

Formation of Quasi-Integrative Aircraft Construction Structure within Ukrainian Defense System In Terms Of Small-Scale Aircraft Production (on example of SE "Antonov")

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Abstract— Urgent need of successful embedding of national high-tech enterprises of the national military-industrial complex in the global reproductive cycle is grounded. The analysis of quasiintegration processes in knowledge-intensive and high-tech sector is conducted and basics of creating mobile quasiintegrative aircraft mconstruction structure in the military-industrial complex as one of the areas of defense industry integration in the global defense industry. Urgency of decentralization of aircraft building corporations and refusing from closed technological cycles as natural measures of increasing management flexibility and response to complications of their basic functions (R&D, manufacturing, marketing, sales, planning and accounting, investment) is scientifically grounded. Basics of system integration in the aircraft industry as a new model of technological chains management on example of EADS corporation are explained where product integrators implemented model of the globally integrated supply chain Global Sourcing Network (GSN). Creating open model of aircraft manufacturing corporation on the basis of domestic aircraft building enterprises in the system of military defense is grounded, which involves the purchase of structural elements of the highest quality from specialized suppliers, uniform design and manufacturing and service enterprises, and involving capacity of aircraft construction corporation only for assembly work, which will ensure reduction in the duration of the project-production cycle, decreasing of working capital and transaction costs parrallel with cost savings on production of structural elements and more. Conceptual basis for the formation of quasi-integrative aircraft construction structure on the basis of domestic aircraft construction enterprises headed by leading aircraft enterprise SE "Antonov". Additional formats of quasi-integrative relations in the creation and functioning of quasi-integrative aircraftconstruction structure as a mobile economic unit are described, namely quasi-internalizing and externalizing relations format, quasi-externalization which assumes within the network relations preserving by the main system integrator control over the assets and hierarchy of all structural elements of the system based on the market coordination and vertical disintegration through outsourcing, etc. The question of balanced functioning of quasi-integrative aircraft construction structures based on the united subjects' resources complementarity is considered; selecting participants by the criteria of economic feasibility of common effective functioning, sectoral affiliation, specialization, as well as the location of enterprises and related co-productions; concentration of ownership, which leads to the strategy of the quasi-integration initiators in the part of rights distribution management in accordance with the capital share.

Index Terms— Quasi-integration, quasi-integrated aircraft construction structure, system integration, defence industry.

I. INTRODUCTION

Forming an open economy leads to increased competition in the global market and urgent need for scientific substantiation of the successful embedding of national high-tech enterprises of the military-industrial complex in the global reproductive cycle.

This raises the topicality of taking into account economy of military organization, including the effective functioning of the military-industrial complex (MIC) of Ukraine, where new technologies of military purpose are produced, basic production of military-air technics (IWT) concentrates, scientific-technical and technological foundaions are accumulated, as well as state-owned military-technical policy is realized. An important component of defense industry of Ukraine that has high defence, economic and scientific importance is production and scientific-technical potential of the enterpeises of military and civil aircraft construction sector. Needs of accelerated development of a competitive defense industry of Ukraine require scientific substantiation advanced forms of economic integration of aircraft construction enterprises in the form of quasi-integrative aircraft construction structure, which is a single, flexible integrated system of high-tech production technology and modern design.

1.1 The purpose of the article is analysis of the processes of quasi-integration in the science-intensive sphere and formulating foundations for creation within a system of defense industry a mobile quasi-integrative aircraft construction structure as one of directions of defence sector integration into the world defence industry.

II. LITERATURE REVIEW AND CONCEPTUAL UNDERPINNINGS

Peculiarities of functioning network structures and issues of integrative-logistical approaches to business management and creating a network of integrated supply chains, which are widely used in industrialized countries, is reflected in scientific works [12, 13,14, 15].

Production potential of high-tech enterprises of the defense industrial complex of Ukraine and mechanisms for its effective use, especially in international relations, is discussed in sources [1, 9, 10].

