

III. WYBRANE PROBLEMY BEZPIECZEŃSTWA

AN EVOLUTION OF SECURITY ENVIRONMENT AND ARMAMENT DEVELOPMENT PLANNING

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Abstract. In this article the dynamics influencing armament development planning have been characterized by the authors. The most important tendencies in determined areas of security environment (geographical, political, economic, demographic, ethnic, civilization) have been described as a reflection on development of present armament systems and visions of its future. The procedure of perspective planning of armament system development has been presented taking into account necessary forecast information connected with evolution of security environment. Selected parts of planning procedure have been illustrated by some examples that include determined types of armament. The conclusions formulated at the end of article are connected future research on the influence of credibility, accuracy and risk within security environment forecasting.

1. Introduction

Armament development planning could be defined as a set of activities which match mid- and long-term needs of future security environment with armament products and technologies required to satisfy the needs. The planning process is iterative and maps a path between a present condition and a vision for the future in order to provide for armament needs in a controllable way. Fundamental changes of the security environment at the end of XXth century have strongly influenced the views on armament development planning. The Cold War bipolar world represented relatively stable and predictable security environment, almost analyzable mathematically. General objectives of armament development planning were clear enough for planners to organize the planning procedures around the main task which consisted in satisfying the needs of future war between two systems. The scenario-based forecasting of security environment limited itself to analyzing possible variants and models of conflict in bipolar world. The unexpected end of the Cold War has had unexpected effects. The forecasters failed to predict the Cold War's end, the Soviet Union collapse, the Gulf War. Bipolar system has turned into a multipolar system. The end of Cold War stopped or significantly slowed down the most advanced and the most ambitious armament

development programs (like e.g. SDI programs: ERINT, HOE, ERIS, DEW, SBI, Brilliant Eyes, Brilliant Pebbles etc.). In the post-Cold War world not only the “scenarios” seem more complex but the relations between the long-term vision of armament and the objectives of armament development planning are not as clear and “direct” as before. The information on future security environment remains still important for the planners but now they seem more demanding in regards to the question of credibility, accuracy and detail of the results of the forecasting. They seem also paying much more attention to risk analysis (e.g. to the risk that comes from external armament dependencies, proliferation, from armament market instability and from forecasts inaccuracy), to risk management and related input information as well as to economic limitations and challenges. The end of Cold War also meant the end of a predictable and stable global arms market. In its place emerged a complicated situation, characterized by diffusion of weapons and technology, migration of skilled personnel, appearance of new suppliers and new supply channels, reduced national control over defense industry, advanced-technology weapons in developing countries and in the hands of illegal, transnational organizations. From armament development planning point of view – two decades after the end of Cold War – global security environment seems not more predictable than before.

2. Present day factors influencing armament development planning

There are many factors influencing present day armament development planning: political, economic, technological, future battlefield visions, logistics, historical (lessons learned) etc. (figure 1).

The influence of political factor could be characterized as political (governmental) decisions e.g.: to increase the scale of imports in national arms acquisitions, to cooperate in production and development of armament, to purchase or to rent weapons systems – generally – to increase the number of acquisition sources and to diversify national armament strategies.

The influence of economic factor includes among others: defense budget reductions, rising advanced armament costs, privatization of defense industries and changing proportion of state and privately owned enterprises, increasing internationalization of armament production and commercialization of national defense industries (i.e. selecting products and investment priorities satisfying international market demands rather than domestic defense requirements), development of global arms market.

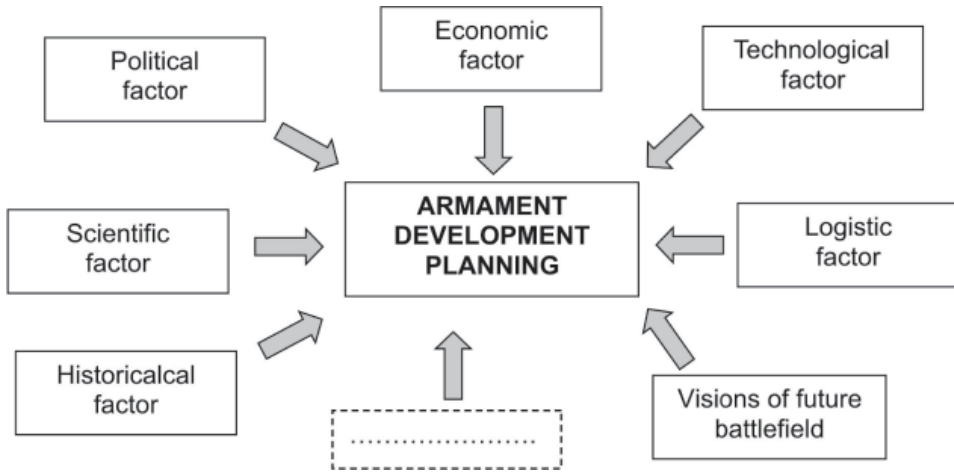


Fig. 1. Factors influencing on armament development planning

Technological factor still strongly influences present day armament development planning. Increasing number and level of advancement of new technologies (e.g. nanotechnologies, biotechnologies, information technologies or environment-control technologies), frequent appearance of breaking through technologies, improvement and unexpected possibilities of application the so far known technologies in the areas of armament, the so called “dual-use” technologies – attract the planners, open new perspectives and chart new directions of development. The advanced-technology weapons have now reached the emerging nations and present solutions in the area of arms control and nonproliferation regimes seem insufficient in respect to modern technology diffusion. Figure 2 shows the example of soldier as a system effectiveness evolution.



Fig. 2. Example of soldier as a system effectiveness evolution (adapted from [8])

Scientific factor has as its source advances in different scientific fields e.g. new physical principles (quantum physics, particle beams, "smart" materials) or biological advances (biosensors, bioelectronics, performance-enhancing drugs). Both technological and scientific factors' influence manifests itself in the scope and number of research projects (particularly in the realm of basic sciences) included in armament development plans and programs.

