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Tetiana Bodnarchuk¹

**POLICY OF THE TRANSITION FROM AGRICULTURAL TO
HIGH-TECH EXPORT IN CONDITIONS OF PERMANENT
MILITARY THREAT: ISRAELI EXPERIENCE FOR UKRAINE²**

The Russian-Ukrainian war causes the loss of a significant part of Ukraine's production and raw and food export potential, which creates the risk of economic insecurity in the long run. At the same time, the new challenges create favorable conditions and opportunities for restructuring the national economy in the direction of developing high-tech areas and increasing the science-intensiveness of traditional industries. Today, the question is to choose the most effective institutional and economic mechanism for such a transformation, as exemplified by the State of Israel.

The article is devoted to the research of the Israeli practice of transition to high-tech production and the formation of an innovative export-oriented economy. The author aims to clarify the conditions, factors, mechanisms, and tools for the successful economic transformation of Israel in terms of the possibility of implementing the acquired historical experience in Ukrainian realities.

The methodology is based on a systematic approach, which considers the economic transformation of Israel as a set of processes and systems of closely interrelated elements (historical conditions, institutional factors, public policy, available resources, economic potential, etc.). It is necessary to

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apply the historical-evolutionary approach to identify the features and trends of the country's transition from traditional spheres of production and export to high-tech. In this context, comparative-historical analysis is used.

The precondition for the transition of the State of Israel to high-tech production and exports was the development of powerful science-intensive complexes of its own agricultural and defense production through targeted public and private investment, subsidies and loans to producers, stimulating education and research, a unique system of public-private partnership (so-called "gold triangle"). It is determined that the use of defense technologies in production of the double-purpose products (in space, aviation, cybersecurity spheres), the flow of intellectual capital, and the formed research base became the basis for the development of pharmaceuticals, electronics, microelectronics, computer hardware, and software, etc.

The key role in the Israeli transition to high-tech production and exports was played by state support policy implemented by grant funding instruments for education and R&D, venture capital incentive programs, tax and credit benefits for small and medium businesses, an extensive system of institutional assistance, and effective legal regulation of the business environment for the protection of intellectual property rights, granting special privileges, simplifying the procedure of repatriation of profits, ensuring high-quality products, etc. The policy of "arms diplomacy", trade liberalization, tax, credit, and institutional support of exporters, the conclusion of a system of agreements on international trade, and economic and scientific-technical cooperation contributed to the formation of the competitive advantages of Israel in the markets of high-tech products.

Keywords: *The State of Israel, agricultural production, defense-industrial complex, high-tech production and export, policy of state support, trade and economic liberalization*

In the context of the Russian-Ukrainian war, Ukraine is rapidly losing its competitive position on international markets, which certainly poses a threat to its economic security in both the short and long term. Ukraine is "at

risk" of losing its status as an exporter of raw materials and agricultural products: in fact, over thirty years of independence, a tendency to simplify national exports formed, although in the second half of the twentieth century, the structure of export trade was dominated by products of mechanical engineering, chemical, energy, and other industries [1]³. Accordingly, today's new political challenges and economic determinants create conditions for changing priorities in economic development, consolidating available resources, reorienting them towards restructuring national production and developing high-tech industries, and thus shaping the basis for progressive changes in the structure of exports. This in turn raises the question of choosing mechanisms and instruments for such an economic transformation, which undoubtedly requires a study of effective international practices.

Taking into account everything mentioned above, the experience of the State of Israel is of interest to Ukraine. Firstly, it is a country that thrived for decades in the face of constant military threats and a hostile environment. Secondly, it is a country that surprised the world twice, first by becoming one of the main agricultural producers, while lacking adequate natural resources, and now by becoming an innovation leader. Thirdly, at the start of the economic transformation, Israel resembled modern-day Ukraine in the difficult conditions of state-building, which are: a heavy military conflict, economic crisis, social destabilization, a threat to food security, high dependence on external supplies of products, weapons and capital. Today, however, the State of Israel is one of the world's top ten high-tech countries⁴. It is not only one of the world's leading producers, but a global exporter of innovative products. The country underwent a long period of economic transformation, from a focus on traditional industries to the development of high-tech industries. In particular, trends in Israel's economic structure over the past 25-30 years are presented in Table 1.

³ A more detailed issue is covered in the fundamental study of the Department of Economic History of Institute of Economics and Forecasting of NAS of Ukraine: Historical determinants of Ukraine's inclusion in the system of international economic relations: collective monograph / edited by Dr. V. V. Nebrat; National Academy of Sciences of Ukraine, State Institution "Institute of Economics and Forecasting of NAS of Ukraine". Kyiv, 2021. 528 p.