Integration of material and informational resources in the world's leading aircraft building companies as one of the main factors of competitiveness of integrated supply chains and experience of forming inter-organizational and inter-sectoral

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cooperation and competition models are presented in the works [2,3,11].

Issues of system integration as one of the manifestations of business networks nature is confirmed by scientific opinions [4,6,7,8]. However, in terms of new integrative challenges in high-tech field issues of the possibility of building flexible quasi-integrative structures, particularly in the defense system, as new aircraft construction units in an open industry and object-oriented model of aircraft construction.

III. RESULTS AND DISCUSSION

For a long time in terms of industrial and partly in the post-industrial economy an optimal direction of transformation and development of defense enterprises was the centralization of the bulk of high-tech manufacturing of arms in defense TNC based on wide profile and presence both in the markets of weapons and civilian products, which usually always have a clear national "core". Herewith it does not prevent the creation of strategic alliances of TNC [].

Formation of a single global scientific, technical and technological space, increased organizational flexibility of enterprises through segmentation or the dissolution of large enterprises and cooperatives of small and medium-sized enterprises through the development of new flexible forms of quasi-integration ("quasi" from the Latin "quasi" - like - "almost", "close") is characteristic for the current stage of development of the international division of labor in the high tech field.

Quasi-integration in contrast to the classical integration does not assume full control over the property and management of the combined assets, and provides only control over the behavior of formally independent participants in the absence of legal control over their property. System-inherent feature of quasi-integration - is an organized coordinated activity of partner organizations seeking to reach their goals through participation in joint projects, implementation of which aims at integrating their resources and core competencies, and is supported by modern information technology. Result of quasi-integration is creation of flexible integrative structure, involving in the agreed financial, industrial, technological, commercial activities many manufacturing, engineering, service, R&D-centers. Features of quasi-integrative structure are operational inclusion of the required additional participants and possibility of participating in several high-tech projects; ease of entry/leaving of integration structure; high motivation of enterprises in a sustainable concerted action. In a more specific sense quasi-integrative structure is interpreted as "artificially formed" or "imaginary, that does not exist in the real physical space" [2], but which, in our opinion, can be regarded as an economic unit newest integrative organizational form.

Practical embodiment of quasi-integration used in high-tech sectors of the economy, in particular in the aircraft industry, is system integration, which is characterized by a chain from the ODM (original design manufacturer – developer of the product and/or design) to the OEM (original equipment manufacturer – manufacturer of the product having the trademark or brand) and then to the CEM (contract

equipment manufacturer – contract manufacturer of products, operating under the trade mark of the customer, OEM). In this chain, the OEM-enterprise when creating a new product uses services of other organizations and practically performs only final assembly of the product and gets the most profit, whereas the production of components (parts and assemblies) and most of the actual production is transferred to contract manufacturer. In this case created quasi-integrative structure is based on the identification by the OEM-company its strongest sides (so-called core competencies) and conducting independent work only within the framework of this competencies. Outside the structure OEM-company uses outsourcing. OEM-company promotes use of new information technologies for the integration of joint activities.

In our opinion the relevance of decentralization as a natural measure to increase the flexibility of management and response to complications of the basic functions of a high-tech corporation (R&D, manufacturing, marketing, sales, planning and accounting, investment), is determined by variability of the environment above all, especially in the field of high-tech production, so high-tech corporation with a closed production cycle does not have time to adapt to new conditions, which ultimately leads to lower efficiency.