The visions of future battlefield were in the past fundamental factors influencing armament development planners, inspiring designers and manufacturers. Now those visions – much more diversified, complicated and controversial than during the Cold War – appear to be the factors the influence of which seems disputable. Not only the notion of "battlefield" needs now new definition (including: space, cyberspace, bio-space), but also the scope and essence of the word "armament" have changed as well as the meaning of adjectives: "conventional" or "classical". Also the question: how far the needs of arms market have substituted the needs of future battlefield – seems not only a rhetorical question. The feedback between the visions of future battlefield and armament development planning (fig. 3) is still important but the impact of "planning" seems now stronger than the one of "visions". Figure 4 shows the example of Future battlefield concept.

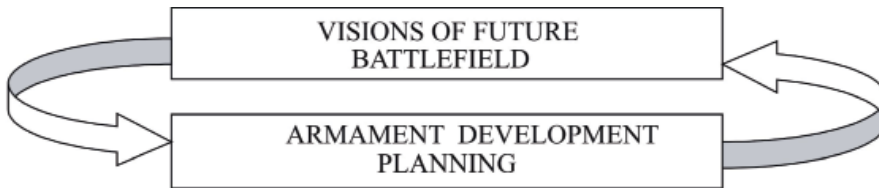


Fig. 3. Feedback between the visions of future battlefield and armament development planning



Fig. 4. Future battlefield concept (adapted from [1])

Many advanced technologies are currently being tested or even are on the battlefield now and are stimulating the imagination of future battlefield visionaries (e.g. remote-controlled reconnaissance drone “Predator”, “Micro Air Vehicle”, unmanned “Fire Scout” helicopter, miniature combat robot “Swords”, combat robot “Gladiator”, walking robot “Big Dog” or unmanned stealth fighter jet X-47) – fig. 5. On the other hand – tomorrow’s high-tech battlefield, digitalized, with computer-enhanced information technologies, space-based military systems and precision guided smart weapons – is generating goals and criteria for armament development planners.



Fig. 5. Examples of tomorrow’s soldiers [11]

Logistics has recently become one of the most important factors influencing armament development planning. Development of logistic systems is often planned together with development of armament systems. Modern armament and military equipment are more and more complex technical devices or technical systems with determined needs for maintenance, servicing, supply, storage etc. Logistic requirements of armament strongly influence the size, structure and functioning principles of its logistic system. Logistic systems are frequently contracted and purchased together with armament systems but still in many cases the existing logistic system is considered an important planning limitation or factor conditioning the development of armament.

Historical factor seems presently also very important factor the impact of which on armament development planning appears fundamental in the sense of general assumptions and objectives of planning. Lessons of the post-Cold-War conflicts and conclusions concerning armament determine new directions of armament development e.g. improving preventive and protective weapons or creating new countermeasures against: more and more sophisticated improvised explosive devices (IED), car bombs, suicide bombing techniques, specific use of light weapons, mortars, portable anti-tank (ATGM) and anti-aircraft (MANPADS) weapons, informal

distributed networks, adapting technologies like GPS to insurgency and terrorism, use of tunnels, shelters, mountain areas, urban infrastructure etc.

There are many other factors influencing armament development planning: the social need to deal with legacy defense industries from the Cold War, obsolescence of weaponry, promotion of alliance interoperability, globalization. It seems now difficult to make the ranking of all the mentioned above factors according to their “strength of influence” which depends on the kind and generation of armament, region of the world, level of development, position of exporter or importer etc. But it would be useful for armament development planners to have the long range forecasts ranking the factors in the categories of probability of influence within the given horizon of planning. All the factors are changing in time and the changes are depending on evolution of security environment.

3. Armament development and areas of security environment

Since antiquity armament has been inherent component of security environment in every historical era. Armament reflected the nature of threats and countermeasures – from Ancient and Classical Periods through Middle Ages and Renaissance to Early Modern and Modern Times. Armament has been often used as the identification mark of given historical era (fig. 6). Development of technology makes the feedback between armament and security environment and armament stronger. Since the beginning of nuclear era the impact of armament on the security environment has significantly increased in comparison with the impact of security environment on armament. Security environment could be defined as a superposition of several areas.



Fig. 6. Armament as identification mark of historical era

Mutual interactions and relations between the areas are shaping the architecture or the specific configuration of the security environment. Following areas are particularly important from armament development point of view: geographical, political, economic, ethnic, demographic, cultural (or civilization) – figure 7.

