# THE INTEROPERABILITY LEVEL OF REENGINEERED ATYPICAL MILITARY EQUIPMENT: A MAJOR INDICATOR OF INTERNATIONAL MISSIONS' ACCOMPLISHMENT

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## Abstract

Article aims to analyze the degree of interoperability of atypical military equipment for international missions, which was regarded as one of, the levels "of standardization in NATO, but also as a measure of the degree of interaction between C4I systems. Interoperability is the ability of the allied forces and, where appropriate, the forces of partner countries and other states to train, participate in exercises and to work effectively together to accomplish missions and tasks. The interoperability is an essential characteristic of the capability itself: there is no capability without interoperability. Interoperability consists of factors such as equipment, logistics and procedures. Increasing the interoperability for these aspects will increase the efficiency of operations. Planning and cooperation in the area of military atypical equipment for international missions, having as an objective the multinational approach of the issue of military equipment through the reengineering of the matter can be undoubtedly seen as an effort to reach the level of common standardization.

## I. Interoperability

Improvement of military cooperation capability, also known as "interoperability", is an important goal of the Romanian Armed Forces. Military cooperation between NATO and non-NATO countries creates the prerequisites

for taking jointly part in peace support operations or the supporting of international humanitarian operations. Important tools in improving military cooperation are joint exercises and drawing up joint standards and norms.
In Europe today, NATO's military standards and norms are an important point of reference. All European countries base their armed forces' reforms on them. Also the military cooperation within the European Union is aligned with NATO norms and standards. Thus the Partnership is an important tool for Romanian Armed Forces to increase cooperation capability with friendly countries.

For Romanian Armed Forces improving its ability to cooperate with its partners is not just an essential prerequisite for contributions to international peace promotion and desaster relief, it is of equal importance for domestic security operations jointly executed with neighbouring states. All in all, the capability for multinational cooperation increases the armed forces' freedom of action. They have therefore set themselves the improvement of their interoperability as a long-term goal. The success in multinational operations (MNO) depends on two factors:

-the own proper capabilities;

-the degree in which these forces could be involved in MNO.

It clearly results – the multinational force (MNF) general capability is a sum of partial capabilities of the participating forces – occurring from first factor – and from the second – it must to be an interoperability acceptable level, a critic threshold.

I consider that the junction capability enlargement in MNO it should be the central preoccupation at all the levels; even in the situation of a very good interoperability, the absence or shortfalls in critical capabilities such as detection and reconnaissance, air defense, precision strike, communications, command, control, computers, and information – C4ISR, logistics or, in short terms, information processing (and correct exploitation) capacity can not be replaced.

COMPATIBILITY: proven ability of the different forces to act together without interfere; the notion does not supposes synergy and/or common benefits, the forces acting only separately;

INTEROPERABILITY: proven ability of the different forces to act together changing services and/or mutual support in a common mission; the notion supposes synergy and/or common benefits, the forces acting independently;

INTEGRATION: proven ability of the different forces to act together changing services and /or mutual support in a common mission; the notion supposes synergy and/or common benefits, the forces acting only together due to a (minimal) degree of (inter)dependence.

When we speak about interoperability, the acquisition process must to be placed under the high command of mission capability management; the planning and subprograms must to be strictly accordant with directing documents; it must be avoided the situations in which some program segments can speed up face of others, without that the first ones to be effectively accomplished. This situation is not new, but, in this case, the strictness plays a capital role.

An aspect not less important is the configuration control; interoperability and especially the informational one must to be kept at least at the initial level on all life cycle duration of the systems involved; we must not forget that it is unacceptable that systems initially interoperable, on the battlefield loss this quality.

Each significant technological advantage in warfighting equipment, from the sling to the cannon, and than after from the plane to the missile has triggered changes in the doctrine. Since that time until now the things have been evaluated, the conflicts are more than more complex; it has not only the profile of a simple war, requiring other kind of implications, participation in coalitions or alliances. Despite of some recent progresses in more clear definition of information interoperability requirements, doesn't exist yet an appropriate

process which satisfies these requirements. That problem it will not be solved without fundamental changes in which systems and their operational capabilities – as the services offered by C4ISR systems – to be natural joint born.