⁴ According to the Bloomberg Innovation Index in 2021, the State of Israel ranked seventh among the 60 most innovative countries in the world in terms of R&D spending, concentration of high-tech companies, added value of production, patent activity, etc.: Most Innovative Countries 2022. World Population Review. URL: <https://worldpopulationreview.com/country-rankings/most-innovative-countries>

Table 1

**Change in the structure of production and exports of the State of Israel
by main economic sector, %**

The structure of the country's GDP by main sector		
	1995	2020
Agriculture	2.3	1.4
Industry	31.3	23.9
Services	66.4	74.7
Structure of the country's exports by main economic sectors		
	1990	2020
Agriculture	5.4	1.3
Industry	90.6	44.8
Services	4.0	53.9

Source: Central Bureau of Statistics. National Accounts 1995–2020. URL: <https://www.cbs.gov.il>; Central Bureau of Statistics. Exports by Economic branch. Statistical Abstract of Israel 1996. No.47. URL: <https://www.cbs.gov.il>; Central Bureau of Statistics. Imports and Exports of Goods and Services. Statistical Abstract of Israel 2021. No.72. URL: <https://www.cbs.gov.il>

The country's economic and technological growth was achieved due to a strong intellectual resource combined with a number of effective economic reforms and a well-balanced economic policy of the government, which is undoubtedly worth noting. At the same time, direct implementation of the Israeli model of economic development in Ukraine's realities is impossible because of the key differences between the countries in terms of population size, the level of homogeneity of their national-ethnic composition, cultural-mental and religious-values features, intellectual capital development trends, etc.

The phenomenon of the "Israel's Economic Miracle" is quite widely reflected in the works of contemporary foreign economic scholars. An in-depth review of the Israeli economy, which went through armed conflicts, migration, rapid growth, and governmental neoliberal economic policies is provided by J. Zeira [2]. The sources of growth and stagnation of the Israeli economy, as well as the peculiarities of development of the industrial and agricultural sectors, foreign trade, labor and capital markets are studied in the works of P. Rivlin and M. Shalev [3, 4]. J. Nitzan & Sh. Bichler [5] approach the assessment of the determinants of Israeli economic growth from the perspective of the concept of capitalization of power, paying attention to the role of regional conflicts, energy crises, the dominant ideology, the policy of militarism, etc. The problems of state regulation of the Israeli economy, the evolution of socio-economic and political institutions are revealed in the scientific developments of I. Sharkansky [6],

B. Neuberger [7] and other scientists [8]. Conditions, factors and mechanisms of scientific and technological development of the Israeli economy were analyzed by D. Senor, S. Singer [9], D. Abraham, T. Ngoga [10] and other researchers [11]. These issues are also of interest to domestic scholars, primarily in terms of the application of positive international experience to Ukrainian realities [12-17].

The purpose of this study is to identify the determinants and mechanisms of the state of Israel's transition from agrarian and raw material specialization of production to the development of industries based on knowledge and technology, and export of innovative products. In this way, the author tries to continue the conducted scientific exploration and aims to highlight - given Israeli practice - the most effective and productive tools of qualitative economic transformation in terms of the possibility of their use for the reorientation of the Ukrainian economy to innovative and technological development.

Prerequisites and mechanism for the formation of a high-tech agrarian production model in the State of Israel

The prerequisite for Israel's economic miracle was the identification of clear priorities for the country's development in the 1950s-60s:

- stimulating agrarian and industrial production in order to achieve self-sufficiency, develop foreign trade activities and strengthen the country's position in the geopolitical space;
- establishment of a national defense complex in order to enhance military security;
- development of the nation's intellectual potential through active support for science and education.

This view is supported by the fact that it was exactly in the 1950s and 1960s that the entire state budget of Israel was distributed as follows: 1/3 was allocated to support agriculture and water management, 1/3 to national defense and 1/3 to the development of the scientific and educational sector [10, p. 18]. Under the conditions of a massive shortage of resources and food, increasing dependence on foreign markets, the development of Israel's own agro-industrial complex became one of the main goals of the Israeli government.

At the beginning of the reforms, agriculture was an important sector in Israel's economy, providing a significant share of GDP and employment. The situation is the same in Ukraine, but in war, the national agricultural sector suffers because the land is occupied, mined, and turned into a

battlefield and transport and logistics routes are blocked or destroyed. At the same time, the growing problem of food security requires attention to the technological modernization of Ukraine's agriculture, so the agricultural production based model of the State of Israel serves as a good example from this perspective, since this model's nature is not extensive, but rather high-tech.

The country with limited land and water resources turned into one of the leaders of agricultural production and strengthened its position in agricultural exports: today, Israel has the highest productivity in cow's milk, citrus fruits, tomatoes, and is a leader in the cultivation of dates, pomegranates, nectarines, plums, strawberries, avocados, jojoba, etc.

At the same time, more than 40% of agricultural output is cultivated in the desert [10, p. 10]. The focus on the development of agricultural production was taken in view of the need to achieve food security and the importance of the country's integration into the world market. In the post-war period, industrial Europe had a considerable demand for food and agricultural raw materials, and exports were vital for Israel, primarily as a source of payment for arms, of which there was no national production at the time. Israel's strategy of "desert bloom" looked more like a "government venture", but in practice it yielded significant positive results - the formation of a knowledge-intensive agricultural sector and the establishment of full-fledged agricultural production and processing chains.