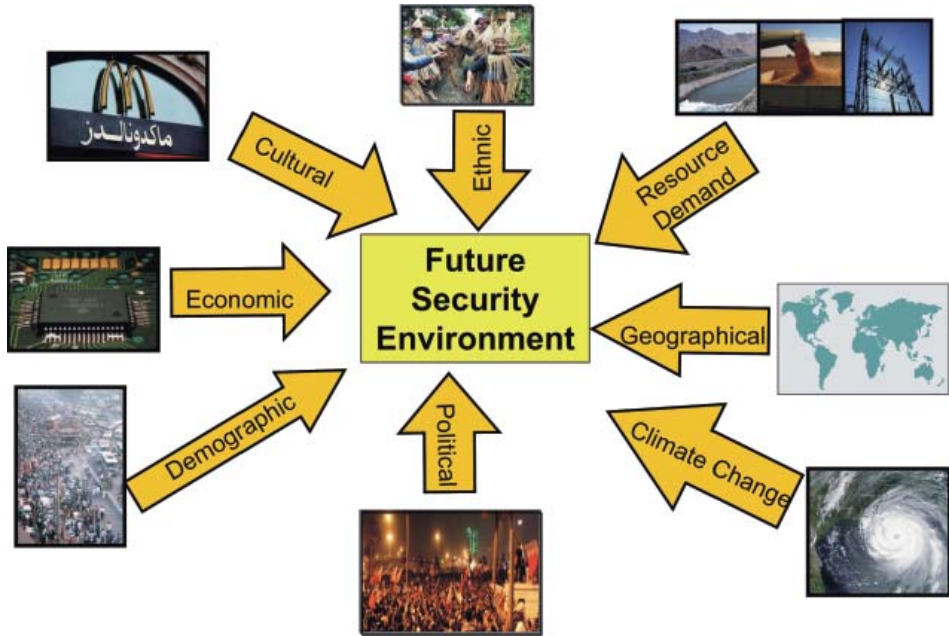


Fig. 7. Future security environment areas

Geographical area. Historically geographical location used to be advantage or disadvantage from security point of view. For instance in Europe wars were usually waged from West to East or from East to West. Poland situated on flatlands between two powers: Russia and Germany experienced during centuries the disadvantages of the location. During long time geographical location was advantage for countries situated on islands or separated from potential aggressors by mountain ranges. The impact of geographical area on military technology and armament has been reflected among others in ancient and contemporary fortification constructions like: Hadrian's Wall, Great Wall of China, Maginot Line, Berlin Wall or Gaza Wall (fig. 8).

Islands or seaside regions favored development of navy and naval armament. Mountainous regions or tropical jungles (as well as "urban jungles") have been favorable conditions for insurgency and terrorism. The impact on armament in this case manifests itself in requirements (coming from both insurgency and counter-insurgency sides) for developing special types of weapons (mines, IED-s, mortars, portable ATGM-s, short range missiles, reconnaissance and combat

drones, helicopters, MPADS, precision targeting devices etc.). Another important characteristic of geographical area – from armament development point of view – is presence and availability of natural resources e.g. oil, natural gas, minerals, necessary for armament production. Directly connected with geographical area – climate change may result in migrations from ecological catastrophes regions and needs for developing special weapons supporting migration control, delivering humanitarian aid, non-lethal weapons etc.

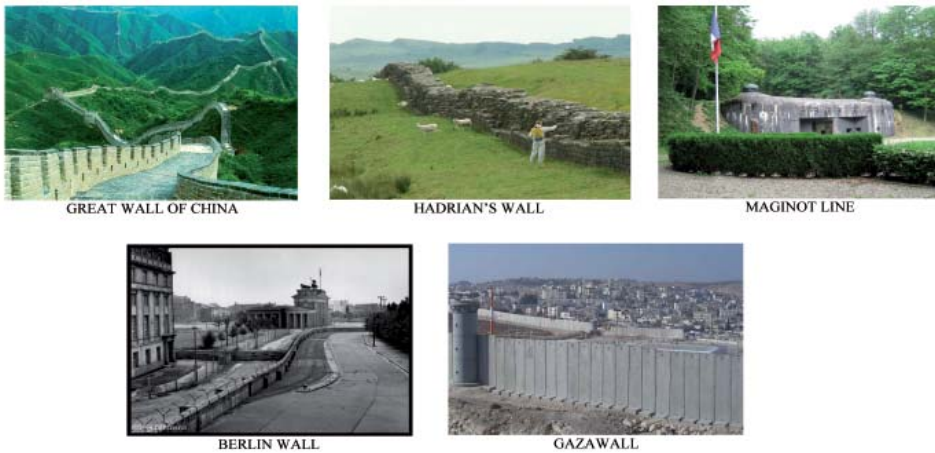


Fig. 8. Evolution of fortifications

Political area. Number, size and type of states in the region (or simplifying: the political map of the region), their political systems, their mutual relations and interactions – are fundamental and “active” (in comparison with geographical area) components of security environment which impact on armament development is decisive. Governments are working out national armament strategies and defense industrial strategies, armament development plans and programs aimed at providing necessary measures to neutralize security threats. Actors on the scene are also coalitions, alliances (with their armament strategies) and recently – separatist, terrorist and criminal organizations. State’s security is relative and depends on all the actors and their behavior in political area. International conventions, treaties and agreements on: selected weapons bans, disarmament, arms control, nonproliferation – are “legal regulators” or “legal limitations” of armament development in given political area. Several types of political areas could be distinguished taking into account criteria of: “dynamics”, “probability of war”, “diversity”. Stable, peaceful and homogenous political areas, their opposites and mixed variants are generating different needs for armament. Depending on the type of political area those needs determine general directions of armament development (e.g. developing: offensive or

defensive weapons; heavy or light; WMD or conventional; land, air, naval or special forces' armament etc.).

Economic area. Economic flows (movement of goods, services, capital and labor) often overlap geographical and political borders. Area – over which economy operates not necessarily adhere to states' borders or economic influence spreads beyond national territories – has been called economic area. Following characteristics determine economic area: levels of economic development and economic integration, existence of transnational companies, labor market, financial flows, supply chains in industry and commerce, transport networks, common currency. From armament development point of view additional characteristics of economic area are: saturation of the area with defense industries, level of military technology and armament products, transnational arms producers, suppliers and customers, common arms market. Since long time the differences between rich and poor economic areas have been causes of migrations, conflicts and wars, resulting with lessons learned and new requirements for armament development. Evolution of contemporary economic areas goes from number of closed economies, each independent and self sufficient – to international economic organizations with free flow of goods, services and factors of production (labor, capital, technology), also with common currency etc. Tools of integrating economic areas are economic treaties, agreements and institutions. Levels of integration of economic areas include: preferential trade agreements, free trade areas (sometimes limited only for certain classes of goods and services), customs unions, common markets, economic and monetary unions. There are many economic areas in the world on different levels of integration reflected in the names of institutions and organizations like: NAFTA, CAFTA, ASEAN, EFTA, SACU, Mercosur (Southern Common Market), European Economic Area and European Union. Tendency of industrialization in third world's economic areas results in location armament production in the regions and significantly changes the situation of the so far dominant suppliers on world's armament market. Their new strategy could consist in selective production of the most advanced technology armament only. The new suppliers' response could be increasing production and supply of low and mid-technology armament.

