Integration processes in industry: theoretical approaches and pestilence experience

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Abstract: The current article considers the evolution of the concept of "integration" and the empirical development of the theory of consolidation. The advantages, disadvantages, as well as outstanding representatives of the main scientific schools: federalism, neofunctionalism, communication theory, liberal intergovernmentalism and network approach, neo-institutionalism, social constructivism, legalist approach. The main hypothesis is the assumption that the postulates of the theory of the network approach currently most fully identify the integration processes in industry. The article presents the main forms and examples of the enterprise integration of various industries in the context of world experience, such as: machine tool building, power engineering, aircraft building, non-ferrous metallurgy, shipbuilding, oil production.

1. Introduction
The uncertainty of the current state of the world economy prompts to go beyond the usual functioning of industrial enterprises in order to maintain and intensify the competitive position in the market [1]. In particular, when introducing managerial innovations, first of all, it is natural to turn to theoretical knowledge of scientific thought and the successfully implemented practical experience of other enterprises. As practice shows, integration is one of the most successful ways to overcome the crisis of industrial performance, and it manifests itself in various forms and has passed a significant path of development. Consequently, the need to understand the evolution of integration processes and the theory of consolidation for the effective functioning of industrial enterprises in a transforming economy determines the relevance and objectives of the study.

2. Problem statement
Representatives of world economic thought have been actively involved in the theoretical and practical foundations of the development of the theory of integration for a long time (from the end of the 19th century to the present). Discussions about the root cause of the integration processes, their content and regulation, as well as, most importantly, the definition of the effectiveness of integration as a process, are still relevant.

3. Research questions
What forms and types of integration are preferable, which countries and industries have achieved the greatest synergistic effect in the framework of the consolidation of assets and resources? These are the points outlined in the study.
4. Purpose of the study
Based on the research questions raised, the purpose of the work can be defined as generalization and systematization of the development of theoretical knowledge of integration processes, as well as the main forms of enterprise integration based on the study of the experience of various industries in a global context.

5. Research methods
The use of methods of scientific knowledge to identify the most profound, essential aspects of the theory of integration, the connections between them, and the main regularities, shortcomings that determine the change in the generally accepted paradigm, such as abstraction, generalization, analogy, analysis and synthesis formed the basis of this study [2]. Thus, a hypothetical-deductive model of the scientific method, including the use of experience, the formulation of assumptions and conclusions, makes it possible to solve the tasks and achieve the goals of this work.

6. Findings
The study of integration problems in economic processes is presented in works dated as the end of the 19th century and the early 20th century, and the term "integration" comes from the Latin integration (restoration), as well as integer (whole) [3]. Following this approach, integration means the restoration of disparate parts into one whole. From an economic point of view, integration can be considered as the formation of production and innovative communications for the symbiotic exploitation of resources, including human resources, as well as the concentration of capital, complimentary agreements, and increased competitiveness.

Undoubtedly, the study of scientific works of foreign and domestic scientists enables to form an idea of the nature of integration processes, their evolution and contributes to the relevance and implementation of proven experience in practice.

The main schools of integration research can be visualized in chronological order in figure 1.

| 1920-1940       | 1950-1960      | 1970-1980       | 1990-to the present               |
|-----------------|----------------|-----------------|-----------------------------------|
| Federalism      | Neofunctionalism | Legalist approach | Liberal intergovernmentalism     |
| (A.Spinelli,   | (E.Haas,       | (A.Lenaerts, P.Mancini, | (A.Moravcsik)                   |
| K.Friedrich,    | L.Lindberg,    | J.Weiler, D.Rasmussen, |                                   |
| D.J.Elazar,     | Ph.Schmitter,  | M.Cappelletti)   |                                   |
| A.Marc, H.Brugmans, | L.Scheinemann |                 |                                   |
| P.Duclos)       |                |                 |                                   |
| Communication theory (K. Deutsch) | | | |

Social constructivism (P.Berger, T.Luckmann, N.Luhmann)

Neo-institutionalism
(M.Pollak, J.Buchanan, H.Demsetz, R.Coase, D.North, R.Posner, G.Tullock, O.Williamson)

Figure 1. Major schools of integration studies (compiled by the authors based on [4-14]).

One of the first, in 1920-1940, the scientific course of federalism became widespread thanks to A. Spinelli, K. Friedrich, D.J. Elazar, A. Marc, H. Brugmans, P. Duclos and others, who revealed the ideal form of interaction - federation, as an optimal combination of separate parts with the obligatory institutionalization of the union. M. Albertini defined the federation as “a suitable tool to unite humanity within the framework of a multilevel system of democratic governance” [4]. However, the school relied mainly on the political aspects of integration processes, not taking into account the economic and social component.