Summarizing, we can have the following conclusions:

-reaching the adequate interoperability will request fundamental reforms in the defense processes; ones of them were mentioned in the work paper; it is clear that these reforms must be included in the defense transforming strategy;

-from the multitude of the domains over which the interoperability concept could be applied – armament, ammunition, logistics, etc. – the most important is the information;

-compatibility, interoperability and integration are 3 different stages of the capability evolution process;

## II. Reengineering of Romanian Defense Industry

### II.1 Reengineering definition

Reengineering project is the radical change of the company designed and developed by general manager into practice the study of innovation total production.

Modern information technology is a component of the concept of reengineering where as assist new processes to produce quality goods and irregularities occurred are asked in real time. Successful managers in reengineering should be based on an inductive thinking and not deductive thinking.

Reengineering and rethinking of AE radical redesign and production is made in order to improve the substantial technical and economic indicators (quality, cost).

Reengineering starts from scratch and is building a new strategy of thought and realization of the production processes of EA. The new process should be built on new principles and models and facilitate the production structures design based on substantial innovation.

Reengineering industrial processes is following the next sequence of

design:

- Redesign technology innovation based on total production AE;
- Reorganization items in the work scheme based on human engineering;
- Japanese companies decision making;
- Inventory and application technology;
- Minimize entropies in the design stage of the management schemes;
- Ensuring the quality of the human factor on the basis of empathy maximize management;
- Engineering teams training process based on converging engineering;
- Redesign places of work on the ergonomic basis, pursuing optimization of human labor and the environment;
- Use of innovations theory in of cases of AEPF reengineering. The AEPF management reengineering team is able to implement successful radical changes in both the products and the processes. Reengineering success in the applications is based on knowledge and managerial capacity of project leaders to prevent mistakes and ways of generating errors.

The main stages of implementation successfully reengineering are as follows:

- Changing the degree of responsibility of designers by radical innovation architecture of the EA production;
- Redesign process through substantive changes made to the functions and structures, and management;
- The work of convincing employees to determine AEPF work performance through motivation whereas this way to change mentalities workers;
- The exact definition of the reengineering program objectives;
- Reengineering application in the enterprise is starting from the top level management;
- Acceptance of general manager as a leader of reengineering team because he

(she) understands the phenomenon of reengineering as a whole and is able to implement creativity in complex military equipments production process.

### II.2 The strengths and weaknesses of defense industrial potential

Strengths of the defense industry

- It is the principal supplier of products of technical military forces needed for endowment of the national defense system
- Export potential
- Labor force with experience in the field
- Has surplus spaces, which can be restored in order to receive other destinations in the sphere of production and maintenance activities
- Owns equipment and objectives unique in South - East Europe.

Weaknesses of the defense industry

- Traders do not have enough money;
- Locations are placed in weak industrialized areas.
- Research and development structures have reduced the personnel number.
- Manufacturing technologies are partial efficient (morally and physically exhausted)
- Investments and modernization of defense sector production capacities
- Personnel structures are not adjusted to principles of modern management.

### II.3 Possible courses of action

- Cooperation agreements between Romanian defense industry companies and the defense companies of EU, U.S. and other geographical areas, in order to achieve the liabilities offset of the final product, sub-assemblies, spare parts and provision of services for processing, painting, integration, assembly and test.
- Realization of offset agreements obligations, transfers of technology, know how, investment flows to modernize production by foreign companies supplying military equipment to Romanian defense industry.
- Defining with high accuracy internal and external markets

- Restart of research-development of their companies / groups, as well as at national level
- Reconfiguring the defense industry structure
- Sizing production capacity for defense in accordance with current requirements and specific forecasts
- The creation of centers of competence and technological centers of development
- Modernization of production capacities for defense
- Development of new production capacities for defense
- International Cooperation
- Intensification of activities promoting the company / group profile, media achievements and reward performers

**III**. **Atypical Equipment Standardization**

AE[1] offers benefits to both end users (Romanian Armed Forced Services) and for AEPF[2]. End users (customers) may be based on simplicity and ease of buying standardized AE. Similarly, the fixing of prices uniform (standard) for code labels resulted in a higher efficiency for the retailer. In designing the new AE, standardization can increase productivity by:

(1) design to avoid unnecessary when there is already an appropriate;

(2) simplify the planning and control of materials during the production of EA, because the system there are fewer components;

(3) reduce production of components (if the components are produced internally) or reduce the requirements for purchase and limiting the number of vendor (if components are purchased). Risky part of standardization is that competitors AEPF can overcome with a new feature that AE made in AEPF can not touch because of its limited design capacity.