Government support played a key role in the development of the agricultural sector of the State of Israel. The state actively promoted the development of the agricultural sector through a direct funding mechanism. For example, in the 1990s, the Israeli government allocated 300 million USD per year for the development of agriculture [15]. At the same time, government aid was exclusively earmarked for the manufacture of products that had an export potential. As soon as demand for a certain product dropped in the foreign market or a stronger competitor emerged, state funds were redirected to the development of a more profitable product. In the 1990s, for example, Kenya's growing position in the overseas flower market encouraged government subsidies to support vegetable and tree crops; falling melon prices redirected public investment towards the sweet pepper and date market. Farmers received substantial subsidies and soft loans. The state pursued a policy of active price regulation of agricultural products. Support was provided not only directly to agricultural producers, but also to allied industries: substantial funds were invested in new agricultural and



water technologies - such as irrigation, water supply, desalination, and wastewater treatment systems; the expansion of agricultural machinery and equipment, chemical and mineral fertilizers, pesticides, and the food and pharmaceutical industries was supported.

In addition, the government provided financial support for the development of farmer education - a number of regional producer training and advisory centers were set up, and extensive agricultural research and development was carried out, enabling crops to be grown in the desert. In particular, the Volcani Centre, a division of the Ministry of Agriculture that now has 200 scientists in the fields of crop production, soil science, animal husbandry and agricultural engineering, was opened under the auspices of the government and its 100 per cent funding [10, p. 23]. In addition, research stations were set up at local levels to provide scientific services to farms. It was the close cooperation between farmers, scientists and industries related to agriculture that ensured a high level of technologization and augmentation of agricultural production, and the creation of a holistic and innovative complex.

Government support for the development of agricultural production was implemented through the mechanism of an extensive system of bodies and institutions, including the Ministry of Agriculture, the Ministry of Economy and Innovation, crop production and marketing boards, the Agricultural Research Centre, etc. These state bodies do not have an administrative, controlling and regulating function, but rather act as "co-participants" in production through a centralized planning system (determining what to produce and how much) and as centers for joint public-private decision-making. For example, specialized agrarian councils (citrus, date, cotton, etc.) are involved in promoting production in foreign markets: they take on the functions of market research, collecting and disseminating market information, and developing new markets. Farmers focus only on the production process itself. Such councils are financed by the state, as well as with a low agricultural levy, royalties from licenses and commissions on the sale of products. In other words, it is a state body acting as a marketing company with an interest in production, promotion, and sales.

Another factor in the rapid development of agricultural production in Israel was the close cooperation of the producers themselves. The association of agricultural communes (kibbutzim), moshav agricultural cooperatives and private farms helped to achieve economies of scale and

expand the market reach. Within the framework of agricultural cooperatives conditions were created to optimize production costs, accelerate marketing, reduce the risks of unprofitability, and to attain wider introduction of innovation and technological innovations [12, p. 12].

Active cooperation was established with both academic institutions and government agencies. The State of Israel developed a unique ecosystem of public-private-scientific partnerships - the so-called "golden triangle", involving close cooperation between the three sectors, that is, government, research and farming. The cooperation is so close that a farmer can easily contact scientists at any time (by phone, via messenger) and send, for example, a photo of a pest or damaged fruit directly from the field. This system of mutual accessibility is facilitated, firstly, by the fact that in Israel bureaucrats, scientists and farmers are all on the same level of education and social status, mostly former classmates and those who served together in the army. Secondly, specialized state councils, scientific institutions and research stations are part of the overall bureaucratic pyramid, and were created precisely to support the respective agricultural producers.

An important role in the rapid development of Israeli agricultural production was played by the massive financial support of the wealthy Israeli diaspora. The development of agriculture in Israel was financed by the Jewish National Fund, which was founded as early as 1901. This non-profit and quasi-governmental organization was used to plant 240 million trees, build 180 dams and reservoirs, develop 250,000 dessiatinas (~hectares) of land and create a powerful transport and logistics infrastructure [10, p. 40]. Private investors, such as Barons Maurice de Hirsch and Edmond de Rothschild, also helped to develop the country. In 1970, the US-Israeli Agricultural Research and Development Foundation was established under the auspices of the American diaspora, which invested about \$300 million in the Israeli research sphere over the entire period of its existence. [10, p. 40]. The importance of private venture capital funds, such as International Finance Corporation, Vertex Ventures, Horizon Ventures has increased since the mid-1990s.

Thus, targeted public and private investment both directly in agricultural producers and in the high-tech development of related industries supporting agriculture (agricultural technology, machinery and equipment, chemical industry, food industry, pharmaceuticals), subsidies and loans to producers, the elimination of state bureaucracy, the promotion of farmer education and research, and a unique mechanism of public-private-scientific

partnership all contributed to the formation of a developed model of intensive agricultural production, which served as the basis for the country's food supply and strengthened its export position.