In contrast to federalism, E. Haas, L. Lindberg, Ph. Schmitter, L. Scheinemann and others developed the theory of neofunctionalism, which denied the automatism of integration, proving the importance of
the political component, but through economic cooperation. E. Haas argued that integration processes stimulate functional needs, and also introduced the concept of "spillover", implying the spread of integration from one industry to another [5]. Unlike functionalism, neo-functionalism implies not global, but regional cooperation. Representatives of this school denied the stimulation of integration from the outside.

In parallel with neo-functionalism, the theory of communication arose, the founder of which was K. Deutsch. The main idea of the theory is stable interstate interaction based on the optimality of costs taking into account the socio-psychological component. The main concept is communication as a way of transmitting messages and signals, exchange of information for effective functioning and accumulation of experience, aimed at the formation of a common identity and a sense of the community [6]. Within the framework of the theory, the automation of managerial decision-making is promoted, with a separation from the psychology of persons responsible for making strategic decisions. In addition, the theory is imputed to the ambiguity of the goals, first of all, of persons who implement managerial functions. Also the statement that the basis of the theory is the decision-making process was criticized, focusing on information flows, neglecting the very essence of the problem, and not aimed at the consequences of managerial influences [7].

The development of neo-institutionalism can be found in the works of M. Pollack, J. Buchanan, H. Demsetz, R. Coase, D. North, R. Posner, G. Tullock, and O. Williamson. Formation of economic and social institutions (rules of behavior and methods of maintaining rules) as the basis for the transformation of institutional structures, based on integrated knowledge. The main paradigm of the theory is property rights, as well as the introduced concepts of costs associated with transactions, strategic alliances, business ties. Thus, R. Coase defined transaction costs as “costs of using the price mechanism”, “carrying out exchange transactions in the open market” or “market costs” [8]. In these studies, the use of the postulates of game theory has become widespread. The difficulty of assessing the level of transaction costs, as well as the explanation of the actions of the integration participants by the "logic of conformity", despite the effectiveness of strategic decision-making, were harshly criticized. At the same time, a shift was noted in the main aspects of the theory from the expediency of the integration process to the study of interests and assortative mating of the choice of the form of integration, as well as understanding the root cause: who forms the rules? Institute? Or the rules form the institution [9]?

The theory of social constructivism, which emerged in the period from 1966 and is developing to the present, is found in the works of such scientists as P. Berger, T. Luckman, and N. Luhmann. In accordance with this theory, the participants in the integration process influence each other, leading to an identity based on established traditions. This process has been defined as social construction. For example, Berger described the need for integration processes in the following way: “Designing ... the routine actions in turn makes it possible to divide labor between them, opening the way for innovations that require a higher level of attention” [10]. The undoubted novelty and independence from other theoretical approaches to the study of integration are questioned by many critics as one of the versions of the liberal intergovernmental approach. It should be noted that the theory of social constructivism was not initially associated with the theory of integration.

A. Lenaerts, P. Mancini, J. Weiler, D. Rasmussen, M. Cappelletti in the period 1970-1980 founded a legalist (legal) approach. This school recognizes law as the predominant integrating factor for successful integration. However, even supporters of this theory came to the conclusion about the root cause of the integration of the interests of the participants themselves, and not the rigidity and direction of the activity of the legal mechanism [11].

A. Moravecik at the end of the 20th century introduced a liberal intergovernmentalism, highlighting a three-level approach to integration processes: the first level includes coordination of the interests of stakeholders, the next level - coordination of positions, formulation of integration proposals, the final level - making a final decision, delegation of powers, with the priority of internal policy over the outside. “Integration becomes possible only upon finding between... the interests... a common denominator” [12]. This theory has been criticized for the lack of analysis of interactions between stakeholders to explain the reason for integration. On the other hand, the principles of liberalism underlie the abstraction
from the behavior and interaction of integration participants, and this theory defines the above factors as the basis for the first level.