[1] AE- Atypical Equipment
[2] AEPF - Atypical Equipment Production Firm

## III.1. Atypical Equipments Production Reengineering (Figure no. 1)

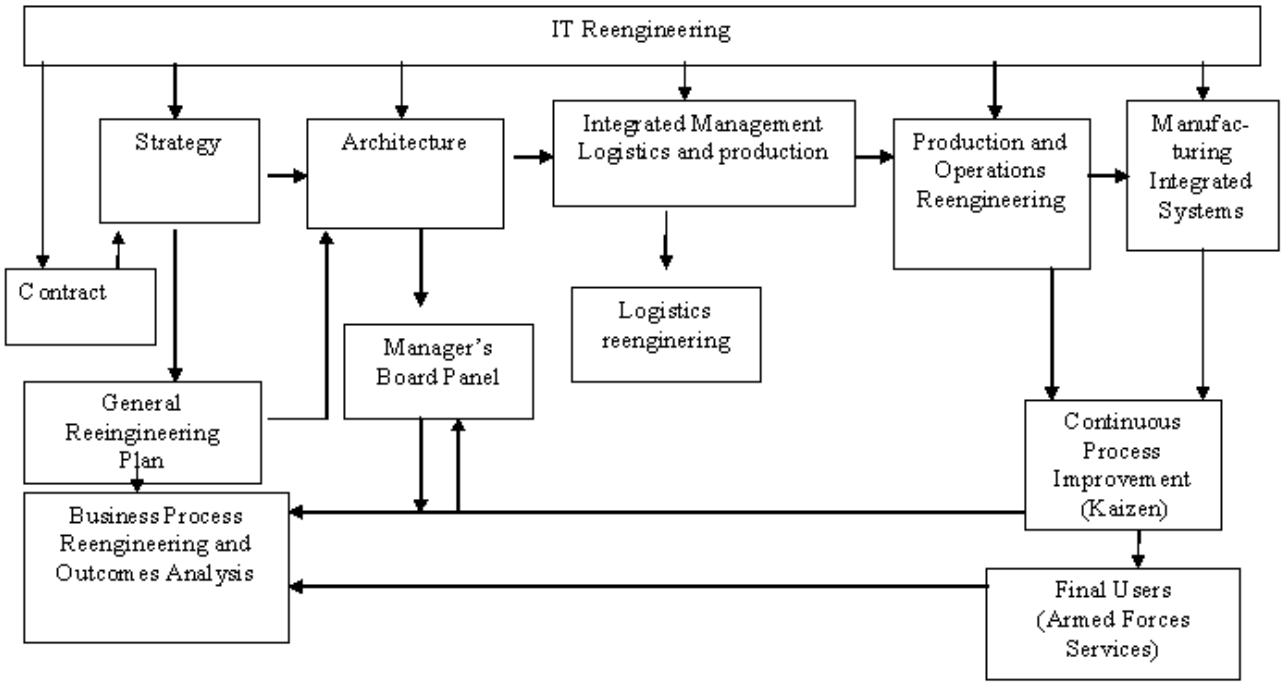


Figure no. 1. Overview of a reengineering production process at AEPF

**Process Definition**

The process is a sequence of activities that contribute to generate a default result. A task turns partly entries exits, exit from an entry in the work. Each activity adds value. Production management requires. Rethinking the form of a variety of processes. Trials undertaking not to recompose the unity of its structural but functional unit. Management requires the definition of critical processes.

**Taxonomy processes**

Production includes activities conducted by people and carried out by means of employment for processing work items into finished products. The production process is composed of processes, processes employment and natural processes.