Since the mid-1990s, the general reorientation of the country towards innovative development also increased the knowledge- and technology-intensive nature of agriculture. Immigration also played a key role, encouraging an influx of qualified specialists to Israel, some of whom were educated in the natural sciences. The agricultural sector, which continues to be important for Israel, is currently developing in areas such as biotechnology, genetic engineering, smart farming, the robotization of farm operations, the development and implementation of innovative systems for irrigation, water desalination, crop protection, crop storage, the establishment of a seamless farming information system through cloud technology, etc. [15]. The country has become a hub for the development of agricultural business incubators and start-ups, a number of which have world-renowned names - Beeologics, Kaiima, Taranis, Evogene, MiRobots and others.

Features of the State of Israel's transition to high-tech production and exports

The increase in knowledge-intensive agriculture in Israel contributed to the expansion of the value-added of the agricultural sector and in labor productivity. As a result, the demand for industrial products increased, which led to the rapid development of industry, as well as of a technology-intensive services sector. This, in turn, led to a decrease in the importance of agricultural production in the structure of the country's economy. There was a gradual transition from production aimed mainly at local markets to high-tech export-oriented industries [18, p. 5]. While in the 1950s-1970s agricultural products dominated in the export trade, in the 1990s the basis of export was formed by the products of traditional industries, and today the leading positions are occupied by industrial high-tech industries and the service sector (Table 1, 2). In the current environment, the State of Israel is an important exporter of technology-intensive services, among which computer and R&D products account for the largest share. Computer equipment, optical and medical instruments, electronics and microelectronics, pharmaceutical and chemical products, etc. form the basis of Israel's merchandise exports.

Table 2

**Commodity structure of the industrial exports of the State of Israel:
comparison of 1990 and 2020 data, %**

Major industrial exports	1990	2020
Foodstuffs, beverages, tobacco	5,8	2,3
Textiles and leather products	6,7	1,0
Chemicals and pharmaceuticals	13,6*	21,7
Computer equipment, electronics and optics	8,5	44,0
Machinery and equipment	20,2	6,1
Diamonds	29,6	6,3

* A measure of the specific weight of chemical products only.

Source: Central Bureau of Statistics. Exports by Economic branch. Statistical Abstract of Israel 1996. No.47. URL: <https://www.cbs.gov.il>; Central Bureau of Statistics. Imports and Exports of Goods and Services. Statistical Abstract of Israel 2021. No.72. URL: <https://www.cbs.gov.il>

The share of high-tech exports (including industrial products and technology-intensive services) in the 1990s was 45-47%, and, according to 2020 data, it was 52% [19, p. 14]. Over the past 30 years there was a tendency to strengthen the role of high-tech and medium-high-tech industries in the industrial sector (Table 3).

Table 3

**Commodity structure of the State of Israel's industrial exports by level
of technological sophistication: comparison of 1990 and 2020 data, %**

Industrial products according to level of technology	1990	2020
High-tech: pharmaceuticals, computer hardware, optics, electronics, aircraft and spacecraft	29,6	37,1
Medium high-tech: chemicals, machinery and equipment, medical devices	31,0	41,4
Medium technology: fuels, rubber, plastics, metals, mineral products	20,0	14,2
Low-tech: Foodstuffs, tobacco products, textiles, paper, furniture	19,4	7,3

Source: Central Bureau of Statistics. Manufacturing exports by technological intensity. Statistical Abstract of Israel 2012. No.63. URL: <https://www.cbs.gov.il>; Central Bureau of Statistics. Manufacturing exports by technological intensity. Statistical Abstract of Israel 2021. No.72. URL: <https://www.cbs.gov.il>

As noted above, in the 1950s and 1960s, the Israeli government invested heavily in supporting agricultural production, which included

encouraging the development of related industries - machinery, chemicals, metal fabrication and processing, plastics, food and pharmaceuticals.

In order to support national production, appropriate legal and regulatory support for measures to improve the quality of Israeli products was developed: the law "On Standards" was adopted [18, p. 12], the Standards Institution of Israel (operating independently of the government, composed of representatives of business, government, and the scientific sector on an equal basis) was established, compulsory standardization and testing for certain types of products (agricultural, pharmaceutical, machinery and equipment) was introduced. To support scientific developments in traditional industries, the system of protection of intellectual property rights and industrial property was improved: laws and regulations were adopted "On patents", "On designs", "On trademarks", "On product names", "On breeders' rights", and "On copyright" [18, p. 13].

In order to stimulate investment activities, the law "On investment promotion" was introduced [20], as well as the laws "On the industrial R&D Support" [21], and "On the Regulation of Foreign Currency Transactions" [18, p. 12]. A Small Business Incentive Fund was established, a system of credit and tax incentives for businesses was developed: special privileges, exemption from administrative restrictions, and free conditions for repatriation of income. In order to form an effective competitive environment, Israeli Restrictive Trade Practices Law was adopted, which defines the conditions for preventing the emergence of monopolistic associations and fighting against them [22].

The development of appropriate legal and regulatory frameworks, production subsidies, a system of soft loans and tax privileges, together with favorable state innovation policies, which were implemented through various grant programmes for financing specific industries (machine building, energy, chemical industry, pharmaceuticals, etc.), technological and medium high-tech production, contributed to the development of a powerful base for medium-technological and medium-high-tech production, whose role in exports remains significant today.