From an economic point of view, the most interesting are the postulates of the network approach, the development of which continues to this day. J. Peterson, E. Bomberg considered integration as a set of networks that generate unique information and resources that the participants in the integration process would not have separately. The main advantage of their vision is the universality of the presented methodological scheme, which is coordinated with all known theories of integration. J. Peterson and E. Bomberg define the concept of a political network as follows: “a group of actors, each of whom is involved in one or another segment of political governance, realizes their interests in it and has the ability to influence the success or failure of making and implementing a political decision and the practical measure provided by it” [13]. But critics revealed the insufficient substantiation of the criteria for assessing the effectiveness of network interaction, a significant predominance of description over analytics, the high role of partnership in making strategic management decisions [14].

The authors believe that the postulates of the theory of the network approach currently most fully identify the integration processes in industry. Since this scientific approach combines the main ideas of most of the schools represented, and, most importantly, it defines integration as a source of exceptional knowledge and resources, which the participants in the integration process do not have before unification (the so-called synergistic effect).

In addition to theoretical knowledge, the effect of increasing understanding of the nature of integration processes, their effectiveness or a negative result can be obtained by studying the types, forms and examples of integration in the world community (table 1).

**Table 1.** The main forms and examples of the integration of enterprises by industry (world experience)³.

| Industry          | Country     | Prevalent form of integration | Examples                          | Key characteristics                                                                 |
|-------------------|-------------|-------------------------------|-----------------------------------|-------------------------------------------------------------------------------------|
| Machine building  | Japan       | Concentrated vertically      | JMTBA                             | High level of corporate governance, diversified ownership structure                  |
|                   | Taiwan      | integrated production        | TAITRA                            | Division of labor, lack of vertical integration within companies - State planning and consolidation of resources in the cluster |
|                   | China       | Asset consolidation, cluster | China Machine & Tool Builders Association | Two leaders controlled by the state Success depends on the future development of its technological base |
|                   | the USA,    | organization                 | General Electric and Alstom       | In the USA, it is possible to create holdings only within one industry              |
|                   | Sweden      | Asset consolidation          | General Electric and Alstom       | In the USA, it is possible to create holdings only within one industry              |
| Power engineering | France,     | Joint venture                | Siemens and Power Machines        | The possibility of involving several foreign partners to increase the company's financial capabilities and minimize the financial risks of domestic investors |
|                   | Germany and |                               |                                   |                                                                                     |
|                   | Russia      |                               |                                   |                                                                                     |
| Aircraft construction | Japan | Public-private partnerships, vertical corporate groups | Hitachi, JEMA | World leaders, the state provides investment resources, transactions in related industries are prohibited |
|-----------------------|-------|-------------------------------------------------------|--------------|------------------------------------------------------------------|
| Interstate cooperation | Consortia | Vertical principle, technological | EADS, Airbus, SSJ-100, Horizon 2020, Future Sky and Clean Sky 2 | Revolutionary ideas, technological breakthroughs |
| the USA | | Vertical principle | Alcoa | Control over as much of each of the production stages as possible, significantly reduced the raw material component in the cost of aluminum |
| Non-ferrous metallurgy | Canada | Vertically integrated company | Alcan | Low production costs, market leader, control over as much of each production stage as possible |
| Norway | Vertically integrated company | Hydro | Continuous unit costs reduction for the production of final products, control over as much of each of the production stages as possible |
| Norway | Cluster structure | Marex | Horizontal integration, the world's leading specialized cargo ship providers through collaboration |
| the USA | Large corporations | General Dynamics | Close interaction of military and financial departments, scientific organizations and shipbuilding firms in the planning and implementation of shipbuilding programs |
| Shipbuilding | China | Public private partnership | CSSC and CSIC | Leader in shipbuilding, government assistance in the purchase of technology and equipment, concessional loans for production, subsidies for R&D and encouragement of structural reforms in the industry |
| Oil production | Malaysia | Vertically integrated company | Petronas | A wide range of activities in the oil and gas sector, owned by the government |

*Source: compiled by the author based on many sources.*

As the study of world experience shows, the maximum synergistic effect occurs when the integration process covers regions, countries, various industries, depending on strategic goals, including global ones. This determines the variety of types and forms of integration [15].

**7. Conclusion**

Thus, the study and generalization of the core provisions of the considered approaches to the theoretical knowledge of integration processes makes it possible to formulate the conclusion that the postulates of the theory of the network approach currently most fully identify the integration processes in industry.
Since this scientific approach combines the main ideas of the schools of the theory of integration and, most importantly, it defines integration as a source of exceptional knowledge and resources that the participants in the integration process do not have before unification (the so-called synergistic effect). The results of the study revealed quite rare examples of pure integration within the same industry and country, which confirms the effectiveness of cross-sectoral cooperation to increase the competitive potential of participants in integration alliances.

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