So in this context of conducted studies of the world's leading aircraft building companies has showed that currently the driver of integrative processes are not M&A processes (although it is possible), but construction and preservation of technological chains through the following key components:

1) change of design system by integrating design in lifecycle management (6D design, simulation design in version Simulate-Design-Integrate-Validate. Only standard design throughout the technological chain allows integrating, production and service. This integration is carried out at various stages, first MIL (Model-in-Loop) simulation is performed or development of software SIL (Software-in-Loop) and is ended by testing of hardware HIL (Hardware-in-Loop). The integration of the factory model with management model or code provides the necessary accuracy and availability of variables necessary for control (fig.1.);

2) changing patterns of innovation policy by capturing innovations from the outside through the coordination of research programs, interaction with independent researchers and developers;

3) re-engineering of business processes (outsourcing model, transition from vertical integration to module organization supply chain). Model of outsourcing can significantly reduce internal transaction costs associated with movement of the product within the vertically integrated structure from one technological stage to another. Unfortunately in Ukraine outsourcing is not very common,

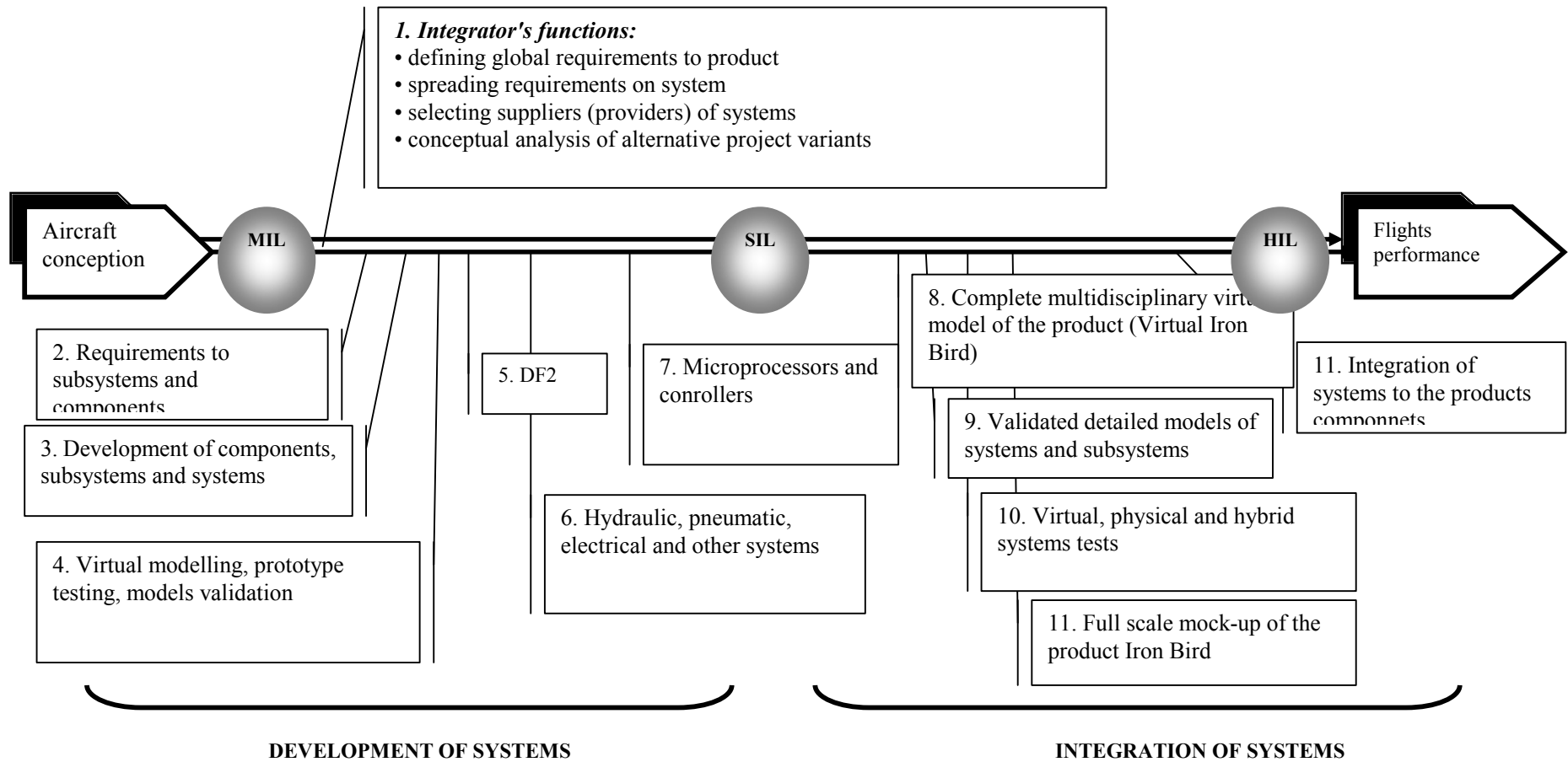


Fig. 1: Model of system integration of AIRBUS corporation

Source: Developing the 21st Century Aerospace Workforce. MIT Center for Technology, Policy and Industrial Development .Lunch Presentation, October 2001

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and many companies, developing its business model, follow the path of integration due to the lack of reliable specialized companies that can transfer some of its functions [83].

As striking example current business model of leading European aerospace corporation EADS can be commented, according to which development strategy is reduced to a re-engineering process chain and focusing on core functions in the technological chain - simulation design and sales management (market). The rest of the processes are transferred to outsourcing (yes, EADS presented Vision 2020 which recorded a purpose - to provide global outsourcing to 40% of all manufacturing operations).

Interesting solution to minimize increased risk of dispersal of manufacturing operations for product integrators is to change model of technological chain and effective communication within the territorial production cluster which has the following rule: the most efficient logistics and the lowest transaction costs occur in the localization of the main parts of the process chain in 50-kilometer area. For the new model of technological chain one can note introduction by the product integrators model of Global Sourcing network (GSN) (in particular, EADS (including Airbus EADS) took it in 2008), whose offices were deployed over the world in the areas of localization of the main suppliers of EADS. Thus within this area of research one can state new