason adequate infrastructure and resources are needed.

Through the theoretical and practical part of the study, the aim of the study was addressed in the best way possible, since ERP was defined, and generally its
importance explained and more specifically with regard to the army and especially the Greek army. The conclusion is that, especially for the army, such a program and other similar ones can produce only positive results by bringing improvements in all areas of operation.

The requirements for ERP proper and useful functioning include more governmental resources available and more investments on part of the public budget. The Greek army should use the ERP during the recession to its favor in terms of helping where is needed to cut costs and gain profit.

In terms of decision making the Greek army has a lot to benefit from an ERP system when applied properly. ERP software when used properly can save both time money and mistakes for units, by avoiding making bad decisions that may cost.

This can be avoided with the recruitment of suitable staff that will handle ERP and also know about the units’ major issues, concerns, advantages and disadvantages. Moreover, existing personnel that deals with the supply sector as well as the decision makers should be better trained on duty on the ERP program.

It is evident that without the proper knowledge and training any ERP program would under-deliver and will not help in acting proactively when not implemented right. This requires time management and resources that will though inevitably result in promoting changes that will help to better management and smooth running of operations.

Concluding the present study, certain recommendations based on the above analysis have to be made. These recommendations are provided based on the author’s own views and on the literature study that was performed during the development of this research.

Today the army must refrain from the old bureaucratic and non-functional model and proceed to the development of a single ERP platform which can be applied in several operational areas of the three Corps of the Greek Armed Forces, such as: budget and finance, personnel and reserves monitoring, management of materials, supplies and munitions, technical support, withdrawal of materials, control management and IT systems.
In addition, the ERP should be applied in the materials management, in the operational needs of the army, and in the management of financial human, technological and other resources. Through this process, the Greek army will become more functional, more extroverted, more competitive and more established as a place for accepting notable executives who would want to work in the administrative departments of the army, being more functional and more effective.

It is recommended that the ERP should be applied in the military factories, which focus on producing military apparel, footwear, medical supplies, accessories etc. Still, it could be used to perform maintenance work, management of the weapons systems, file management, management of defectives, etc.

It is even recommended that the Greek army should combine the use of the ERP with other programs in the development, management, organization and operational development of the army, a prospect that could also become the issue for future research. The programs that may be proposed to be implemented and combined with ERP may include a warehouse system the use of which would address the better management of warehouses and raw materials, which is considered urgent and extremely important. It is essential for the army to be able through these systems to perform inventory and network management and generally to manage its operations.

Another program that could be used is the RFID system, which could be applied in handling the repairable R&R (Repair and Return) military materials that are shipped abroad to repair centres, since this would significantly reduce the handling time, enabling the full monitoring of the progress of the processes, from their shipment until their final delivery.

Through the above processes, the army will definitely become more competitive, more effective and operate with the least possible costs. In the future, apart from its basic role as an instrument in the safety and security of the country, the army can also represent an organization able to contribute financially and technically to the wider development of the Greek society.

Finally, it should be mentioned that from all the above information and recommendations, it is reasonable to conclude that there is a lot of room for the
development and improvement of the management of the operations of the Greek Armed Forces, through the implementation of an ERP program and more generally through the use of new technologies.

Today the army needs to become modernized and be strengthened, and more widely, to be repositioned in the world affairs. A modern military should not rely only on its good performance in times of crisis, but also on its good performance in peacetimes. Its operational and organizational readiness during peacetime will surely provide all the conditions to achieve competitiveness and become more effective in times of crises. In the future it is deemed necessary, as already mentioned, to further investigate the issue of the IT systems and to clarify their applications in the Greek army, as well as their effectiveness in general.

“War is a matter not so much of arms as of money.”

Thucydides, History of the Peloponnesian War.

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Appendices

Appendix 1: Qualitative Questionnaire

1. The use of the ERP program is mandatory or optional; justify your answer.

2. The implementation of the ERP system helps in decision-making process; justify the ways in which this is achieved.

3. ERP helps in user’s involvement in decision-making process?

4. It is profitable for your unit to use the ERP and in which ways?

5. What actions of the Army considered that the ERP can be applied and why?

6. What are the educational processes prior to the implementation of ERP in the unit you serve?

7. Number the application areas of ERP and make reference to potential problems you are experiencing.

8. What are the advantages and disadvantages of the implementation of ERP?

9. Do you believe that the administrative staff of the army has the appropriate knowledge to use an ERP program?

10. Do you believe that the ERP has a positive effect and in what way to the supplies of the army?

11. Do you believe that the ERP has a positive effect and in what way to the training and development of human resources?

12. Evaluate the technological development of the army - What are the problems, what do you consider need to change?

13. The use of ERP in the Greek army differs from foreign armies?

14. What other applications are used in combination with ERP in army?
15. What are some problems (if any) you are facing with the current ERP system you use?

16. What add-ons, more features would you ideally require from the ERP system?
Appendix 2: Just In Time (JIT) Objectives (7 zeros)

JIT objectives can be summarized as “7 zeros” which are the following (Aksoy & Öztürk, 2011):

1. Zero defects produced: In an environment without unnecessary stock, any defective item causes a delay to the next step (workstation) in the production process. Therefore, each type must is produced right from the start.

2. Zero unnecessary quantities: In a JIT system a workstation intended to replenish the stock consumes next to any workstation process. Since the subsequent workstations might require a diversity of species, maximum required response to their demands. This means producing exactly the required quantities rather than large batches.

3. Zero preparation time: Based on this target system will produce small batches and require therefore frequent changes (setups). In this environment it is essential that each preparation time change is very short, so as not to waste valuable capacity.

4. Zero equipment failures: Due to the limited stock of ongoing (Work in Process inventory) any equipment failure leading to downtime and therefore is not tolerated.

5. Zero material handling: The manufacture of articles in just the required quantities minimizes the handling requirement of intermediate manufactured and from the warehouse, as used in the next step of the production process.

6. Zero waiting time: In an ideal environment JIT requirements of a workstation met the previous workstation to process almost immediately (ie little to no time standby). This also contributes to the requirement for production in small batches.

7. Zero spikes: To support the smooth progress of the production process is required and smooth production program without any particular peaks. In case
of high peaks, where there is excess capacity, the system is not given to respond, which leads to delays and holidays. ).
Appendix 3: Steps for Smoothing MPS Peaks Periods

The peaks in the periods of a smooth MPS smoothed are based on two simple steps (Aksoy & Öztürk, 2011): (a) Smoothing requirements in short sub and (b) Developing uniform production sequence.

The first step is accomplished by splitting the requirements of a period of MPS proportionately to sub in this room. For example, suppose that the MTO identified the production 2000 units within the selected period, this implies daily output $2000: 5 = 400$ units (if the week consisting of five working days) production of 200 units per shift (assuming two shifts per day) 25 units per hour (8 hours per shift) and $25/60 = 0.417$ units per min. Naturally, the production can vary from minute to minute with limited distribution around the desired mean. But if the average value is not achieved, then this must be corrected.

The second step requires the transformation of the daily production in a production sequence of day based on the proportions of MPS on finished products. If, for example, weekly production of 2000 units corresponding to a ratio of amounts of the products A and B 3: 1, then the next production will be 300 units A and 100 B units and corresponding sequence will be A - A - A - B - A - A - A - B. Obviously these frequent changes require workstations and product combinations corresponding to minimum preparation times.