Demographic, Ethnic and Cultural (or Civilization) areas. Borders of these areas also do not coincide with the political frontiers. Mutual relations and interactions between the areas are extremely strong in contemporary world. They often have an indirect but noticeable effect on armament development. Neighborhood of demographic areas with population growth and the areas with population decline and aging – results in migrations which strongly influence political, economic, ethnic and cultural areas and are sources of diverse conflicts. This results in demand for developing border protection, border control

and surveillance weapons, non-lethal weapons as well as specific installations and constructions like e.g. the mentioned above walls. Immigration influences the labor market which is important for development of defense industries. Ethnic areas also generate migrations and waves of refugees but – first of all – protracted, destructive conflicts and wars which influence the demand for armament development similar to that caused by insurgency and terrorism. Cultural (or Civilization) area is probably the broadest of the discussed areas in both territorial and semantic aspect. For instance European culture or European civilization area extends far beyond the geographical or political boundaries of Europe. Many authors have described future wars as “wars of cultures” or “wars of civilizations” (Eastern vs. Western, Southern vs. Northern etc.). The influence of cultural area on armament development could be analyzed in at least two aspects: cultural tradition and technological culture. Cultural tradition means in this case certain historically shaped stereotypes of: insidious, “Machiavellian” usage of armament or honest, “open-faced” usage. The armament itself reflects both stereotypes. Mines, traps and particularly IED-s as well as certain kinds of WMD or cyber-weapons represent the first stereotype. Development of “smart” and remote-controlled mines as well as computer viruses and drugs could be good examples of modern incarnations of the old stereotype. The second stereotype is represented among others by new generations aircraft, combat vehicles, artillery, light weapons. The other aspect – technological culture – means level of technological education and technological skills as well as saturation the area with modern technology. Technological culture means not only the ability of manufacturing but also maintaining and supporting logistically the high-tech weapons. There are numerous examples of frequent failures and extremely “short life” of expensive modern armament exploited in the low technological culture areas – not only because of battle damages but also due to lack of preventive inspections, disobeying maintenance principles, careless or abandoned overhauls, obsolete servicing infrastructure, using non-original spare parts, not keeping the storage and servicing regimes and schedules, insufficient skills and knowledge of users, lack of technical education and training. Therefore education and training programs are often included in armament development plans. Historical examples show that in many cases armament contributed to spreading technological culture in given area. This kind of feedback seems one of the reasons for creating new centers of armament production and development in the new areas. Analyses of the present day dynamics of the discussed above areas of security environment have showed the importance of the new approach to forecasts of development of armament of potential opponents which should be input information on particular stages of planning procedures.

4. Forecast information necessary for armament development planning

Armament development plans are often parts of broader strategic documents like e.g. strategic defense reviews, armed forces development plans, defense industries development plans, economy development plans, coalitions and alliances' strategic plans. Armament planners are not the only customers of information generated by security environment forecasting – but it seems useful for the forecasters to have some knowledge on what futuristic information would be necessary for the planners. On the other hand armament development planning requires different kinds of information not only on the future but on the present and on the past as well. Following considerations intentionally pass over the two last kinds focusing primarily on the future. Therefore the described below information environment of the planning procedure is incomplete and reduced to futuristic aspects only. The illustrative planning procedure (fig. 9) starts from the planning task. Necessary forecast information – on particular stages of the procedure – has been divided into two parts: the information got from the long-term forecast of security environment (SE) and the information got from the long-term forecast of scientific and technological development (S&T). On the two initial stages of the procedure (I. Determining planning scope and horizon; II. Working out long-term vision and mission) necessary information comes from predicted SE architecture reproduced by set of SE descriptors and from the forecast of future S&T advances. From the side of future SE architecture – the input information to both stages constitute: “selected characteristics of future SE” and “expected influence of selected areas of SE”. From the side of future S&T advances – the corresponding inputs are: “predicted achievements in selected areas of S&T” and “expected disruptive technologies”. Next two stages of the procedure (III. Identifying products; IV. Formulating critical system requirements) need information coming from scenario-based forecast of SE (“needs for future armament” and “predicted development of potential opponents' armament”) and from the forecast of available technologies (technological challenges and technological limitations). For stages: V and VI (V. Specifying alternatives and their timelines, VI. Selection of alternatives) – necessary information from SE side is forecast of detailed indicators and parameters of SE transformed into risk assessment whilst from S&T side – forecast of detailed indicators and parameters of selected technologies transformed into feasibility assessment. Selection of alternatives requires information on selection criteria which comes from political, economic and military strategies (SE side) and from scientific research and technology development strategies (S&T side). The last stage of the planning procedure is “Working out strategic plans” of two development processes: “achieving critical armament system” and “developing selected technologies supporting the system”.