The main prerequisite for Israel's high-tech transition was the development of the defense industry. Until the 1970s Israel had no military production of its own - weapons were only imported and came mostly from France. But after the Six-Day War in 1967, when Charles de Gaulle imposed an arms embargo and the Soviet Union increased its military exports to the Arab states, the Israeli government understood that its high

dependence on foreign military production was a strategic loss and a threat to national security. As a consequence, the country sought for help from the USA and stepped up its own resource and production capabilities.

During the 1960s to 1990s, a powerful production of high-tech weapons, military electronics, flight and navigation systems, spacecraft, radar systems, air defense systems, etc. was established. Among the manufacturers, the main leaders were both public and private corporations: Israel Military Industries, Israel Aircraft Industries, Rafael Advanced Defense Systems, Elbit Systems Ltd., Soltam Systems, Tadiran Electronic Industries [23, p. 58; 13, p. 88]. The constant military threat determined the fact that from the mid-1970s Israel became a country with its own space developments, and in the 1990s-2000s it became a leader in the field of cyber security. The establishment of Israel's own powerful military production contributed to the formation of competitive advantages on foreign markets: 70-75% of defense production went abroad, mostly to Europe [23, p. 58]. The strong development of Israel's defense sector was aided by significant government support (one third of the budget was spent on military production), as well as US financial aid and German reparations. In 1973-1982, annual U.S. grants and financial aid was \$1.9 billion (which covered up to 60% of defense imports), and in the 2000s, \$2 billion. Between 1976 and 2001, Israel as a whole received \$81 billion from the US, and over the past half century it received \$130 billion. [23, p. 57; 12, p. 7]. However, US funds were used to purchase US weapons, and only a quarter of them were allowed to be used for domestic military development, with Israel being the only country where such a practice was allowed.

Funding was also needed for research and development in the military sphere. The Israel Science Foundation played an important role here. With organizational support from the state academy of natural sciences and humanities, it awarded grants on a competitive basis in the fields of exact sciences and technology, life and medical sciences, and humanities and social research. Additional funding was provided by bilateral foundations, such as the U.S.-Israel Binational Science Foundation (BSF) and the German-Israeli Foundation for Scientific Research and Development (GIF). These funds were used to establish a number of research centers and introduce programs to improve education. For example, the elite Talpiot and Psagot training programs to support talented academic youth were successfully launched and implemented under the auspices of the Israel's Ministry of Defense.

In order to expand the export of Israeli military products, a relevant regulatory and coordinating body was established – the Foreign Defense Assistance and Defense Export Department (SIBAT), whose main tasks included promoting Israeli products on foreign markets; facilitating cooperation in the military-industrial sphere; ensuring marketing and sales of military products in the power structures of foreign countries'; providing services for exporting weapons and military equipment; and licensing military export activities [23, p. 62-63]. There is a definite feature – a government structure in the defense sector is endowed with the functions of a marketing company. Military export control used to be a system of disparate standards and directives; in 2007, a unified law on military export controls was adopted, in which an important part was the strengthening of accountability for violations and fraud in this area.

The failed attempt to build the Lavi fighter jet in the 1980s is seen as the greatest boost to Israel's high-tech industry. After the IAI Lavi, the Israeli defense industry focused more on producing military components, electronics, avionics and other systems mounted on American or other platforms [24]. Numerous reciprocal procurement agreements were concluded with leading aerospace and military manufacturers, which helped support high-tech industries. The country became a successful defense exporter, but with a shrinking global market for military products. Presently, the State of Israel is strengthening its position in high-tech civilian production. This transformation is due to the following factors:

- existing high-quality human potential;
- a strong R&D foundation and base;
- formation of an innovative business environment;
- an active government policy of support and assistance.

Over the years, the defense sector of the State of Israel developed a strong R&D infrastructure and a cohort of highly qualified specialists and engineers with advanced expertise in aerodynamics, avionics, computer technology, communications, imaging and electronics, some of whom subsequently transferred from the military to the civilian sector. In addition, many high-tech firms are owned or run by former military personnel with skills in a particular profession. Retired military personnel also move to the civilian sector and apply their knowledge and skills there [13, p. 87].

At one time, significant investments in the aviation, space and military industries created new technologies that became the basis for innovative development in the fields of medical equipment, computer and hardware

production, telecommunications, electronics and microelectronics, and software. This was done by transferring high technologies to civilian production. For example, Blades Technology, originally established to produce engine parts for the Israeli Air Force's Mirage aircraft, opened joint ventures with Pratt & Whitney and Rolls Royce. Military research and development in the space industry formed the basis for development and facilitated the launch of civilian communications satellites Amos and photographic reconnaissance satellite Eros [24]. Active civil-military cooperation led to the creation of Check Point (network security), Mercury Interactive Corporation (corporate testing and performance management) and Amdocs (customer relationship management, billing and order management solutions).