The process is a part of the production process and includes all operations

which are the direct objects of work. Trials of manual work include activities of the contractor. Natural processes are carried out mainly under the action of natural factors (such as paint drying). The production process is composed of a series of partial manufacturing processes:

- The basic processes (which reaches unfinished product);
- Supporting processes (create conditions necessary for conducting basic processes);
- Serving processes (create the conditions for carrying out organizational processes and basic auxiliary);
- Processes attachments (including activities with a lateral process of production). The basic processes are in turn primary (casting, forging), processing and finishing (assembly);

Secondary processes include: the processes of repair, manufacturing SDV-sized energy production. Serving processes are the internal transport, warehouse management, distribution of energy. Annexes processes include manufacturing of packaging, waste recovery, regeneration oils, etc.

Taking into account the human intervention in production processes are different manuals, mechanical processes and automated processes. The basic element of the technological process is the operation of a performer who responds to a particular job. It is the division of labor support, as the main norm work.

Any operation is decomposed in stages and substages.

There are other classifications of production processes. In the international literature meet specified for instance following production processes:

- Based project - in civil engineering, for programs - in the case of special machines or handmade production;

- A lot - for automotive components for electronics items, or the production of clothing;

- On assembly lines - for example for engines for vehicles;

- Manufacturing line - the industry horizontally parts (organs of cars) or preparing meals in a restaurant;

- Continue the process - in metallurgy, chemical industry, paper manufacturing; hybrid production - include industrial processes and natural processes (beer manufacturing, etc.).

Production may be categorized by the following criteria:

- Industry: manufacturing production and services;

- The degree of specialization: handmade production and industrial production;

- The production: production and production continues discreet;

- The strategy used, production orders and production stocks;

- Placements needed: manufacturing and assembly;

To individualize distinct elements of the production processes is necessary to examine some key issues, such as:

- Development characteristics of the manufactured products;
- Processes development
- Evolution of materials
- Development of information
- Manpower development
- Driving the evolution of these processes.

Trials are reviewed in order:

1. Handmade manufacturing (Job Shop)
2. Lots manufacturing
3. Manufacturing in the stopped flow;
4. Manufacturing in line;
5. Continuous flux manufacturing.

a) The evolution characteristics of produced AE

- Decreases the number of models produced;

- Increase the production volume;
- Product customization decreases while is increasing the degree of standardization;
- Introducing new products become less frequent and more expensive;
- Competitiveness is based primarily on price;
- Quantitative aspects are important especially in the production of feed lots or discontinued, the continuous flow of qualitative differences become less significant;

b) The evolution of the processes used

- Production process becomes more rigid;
- Process stages are correlated better;
- It is used more specialized equipment;
- Increases the production volume;
- Increases the size and complexity of construction;
- Machines are used more intensively;
- Location of machine-tools makes the production lines much longer articulated;
- The pace of production is determined from the design;
- Production capacity is measurable in physical units;
- Increased capacity is achieved mainly by large jumps, lost incremental increases in importance;
- Narrow seats appear less frequently;
- Partial adjustments become more frequent, while radical changes become more expensive;

c) The evolution of used materials:

- Increases the degree of vertical integration;
- Using the same raw material for various products;
- Increases safety in the quantity of manufactured items;
- Increases the need for raw materials and supply regularity;

- Contracts validity is higher ;
- Increase the power contract on distributors;
- Reducing stocks of semi-products;
- Increased quantities of finished products which are sold through channels controlled directly;

d) The evolution of information

- The first process is not an organized procedure for the information system of production;
- Forecasts are for sale in the long term;
- To enhance the integration between information system and production;
- Programming techniques to operational use increasingly sophisticated;
- Have managed a large volume of finished products;
- Unidirectional feed and information is usually downward (top - down);
- Quality control standards used increasingly formalized;
- The stock is managed following the cyclical increase in command;
- Because the process is less flexible, they adapt slowly to command oscillations;

**IV. Specific Parameters Redesign of the AE**

Foundation reengineering management processes of manufacturing is in AE redesign those processes that contribute to the improvement of five specific parameters of the EA:

1. Atypical Equipment features (EC - Accomplished atypical equipment capability in accordance with the end-users requirements)
2. The population offered benefit (increase of perceived security)
3. The quality of the equipment that atypical (the warfighter perceived value)

(MC - military capability and individual performance of warfighters, how to use the atypical equipment and collective performance)

3. The speed of response to the end-user request (flexibility)

4. The type of service provided (SS - supporting strategic AEPF satisfaction for the end user in question - stocks, transport and infrastructure)
5. The cost of manufacturing (competition activity in prices).