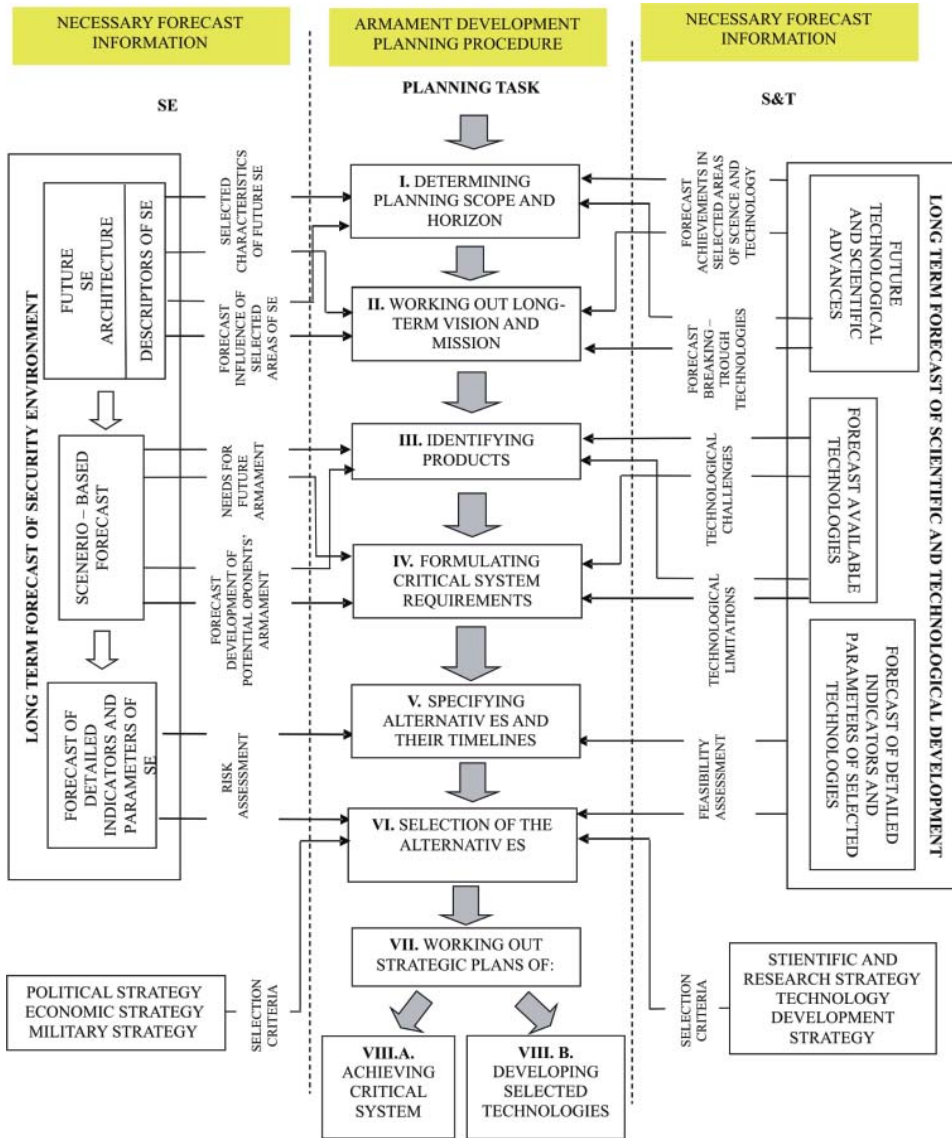


Fig. 9. Forecast information necessary for armament development planning

5. Application examples of armament development planning procedure

One of the elements of national security requirements is possibility of fulfilling and maintaining operational capabilities by armed forces in determined time horizon. The future structure of security environment influences this process, therefore particularly important is definition of main areas and factors which will influence the planning process of weapons systems development (fig. 10). The analysis of future structure of security environment is very important, because it decides what will be the vision and tasks of armed forces in the determined time horizon¹.

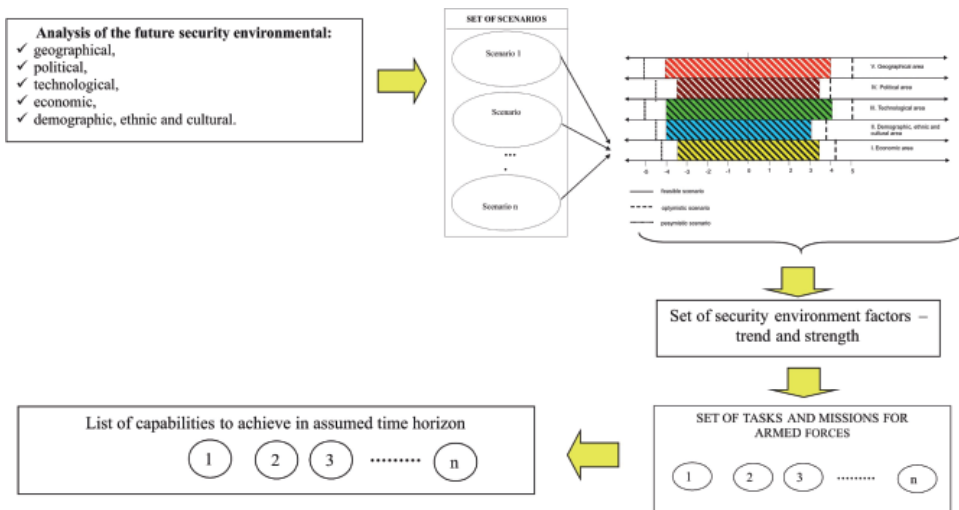


Fig. 10. Analysis of future security environment factors

Following conditions should be subjected to the analysis:

- political,
- technological,
- economic,
- demographic, ethnic and cultural,
- geographical.

In every of mentioned above areas the factors have been defined changes of which could influence particular phases of armament development planning (table 1). Below selected fragments of the scenarios' analysis of international security

¹ Adopted from *Vision of the Polish Armed Forces 2030*, Ministry of National Defense, Department of Transformation, Warsaw, May 2008.

environment have been presented to define perspectives of weapons systems development in Poland.

Table 1. The analysis of tendencies in the security environment

Factors	Trend	Strength	Propability [0;1]
I. Economic area			
Level of inflation	Growth	-5	0,6
	Stabilization	+1	0,3
	Regress (fall)	+5	0,1
Level of GDP	Growth	+5	0,6
	Stabilization	+1	0,3
	Regress (fall)	-5	0,1
Costs level: labor, energy, transportation, materiel	Growth	-5	0,6
	Stabilization	+1	0,3
	Regress (fall)	+5	0,1
Employment (and level of unemployment)	Growth	+3	0,5
	Stabilization	+2	0,3
	Regress (fall)	-5	0,2
Level of international trade (business)	Growth	+5	0,8
	Stabilization	+2	0,1
	Regress (fall)	-3	0,1
II. Demographic, ethnic and cultural area			
Population level	Growth	-4	0,6
	Stabilization	+2	0,3
	Regress (fall)	+3	0,1
Age structure of population	Growth	-5	0,8
	Stabilization	+2	0,1
	Regress (fall)	+3	0,1
Urbanization and concentrating population in urban centres	Growth	-5	0,8
	Stabilization	+2	0,1
	Regress (fall)	+3	0,1
Life style (life conditions) and cultural traditions	Growth	+5	0,6
	Stabilization	+1	0,1
	Regress (fall)	-4	0,3
Health protection	Growth	+4	0,5
	Stabilization	+1	0,1
	Regress (fall)	-5	0,4
Level of education	Growth	+5	0,4
	Stabilization	+1	0,2
	Regress (fall)	-4	0,4
Monitoring common natural resources	Growth	+4	0,6
	Stabilization	+1	0,2
	Regress (fall)	-5	0,2