Thus, the close cooperation between military and civilian production through the exchange of intellectual capital and innovation assets led to the formation and active realization of the productive potential of high-tech lucrative industries. Since the early 1990s, government projects such as Inbal, Yozma, Magnet and Nofar were introduced, creating a local industry of venture capital funds and business incubators aimed at supporting technology start-ups. For example, Yozma was launched by the Science Directorate General of Israel's Ministry of Trade and Industry, managed by professional "venture capitalists". The essence of the programme was as follows:

- public funds were invested in 10 subsidiary venture capital funds, each with a capital of USD 20 million;
- the funds were managed by one Israeli partner and one American or European partner (with a name and good reputation);
- USD 8 million remained at the disposal of the venture capital fund, which was not to be returned to the state in case of failure, while the remaining USD 12 million was invested in innovative ideas and developments [17];
- in the case of a successful investment, the partners could buy out the state's share for practically the mere amount of investment.

This is just one of the mechanisms of state support for the introduction of high technology, which proved quite effective. Between 1991 and 2000, up to 800 new companies were created under such a scheme in the field of high-technology industries, while the Israeli income from innovations rose from USD 1.6 billion to USD 12.5 billion [17]. Another mechanism is establishment of close cooperation between the state, scientific institutions,

universities and private business through formation of technological clusters and incubators. The functioning mechanism of the latter in the State of Israel is quite simple but effective - the technology incubator provides financial support for a start-up or a start-up company operating in the high-tech field, with the state covering 85% of the business project's budget and the incubator provides the remaining 15% in exchange for 50% of the company's shares [25]. In other words, it is the state that assumes most of the risks. Due to the activities of venture funds, technology clusters and business incubators, the country gradually turned into one of the world's startup leaders, created its own Silicon Valley, and become a center of computer, bio- and nanotechnology.

The lion's share of Israeli R&D is funded by foreign companies, diaspora foundations and international grants. For example, between 2007 and 2013, Israel received €875.6 million from the EU's Seventh Framework Programme for Research and Technology Development, 70% of which was awarded to universities, which are now major technology transfer centers. The Horizon 2020 programme (2014-2020) generated an inflow of more than US\$80 billion in Israeli science [26]. The Horizon 2020 programme (2014-2020) provided an inflow of USD 80 billion to Israeli science [26, pp. 412-413]. Money is provided in tranches, with strict accountability. A high degree of transparency, fairness and targeting of international financial aid, public and private grants for innovation, etc., is ensured through an extensive system of anti-corruption bodies, such as: Israel Police, State Prosecutor's Office, the Israel Money Laundering and Terror Financing Prohibition Authority, Israel Securities Authority, State Comptroller and Ombudsman of the State of Israel, State Control Committee, Ethics Committee, and State Companies Administration. These bodies are separate from the ministries, separate from each other, and operate on the principle of overlapping monitoring, so that corruption schemes for the misuse or laundering of funds are practically reduced to zero.

Cisco Systems, Motorola, Intel, IBM, Nortel, Microsoft, Mitsubishi and Deutsche Telekom established subsidiaries, research centers, technology incubators and venture capital funds in Israel. This was facilitated by the high level of trust in the State of Israel among international politicians and the business community, shaped by decades of progress in domestic innovation development, the formation of military superiority, the strengthening of the country's geopolitical position, its accession to the OECD (2012), the openness of the economy to cooperation, the adoption of

international standards, and improvements in the domestic legal environment for business.

According to 2021, the State of Israel is ranked 35th on the World Bank's Ease of Doing Business Index, second in the world for the number of start-ups, and third for the number of companies listed on NASDAQ [25]. Not the last role was played by the government's economic policies in achieving these positions. Interested in the technologization of the country, the Israeli government created favorable conditions for the development of an innovative business environment, primarily through tax instruments - a progressive income tax system for individuals and businesses, as well as various tax incentives. The minimum wage (about USD 1000) in the State of Israel is tax-free. Taxation of earnings starts at 10% for incomes of 6.310 shekels (\$1.700) and goes up to 48-50% for wealthy individuals whose monthly income exceeds \$12.000. As one's earnings increase, the tax rate only increases for each successive level of income. This ensures a fair distribution of the tax overload [14].

The government has developed a system of government tax incentives for innovative companies. In doing so, Israeli law clearly defines the criteria of "innovativeness" by which a company is classified as "privileged". Such companies must, inter alia, spend at least 7% of their annual income on R&D; 20% or more of their employees must be paid for R&D; they must achieve an average annual growth rate of 25% in income over the last three years (preceding the tax year); and they must be recognized as innovative companies by the National Theological Innovation Authority (according to the indicators defined above) [27]. There are heavy fines or seven years in prison for fraud and abuse. Companies that receive funds or benefits are monitored by special government commissions and are subject to rigorous external audits, so that money laundering is virtually impossible. One crucial step in auditing is to assess the level of value added in the innovation and production process. If the level of value added is high and the quality of the product meets stringent requirements, the government may grant this company additional tax benefits. The development of high-tech SMEs is promoted by the Israeli government through appropriate credit instruments - state guarantees for start-up companies of up to 85%, with loans of up to \$500 thousand [25]. The state also assumes the financing of R&D in the private sector at the level of 20-50%.