The process consists of a series of related activities, which start at some entry and the transformations taking place. According to the principles reengineering, redesign processes is aiming for critical processes, namely those that create greater value and which have the capacity to influence competitiveness. In a AEPF there are not more than 6-7-critical processes. But each of them must have an effect on the market in terms of customers (end users) and competitors.

Model reengineering critical processes (Figure no. 2), comprises six processes:

l) the process of change - refers to the strategy of radical change specific reengineering, by redefining the mission AEPF and new paths to follow;

2) the process of innovation refers to the AE design, development, testing and launch commercial market;

3) process the valorization start of supply of raw materials for production of flexible and AE get to dispatch AE finished;

4) the development process - beginning with the choice segment of the market for the production of defense, positioning AEPF market reach and sending the finished EA;

5) the satisfaction - based on the identification orders received from end-users (the Armaments Department and Romtehnica) and extends to achieve their service pre and post sales in order to obtain warfighter satisfaction;

6) the information - creates a system for collecting the information, archiving and reach their communication with end users and control results;

After the identification process, to determine which of them should redesign and with what priority.

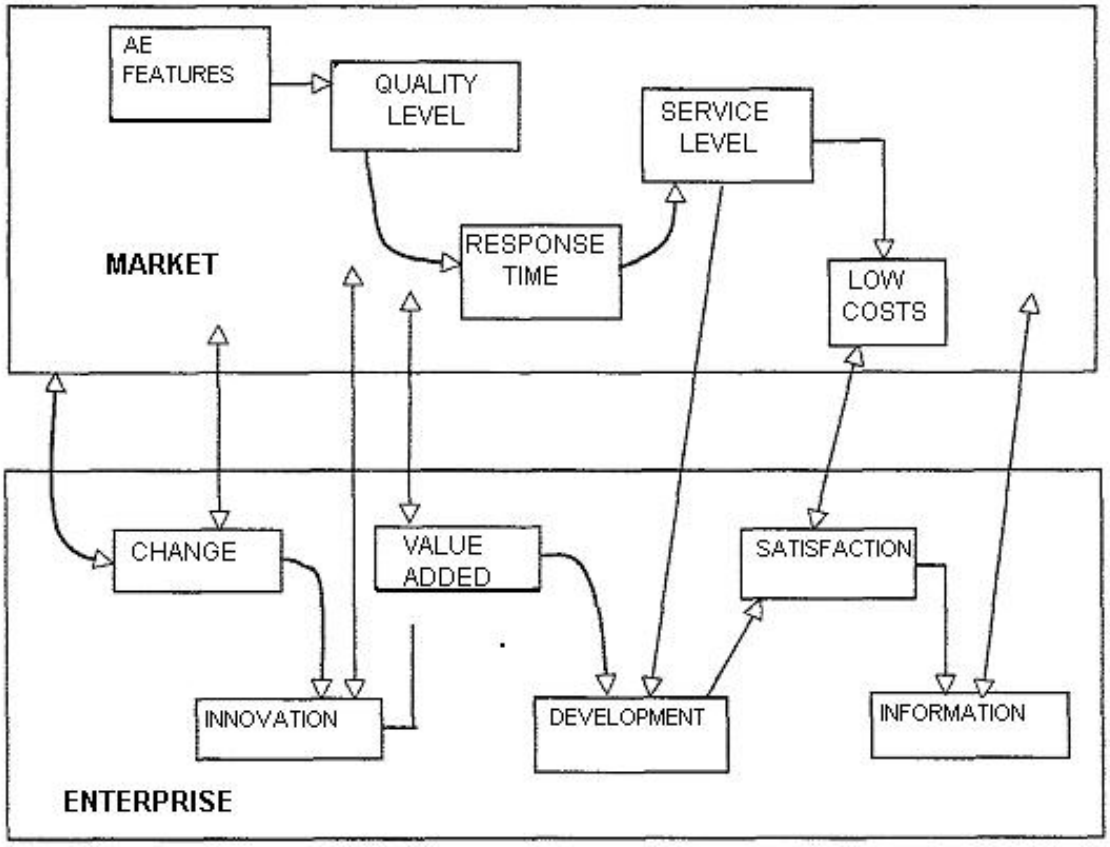


Figure no. 2 - Critical Processes Reengineering for Atypical Equipment (AE)

## V. **Indices of AE Reengineering Production Flows Efficiency**

Reengineering flows efficiency of production of AE can determine the following **indices**:

1) Production Reliability (PR)

$$PR = \frac{\text{Number of orders made}}{\text{Number of confirmed orders for production}}$$

2) Process Efficiency (PE)

$$PE = \frac{\text{The value of unfinished items}}{\text{The amount of daily achievements}}$$

3) Financial Products Validity (FPV)

The total value of stocks

FPV = ----------

Average daily

4) Customer Service Level (CSL)

Number of complete orders

CSL = ----------

Number of confirmed orders from customers

5. Shipping Performance (SP)

Number of orders completed late

SP = ----------

Total orders

6. The ratio of D ( production cycle duration) and T (time of dispatch required)

7. Main Plan Execution (MPE)

Number of orders completed late

Number AE products - Number AE unscheduled

MPE = ---------- ----------

Total number of AE products

8. Profit (P)

Annual volume set

P = ----------

Average volume in stock

**1 The performance indicators**

The performance indicators to be taken into account in reengineering process are based on the following five components:

1. Economic performance: it is to take account of profitability required by