III. Technological area			
Scientific-exploratory potential in the area of armament	Growth	+5	0,4
	Stabilization	+1	0,2
	Regress (fall)	-4	0,4
Length of the life cycle of technology	Growth	-5	0,2
	Stabilization	+1	0,1
	Regress (fall))	+4	0,7
Innovativeness and accessibility of new technologies	Growth	+5	0,5
	Stabilization	+1	0,3
	Regress (fall)	-5	0,2
Level of expenses on research and development in the area of armament	Growth	-3	0,5
	Stabilization	+1	0,4
	Regress (fall)	+2	0,1
Level of computerization of weapons systems	Growth	+4	0,7
	Stabilization	+1	0,1
	Regress (fall)	-2	0,2
IV. Political area			
Political systems	Growth	+3	0,5
	Stabilization	+3	0,3
	Regress (fall)	-4	0,2
Parties and political organizations	Growth	-4	0,5
	Stabilization	+3	0,2
	Regress (fall)	+3	0,3
Political stabilization	Growth	+3	0,4
	Stabilization	+2	0,2
	Regress (fall)	-5	0,4
Affiliation to international organizations and economic and military blocks	Growth	+5	0,6
	Stabilization	+2	0,1
	Regress (fall)	-3	0,3
Availability of government guarantee	Growth	+3	0,2
	Stabilization	+3	0,3
	Regress (fall)	-4	0,5
Level of the commercial protectionism	Growth	-4	0,5
	Stabilization	+2	0,2
	Regress (fall)	+4	0,3

V. Geographical area			
Opening of frontiers	Growth	+4	0,5
	Stabilization	+2	0,2
	Regress (fall)	-4	0,3
Migrations and population movements	Growth	-4	0,5
	Stabilization	+2	0,2
	Regress (fall)	+4	0,3
Growing demand for non-renewable natural resources	Growth	-5	0,8
	Stabilization	+1	0,1
	Regress (fall)	+4	0,1
Growth of new countries on the international map	Growth	-5	0,8
	Stabilization	+1	0,1
	Regress (fall)	+2	0,1

In the next stage of the analysis the selected factors have been grouped according to three scenarios: optimistic, pessimistic and most probable. The graphic presentation of chances and threats for the future security structure presents figure 11.

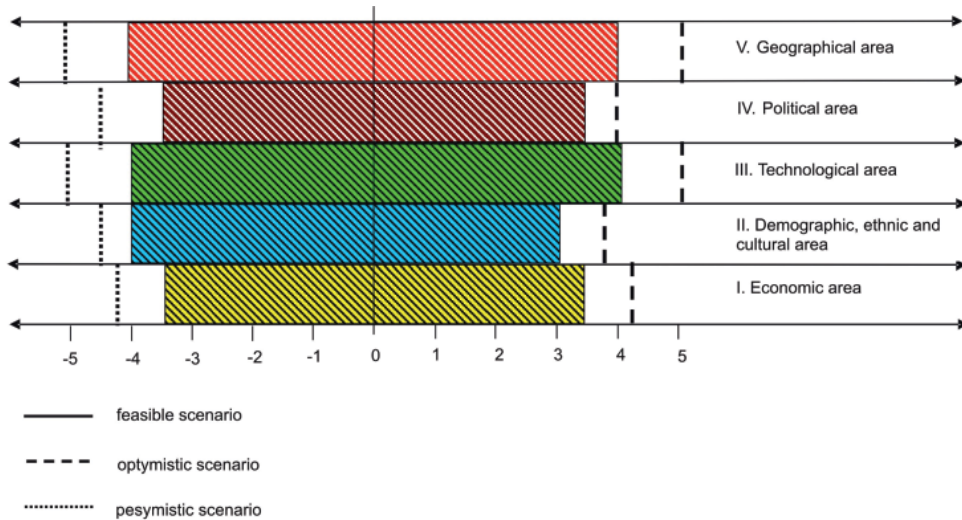


Fig. 11. Strength and direction of trends influencing the security environment structure

Several conclusions could be derived from the accomplished analysis which will influence defining operational requirements and armament development planning in considered time horizon.

Opening of frontiers, growth of international trade and increasing interdependencies between states, which stimulate further integration of economic systems, may essentially limit the possibility of existence of real confrontation sources

having global range. However, their lack will not mean a complete disappearance of threats in international relations. Essential factors generating real threats for the international security environment in the first decades of 21st century and determining their qualitative and quantitative levels, might be: **negative results of progressing globalization, significant demographic growth in African states and in the Middle East, climatic change and limited access to natural resources.** The above mentioned factors may also include growing disproportions in the quality of life between the rich and the poor, both inside particular countries and between individual states, infrastructural diversity, as well as polarization of cultures and religions. Political, economic, social and cultural problems stemming therefrom may contribute to further growth of ideological and religious extremisms and their transformation into political movements, growth of international terrorism and organized crime of a supranational or even super-regional range. Under unfavorable circumstances, the said problems may also become a source of instability and disintegration of state structures and state collapse. They may also lead to local or even regional conflicts and wars waged using differentiated forces and weapon systems. **Waves of refugees and migrations of the population within a given state or group of states** shall be another factor destabilizing international political and military situation. These will be the result of natural disasters, poor economic conditions, internal crises, ethnic cleansings and conflicts. Migration waves of supranational and super-regional nature will result in transferring local conflicts to clusters of immigrants of different nationality and creed in rich countries, where they might become a source of antagonisms and internal crises whose scale and range might be difficult to assess. **A quick urbanization and concentration of the population in urban centers** will be a significant feature of the world development within the next 20-25 years. This phenomenon shall be particularly dynamic in the African continent and in the Middle East. Intense urban development and a simultaneous decrease of employment possibilities will result in a **growth of the unemployment, poverty and pathology districts in which huge numbers of people representing different religions** shall be concentrated. It will also lead to increasing conflicts and tensions. Nature of the future threats shall be linked with specific geographical areas. Conflicts and wars between states will be a characteristic feature of South and East Asia and Africa. The African continent will also see collapsing state structures. **A growing demand for depleting and non-renewable natural resources, particularly sources of energy,** may also be a major challenge to the international security. The fact that a significant part of the world oil and natural gas resources is concentrated in unstable regions and authoritarian states may lead to a formation of trouble spots, conflicts and wars which, in turn, might result in a significant energy crisis. Rivalry and struggle for the control over strategic resources, as well as the desire to ensure constant supplies