trend of the market of large aircraft constructors when the main developer of the aircraft is increasingly becoming the systems integrator whose functions include: determining global requirements for product, spreading requirements on the systems, choice of suppliers (developers) of systems, conceptual analysis of alternative projects, integration of system into the product elements. In our view, as a possible variant of development of domestic aircraft building enterprises in the system of defense industry can be considered a transition to a new model of manufacturing aircraft corporation, which provides for the purchase of structural elements of the highest quality from specialized suppliers, uniform design and manufacturing and service enterprises, and utilization of aircraft corporation capacity only for assembly work. This will help to reduce the duration of the production cycle and design cycle, decrease necessary amount of working capital and transaction costs, and thus lead to significant cost savings and reducing the cost on production of structural elements, etc.

Quasi-integrative aircraft structure as a mobile economic unit in the creation of a particular agreed product implies close relationship of trust between counterparties to minimize the cost of coordination and reduce information uncertainty among individual companies, thus, reducing transaction costs and more efficient use of resources.

However we should underline that main core of quasi-integration is the presence of monitoring over the behavior of independent companies - subcontractors for the lack of control over their property performed by active enterprise of the quasi-integrative aircraft construction structure. As an active company and OEM-company of quasi-integrative aircraft construction structures can serve SE "Antonov" (at present is part of the SC "Ukrboronprom") because it has distinct character of leadership and plays leading role in the production of aircraft. Yes, SE "Antonov"

in accordance with the Regulation "On the general designer for creating technology for defense and security" N 1010 from 31.08.2011 coordinates research, experimental design, research and technological works and production by the companies - and provides scientific-technical and organizational support of creating products and technologies of the world level. SE "Antonov" is the legal owner of the intellectual property rights on their researches, including the registered trademarks "Antonov", "ANTONOV", "RUSLAN", "AH", "AN", certificates of civil aircraft types and has the exclusive right to permit and prohibit the use of rights in production, sales, repairs, maintenance of products manufactured on the basis of its researches. As well as aviation technology developer and the owner of the certificate type SE "Antonov" during all the time of development and production provides architectural support of production.

Thus, the range of SE "Antonov" functions is very wide and significant, which can be added with the right to control quality of products and services provided, require the fulfillment of license agreements and implementation of measures to address the deficiencies and copyright of aircraft maintenance etc.