Thus, the industrial-innovation policy of the Israeli government, implemented through the mechanisms of grant financing of R&D and

development of intellectual capital, legislative reform, subsidies, tax and credit incentives, all ensured the development of medium and medium high-tech industries, whose production and scientific potential became the foundation of high-tech industries and the formation of the innovative orientation of national exports.

Trade liberalization policy as a factor in creating a favorable institutional environment for high-tech exports

In the post-war period, the Israeli economy was protected by severe protectionism, which was facilitated by a number of conditions: the relative isolation of the country from the rest of the world; a large state presence in the economy and rather strict regulation of economic activity; the importance of efficient allocation of scarce resources in a country with intensive immigration; a negative trade balance; and the dominance of socialism as a political and social ideology, which by itself was not very supportive for free market. The main instruments for regulating imports were licensing and currency controls, which in turn led to significant inflationary fluctuations and the development of the black market. For example, in 1951, the "black" dollar exchange rate exceeded the official rate eight times, which significantly increased the cost of foreign products [28, p. 340]. It is clear that in the conditions of insufficient development of domestic production and the vital need to import military products, this was not profitable. On the one hand, the ineffectiveness of the existing state regulation system and public dissatisfaction with economic policy, and on the other hand, the increasing political and economic cooperation with the USA, which made a planned economy in Israel impossible, encouraged economic liberalization and, at the same time, trade liberalization, which accelerated with this country's accession to the GATT in the 1960s.

Free trade, achieved in stages, contributed to the loss of the country's position in traditional areas, while Israel developed a competitive advantage in high-tech military production and the pharmaceutical industry. The strategic objective of the foreign trade policy of the State of Israel from the very beginning until today has been to ensure the permanence of a positive balance of trade and payments. Overall, the current system of trade regulation demonstrates compliance with GATT principles and provisions.

Trade liberalization primarily involved reforming the regulatory framework for foreign trade, and weakening the control and restrictive system against the background of the government's general rejection of expansionary macroeconomic policies. In the late 1950s and 1960s, the

strict state control of exports, imports and exchange rates was replaced by a reduction of state influence on foreign trade operations, a reduction of price controls, devaluation (in late 1955 the difference between the price of the dollar on the black market and on official markets was 1.3 times) and the liberalization of imports of machines, materials and raw materials [28, p. 342]. There was a gradual displacement of quantitative restrictions on imports by customs duties, which were previously insignificant and used mainly to replenish the budget. The average level of customs-tariff taxation of imports at the end of the 50s was 50% [28, p. 346]. The reform did not apply to agricultural products, for which a high level of state influence and protection was maintained. In addition, there was an embargo on imports of goods that constituted significant competition to domestic producers. Sometimes, embargo was imposed even in response to information about prospective production of potentially competitive items, since import protection was one of the most important issues in government negotiations with potential investors (both domestic and foreign) who were willing to invest in Israeli production.

A new round of trade liberalization of the State of Israel was underway since the 1970s: customs tariffs have been reduced, minimal import duties imposed on certain groups of goods (with the exception of agricultural products), and free trade agreements concluded with the EEC and the USA, which provide for the complete removal of customs barriers and a reciprocal policy of greater assistance. In particular, while in 1968 the average nominal level of customs protection for Israeli producers was 45%, in 1977 it was already 16% [28, p. 347]. Even greater relaxation occurred after the adoption of the Free Trade Decree in 1978, one of whose components - the Free Import Decree and the Free Export Decree - abolished most customs restrictions and the compulsory licensing of foreign trade operations. Customs restrictions, in particular those imposed through licensing, continued on certain groups of goods, such as exports of agricultural and chemical products and technological equipment. In fact, by the late 1980s Israel's trade with the US and Europe was virtually free, a high level of protection being maintained mainly in relations with Asian and Third World countries. The trade policy of the Israeli government in the 1990s was aimed at overcoming this "discrimination" and at further liberalization. In 1991, the Law on Trade Duties was passed, which allowed exceptional customs restrictions on imports, as well as a system of anti-dumping and countervailing duties. However, in general, import duties were reduced to 8-12% [28, p. 348].

In addition to import regulation, exports were actively promoted through value-added subsidy mechanisms, credit incentives, tax refunds (taxes on raw materials for export production), a system of floating exchange rates, and institutional bodies providing advisory, financial, marketing, negotiation and mediation support (Israel Chamber of Commerce, Manufacturers Association of Israel, the Israel Export and International Cooperation Institute, and the Israeli Content Marketing Foundation), expanding the network of economic attachés and the products they provide to exporters; supporting firms interested in submitting bids to international financial institutions; encouraging participation in foreign exhibitions, etc.

Israel's policy of "arms diplomacy" was particularly supportive of national manufacturers, and it succeeded because of the considerable demand for Israel military products. The principle was simple: in exchange for arms, the importing state undertook to create favorable conditions for expanding foreign trade relations with Israel and to provide support in the foreign arena. This strengthened the country's geopolitical position and opened up new markets for high-tech civilian products.