of energy resources, may result in new turbulences and essential changes in the system of forces. As a consequence, numerous distrustful and rivalling blocs or alliances of local or regional range might appear, which would try to achieve their objectives through military confrontation. Challenges to the future international security environment might also stem from the condition of international economy and financial markets. Periods of stagnation and economic depression may lead to disturbances of the world economic stability and cause crises and conflicts.

From such analysis following factors appear to influence armed forces development. There are:

- new actors in the security environment,
- enemy operating on easy terms,
- enemy employing a wide range of combat methods,
- future wars fought on a different levels and in many spheres of human activities,
- the battlefield of a diverse nature,
- the military actions taking place in urban areas and major metropolises,
- cyberspace and information sphere as combat areas of a huge potential,
- operations of Polish Armed Forces carried out in international environment,
- expeditionary form of military operations,
- expeditionary forces of a combined nature,
- operations carried out by military units synchronized with activities of governmental and nongovernmental organizations,
- military operations carried out on the basis of new command concepts,
- military operations within expeditionary forces carried out in two phases,
- air forces, special units and highly mobile task groups important for the future military operations,
- information predominance as a basic condition of the success,
- unnamed vehicles and robots commonly used in military operations.

The mentioned factors will influence the character of future missions and tasks, capabilities of Armed Forces should result, to carry out the tasks in future security environment. The list of the capabilities is following:

- ability for an effective reconnaissance,
- ability to effective command,
- ability to conduct effective activities,
- ability to strategic transportation and ensuring high level of mobility,
- ability to survive and protect the troops,
- ability to maintain continuity of actions.

The question appears: *how could this capabilities be achieved?*

The illustrative answer concerns one important element: strategic transportation and ensuring high level of mobility and protection of troops through development of manned vehicles.

Presently following technologies are developed in relation to selected characteristics of armored vehicles:

- vehicle mobility, making possible the quick change of location after the shout fire, and high speed on hardened and wildernesses ways,
- capabilities of deck fire systems, making possible overpowering of the opponent from safe distance,
- resistance on the enemy fire carrying on kinetic and cumulative bullets, and in the future of other ways of directing energy.

From the analysis of world tendencies of armed forces tasks and conditions of future operations with particular reference to the operations in urban areas armored vehicles could be divided into following groups (taking into account: **mass, tasks and armament**)²:

- **patrol high availability vehicles** with the mass of 7 tons, 4 x 4 wheels system, intended to transport the infantry patrol or used as high availability cars, armored in class II and armed with the machine-gun;
- **the 10-15 tons mass vehicles on the 4 x 4 or 6 x 6 wheeled or tracked systems**, intended to combat missions in open and urban areas, making possible transport of infantry team and supporting its activity in the distance of 500 meters by grenade launcher, also to provide safe transport of special equipment (e.g. reconnaissance, communication, command and medical evacuation systems);
- **the mass 15-25 tons vehicles, on the 8 x 8 wheeled or tracked systems**, making possible transport of infantry team and supporting its operation in the distance more than 500 meters by 30-120 mms cannons and mortars, also provide safe transport and functioning of special huge dimensions equipment (e.g. reconnaissance, communication and command systems);
- **the greater mass vehicles**, heavy armored and used in breaking, organized defense.

Some countries define their own requirements concerning armored vehicles in different way. They pay more attention to small scale forces armored vehicles (10-25 tons mass) which could be transported by air by helicopters and aircraft C-160, C-130, A-400M. After the year 2030 the development of multi-role units seems very likely³.

² Z. Mierczyk, *Modern technologies in military systems*, Military University of Technology, Warsaw 2008.

³ *Land Operation in the Year 2020*, RTO TR 8 (AC/323(SAS)TP/S, March 1999, *Urban operation in the Year 2020*, RTO- TR-071 AC/323(SAS-030)TP/3S, April 1998.

Final choice is the system which enables achievement of the determined capability and subsequently the possibility of national defense system and armed forces to respond the previously specified threats.

An important element on this stage is analysis of parameters characterizing the armament and military equipment (fig. 12). Following characteristics should be the subject of the analysis:

- tactical and technical parameters (e.g. range, mass, speed, etc.),
- logistic parameters (e.g. levels of services, time between services, volumes of supplies connected with the wearing of system components, the number of necessary logistic staff etc.),
- economic and political parameters (e.g. influence on the economy of the country, influence on international conditions, possible industrial cooperation, etc.),
- training (e.g. training periods, accessibility of training bases, certification of specialists, etc.).

In analysis of every of the presented group of characteristics different research methods could be used both qualitative and quantitative. For example to asses the tactical-technical characteristics we can use the taxonomic method. This method makes possible comparisons of basic characteristics of analyzed armament and military equipment (or group) with expected characteristics (or standards) and on this basis the best armament and military equipment could be defined.