It should be noted that with the transfer of design documentation and technology of manufacturing new aircraft to serial and repair facilities SE "Antonov" actually invests own intellectual capital in these enterprises, contributing to the development and introducing new technologies (including information) in factories, training professionals, job creation and most importantly - capitalization of serial companies. Taking into account reasonable transfer of functions and rights it can be said about feasibility of giving to SE "Antonov" status of active company in quasi-integrative aircraft construction structure to enter a new round of international relations and contracts.

Content guidelines for the development of quasi-integrative aircraft construction structure on base of leading aircraft construction enterprise of Ukraine SE "Antonov" are shown on fig. 2.

In our own view during creation and functioning of quasi-integrative structure as a mobile economic unit in course of manufacturing certain agreed product additional coordination possibilities based on trust between aircraft construction enterprises can be implemented in following variants:

1) quasi-internalizational relations format. General aircraft construction company - final system integrator pursues its monopoly power through universal control mechanism of collective behavior in relation to supplier-companies and subcontractors (range of vertical restraints), while maintaining legal status of partners. In the structure of market exchanges are viewed items of hierarchical coordination, long-term relationships of integrative type "principal-agent" are established.

2) externalizational relations format. Consolidated aircraft construction company which is forced to respond quickly to rapidly changing conditions in the external environment, transfers number of internal business functions to outside performers on contract basis. This externalizational format of relations can be realized in two basic forms:

- quasi-externalization which involves preserving of main

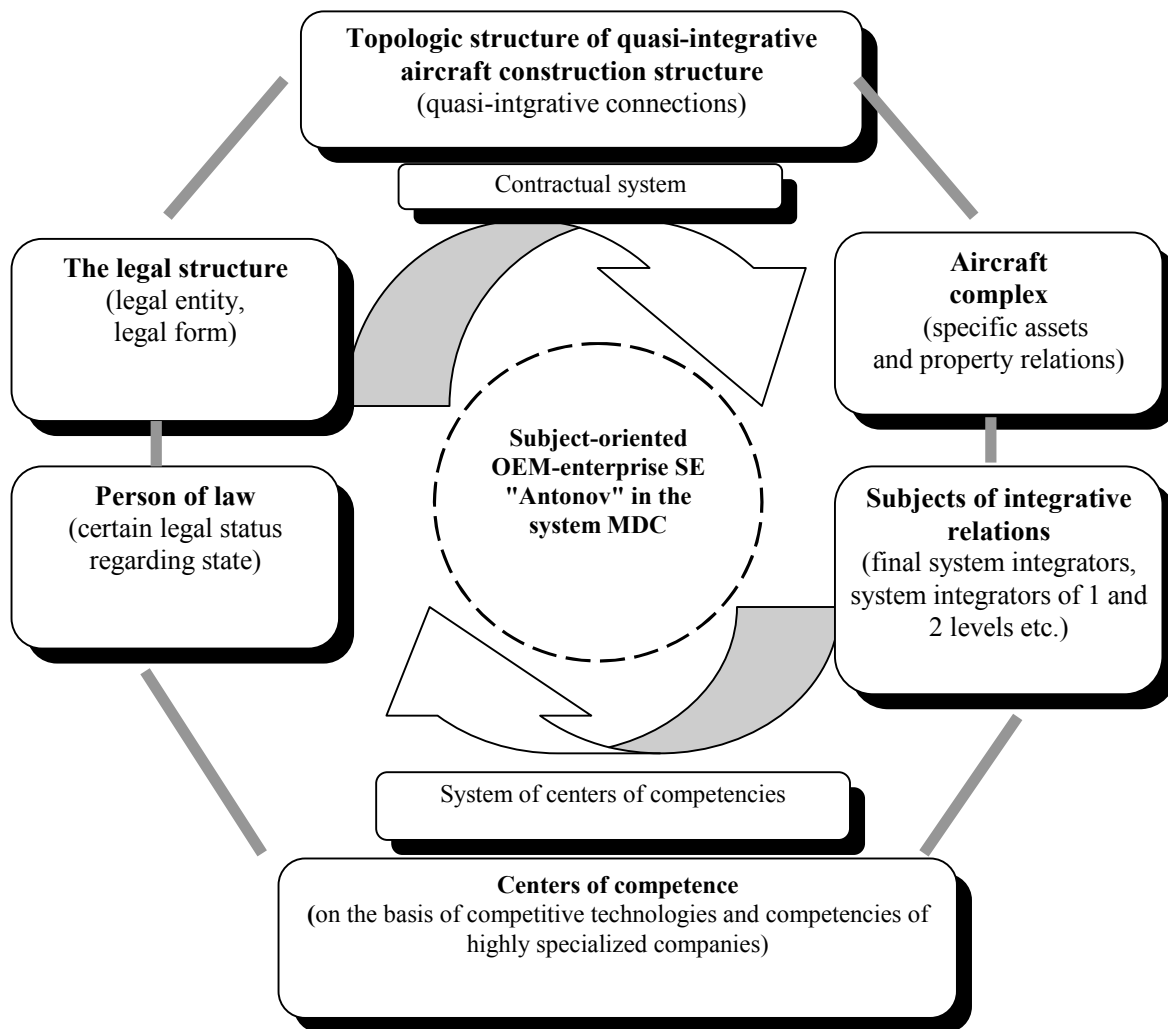


Fig. 2:
Conceptual guidelines of forming quasi-integrative aircraft construction structure
Source: developed by author

system integrator control over the assets within the network relations and hierarchy of all structural elements of the system based on market coordination;

- vertical disintegration through outsourcing. Decentralization of system integrators' power happens at each stage of technological process, leading to the full withdrawal of assets owned by integrated company. This process entails the appearance of legally and economically independent system integrators and forming of long-term intercompany relations.

I. CONCLUSION

Provided study of variety of quasi-integrative integration forms shows that relations of private ownership on assets are complicated and modified, with the growing responsibility of private owners regarding encumbrances on property assets. This means that presence of objects owned by individual investors has less importance, and more emphasis is on motion made by legally separate assets. Thus, in our opinion,

private ownership and disposal of specific assets of

aircraft construction enterprises within quasi-integrative structures tend to take into account also integrated results besides investment interest that provides benefits of joint efforts to control asset management of independent allied enterprises in the process manufacturing of consistent product. Thus on the basis of the private are formed elements of collective appropriation of quasi-integrative structures performance results.

Therefore, the dual model of "integration-disintegration" expanded to three-tier chain "integration-quasi-integration-disintegration" and quasi-integrative aircraft construction structure is defined as a perspective open mobile business unit, which consists of legally independent but economically (technologically) related specialized high-tech enterprises (competence centers and system integrators) that within quasi-integration based on multi quasi-integrational connections include joint involvement of

specific assets in commercial projects, high degree of confidence, information openness and mobility, achieving certain economic benefits of participants agreed in manufacturing of the product.

Thus, in our view, very important question of quasi-integrative aircraft construction structure's balance arises that's based on: resource complementarity of the uniting entities (which implies intragroup comprehensive utilization of labor, scientific, technical, industrial and financial resources); selecting participants for the economic feasibility of common effective functioning, sectoral affiliation, specialization, as well as enterprises location and related co-productions; extent of concentration of ownership, which determines strategy of quasi-integration initiators' in the distribution of rights management in accordance with capital's share. We should emphasize in this context that theoretical and methodological basis for system integration as justification of formation of quasi-integrative aircraft construction structure on basis of SE "Antonov" as an open mobile entity of subject-oriented aircraft production in the system of military defense of Ukraine, is just the latest form of economic integration - quasi-integration. Wherein goal of balancing elements of newly created quasi-integrative aircraft construction structure is to achieve long-term sustainable multifaceted competitive advantages and economic efficiency, which is essential for embedding defence military complex in the global defense complex.

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