shareholders and the financial market. AEPF[3] viable economically will be those that will create value for shareholders, end-users and employees. They will ensure their work success and will have such a decisive advantage against competitors.

2. Satisfying customers (end users of AE[4]): End-users of AE products assess their satisfaction with comparisons between the defense capabilities of AE Romanian and other NATO members during developing joint activities.

3. Satisfying employees: I could say that man is the most valuable capital of the company. Competitive conditions AEPF forces to support the capabilities of innovation, responsiveness, flexibility of their employees to better meet increasing demands of end users of the AE product, in terms of price, quality and deadlines.

4. Environmental Performance: pressing constraints on planetary ecosystem (climate change, air pollution) require an improvement in environmental performance. To protect natural resources and balance their AEPF can implement the concept of eco-efficiency, which is to create more functional value products and services, reducing incidences on the environment.

5. The quality of relationships with partners: the case of relations with stakeholders, civil society, customer, suppliers and others who are part of the AEPF . The performance indicators show whether the objectives of the result were achieved. But they do not explain why the performance is reached or not and what must be responsible to rectify any irregularities. The should identify cases because it is not administered by costs, is administered undertake activities that cost. Thus, reduce the complexity of an AE complex product AEPF , reducing the number of components of the product will affect the level of stocks, the management of stocks, on the simplification of production operations on purchases and accounting.

[3] AEPF - Atypical Equipment Production Firm
[4] AE- Atypical Equipment

The indicators must realize the link between cause and consequences (performance factors). Indicators are referring to the activities and resources related to the product. They are found in the managerial panel and must respond to two essential characteristics:

- Are determined to achieve the level of performance expected from the date of application;
- Controlled by a responsible people who can act on them.

5. Conclusions

Deductive managers define the problems and indicate the direction of settlement without knowing if there is a feasible solution. Inductive managers detect single solution and develop conditions of applicability in the studied field in order to solve the information assisted reengineering systems issue. Stage research design processes subject reengineering and determining the optimal variant with minimal financial efforts. In this perspective is calculated performance indicators, indicators of control, and indicators of profitability. If the solution is feasible in technical-economic aspect is then draw up schemes operational and technological specifying the details of assembly-operation.

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