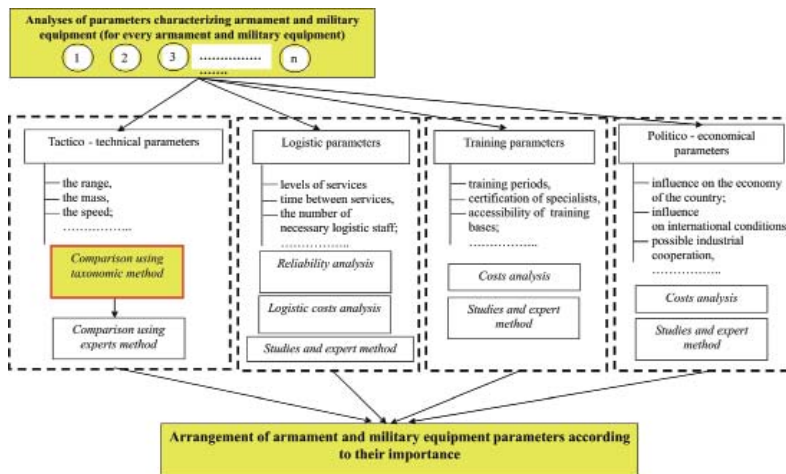


Fig. 12. Analysis of armament and military equipment characteristics (adapted from [6])

For instance the analysis of modern solutions, concepts and prototypes has shown that two systems of modern armored vehicles are presently preferred: wheeled armored vehicle and tracked armored vehicle (fig. 13).

The taxonomic method facilitates the choice of best type and structure of the armored vehicle. This method is particularly useful when features of the system are difficult to measure or sizes characterizing the system are measured in different units. The method's base is the assumption on the additivity, which means that the global value of the object could be calculated as the sum of partial values. The result of application the taxonomic method has been the choice of armored vehicle, which adjustment to the anticipated tasks could be defined by parameters (fig. 14).

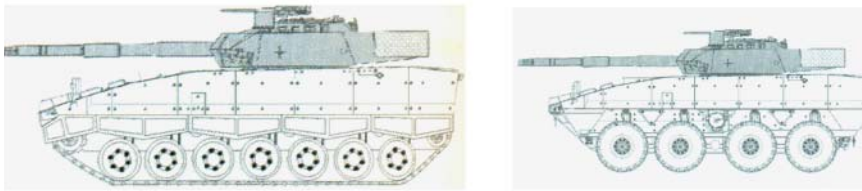


Fig. 13. Two systems of armored vehicle (adapted from [8])

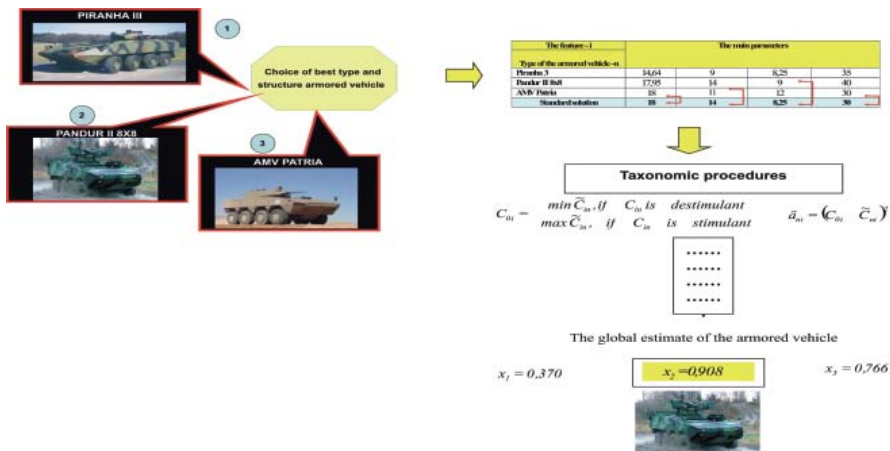


Fig. 14. Taxonomic method facilitates the choice of best type and structure armored vehicle

In this case the result of the analysis was attributing the highest estimate to the wheeled armored vehicle – Pandur II 8 x 8.

4. Conclusions

Armament is inherent part of security environment. As the pace of scientific and technological development increases the feedback between the development of armament and changes of security environment becomes stronger. In general the forecasting of security environment and armament development planning are parallel

processes the information exchange and cooperation between which are very useful. In this paper mainly the one way information flow – from forecasting to planning – has been discussed. From the planners' needs point of view the long range forecast of security environment has been divided into three parts: future security environment architecture, scenario-based forecast and forecast of detailed indicators and parameters of security environment. Exemplification the whole path of the planning procedure with selected armament case studies using information provided by all the three parts goes beyond the limits of the paper. Selected examples have been considered as a way to realize the number and scope of forecasting issues related to armament development planning. The authors intention is to continue the considerations and discussion on the issues. Particularly interesting seems the research on the influence of credibility, accuracy and risk connected with security environment forecasting on the course and final result of armament development planning procedure.

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Ewolucja środowiska bezpieczeństwa i planowanie rozwoju uzbrojenia

Streszczenie. W artykule scharakteryzowano czynniki wpływające na planowanie rozwoju uzbrojenia. Opisano najważniejsze tendencje występujące w wyodrębnionych obszarach środowiska bezpieczeństwa (geograficznym, politycznym, ekonomicznym, demograficznym, etnicznym, cywilizacyjnym) i ich odzworowanie w rozwoju aktualnych systemów uzbrojenia oraz w wizjach uzbrojenia perspektywicznego. Przedstawiona została procedura perspektywicznego planowania rozwoju systemów uzbrojenia z uwzględnieniem niezbędnych informacji prognostycznych związanych z ewolucją środowiska bezpieczeństwa. Wybrane fragmenty procedury planistycznej zilustrowano przykładami obejmującymi określone rodzaje uzbrojenia. Sformułowano wnioski dotyczące badań wpływu wiarygodności, dokładności i ryzyka związanego z prognozowaniem środowiska bezpieczeństwa na przebieg i końcowe rezultaty procedury planowania rozwoju systemów uzbrojenia.