Agreements on free trade zones and economic cooperation were an important pillar of Israel's trade policy. Since the beginning of trade liberalization, such treaties were signed with the European Community (1975, agreement extended in 1995 to participate in the EU Framework Research Programs), the USA (1985), EFTA countries (1993), Canada (1996), Turkey (1997), Mexico (2000), Mercosur bloc (2007), Colombia (2013), Ukraine (2019), etc. In the framework of free trade agreements, highly specialized treaties were also concluded on the most-favored-nation trade regime for certain product groups - agricultural products, pharmaceuticals and telecommunications equipment. Economic relations with Israel's neighbors in the Middle East are particularly important to the State of Israel - there are cooperation agreements with Jordan (1997) and Egypt (2004) through the Qualifying Industrial Zone (QIZ) initiative. Imports of goods from countries with which agreements were signed - if the origin of the goods is confirmed by appropriate certificates - are made on preferential terms.

Thus, trade liberalization, along with certain supportive public policies, strengthened the competitive position of Israeli producers in international markets and fostered long-term economic cooperation and partnerships as a condition for further industrial and technological development of the country.

Conclusions

To summarize, in conditions of war and post-war reconstruction the experience of the State of Israel is extremely valuable and useful for Ukraine as that of a country, which in more than 70 years of independence built a powerful knowledge-intensive agricultural and industrial complex from scratch, and obtained a leading competitive advantage in the military sphere, high-tech production and exports.

From the author's point of view, the main determinants of the economic structural and technological transformation of the economy of the State of Israel were the small territory and population of the country, the lack of resources, the constant threat of escalation of armed conflicts and external aggression, and the powerful intellectual capital, reinforced by immigration, which generally steered the economy towards capital- and knowledge-intensive industries. Among the factors of Israel's economic miracle are the government's broad, consistent and systematic support for the development of manufacturing, science and education; the prioritization of targeted government aid; the diversification of the institutional structure of the innovation economy; encouragement of large-scale research and development in both traditional and new industries; a unique ecosystem of public-private-scientific partnerships; liberalization of foreign trade activities; and a strong financial assistance from the affluent Israeli diaspora.

It is determined that the high level of technologization of the agricultural sector was achieved through a combination of foreign aid and the Israeli government's domestic policies. Mechanisms for the direct financing of both agricultural production and related sectors (primarily the development of agricultural technology, the production of machinery and equipment, and the creation of high-tech infrastructure for the processing industry), subsidizing and lending to producers, encouraging farmer education, creating a strong institutional framework for scientific, technical and marketing support for farmers, eliminating bureaucracy and building a productive cluster system linking the advisory, scientific and private sectors created synergies in the development of a high-tech and highly productive agro-industry. It was substantiated that the construction of a powerful military complex through direct state financing of production, the creation of strategic R&D centers, and programmes to improve engineering and military education was a prerequisite for the formation of an intellectual and information-innovation base for scientific and technological co-operation between military and civil production and the gradual prioritization of high-tech production and exports. The creation of a favorable business

environment (venture capital funds, business incubators, technology clusters), supported through tax and loan instruments, and the grant based financing mechanism, became an important factor.

The governmental policy of trade and economic liberalization also contributed to the structural and technological transformation of the Israeli economy. The elimination of state control over export and import activities, the minimization of tariff and non-tariff restrictions, credit, tax and institutional support for exports, the conclusion of a system of free trade agreements all led to trade and scientific-technological cooperation with the EU and the USA in the first place, improvement of the economic image and strengthening of this country's position in geopolitics.

In view of Israel's experience, it is important for Ukraine today to set priorities for its economic development, including the formation of its own high-tech defense complex to meet the practical challenges of gaining advantage over the enemy; the continuation of agricultural production chains through the development of related industries; the modernization of traditional sectors to improve their competitiveness; and the promotion of innovative start-ups. The financial sources of economic transformation should be private investment, public support and financial aid. At the same time, following the Israeli example, the key task is to ensure transparency in the allocation and use of funds that can be achieved through a branched system of institutional and public bodies independent and separate from ministries and agencies that operate on the principle of overlapping monitoring. Of course, this experience of the State of Israel can be used by Ukraine in the hope of external assistance to ensure post-war reconstruction.

It is clear that even after the war is over, the threat of a military invasion of Ukraine will exist. Building defense capabilities from external sources alone is a trap that could cost economic and political independence. Ukraine needs to create its own military advantage through the development of defense production. At the same time, it should be noted that, unlike the State of Israel, Ukraine at the beginning of its economic reforms had a large military-industrial complex (in the late 1980s and early 1990s Ukraine concentrated 1/3 of the total USSR military-industrial complex) whose potential was not properly exploited for intensive endogenous development. From this point of view, it is important to analyze existing resources, revive, and renew former production capacities in the military sphere and stimulate scientific and technological development through public and private investment, joint production with foreign partners, the mechanism of civil-military integration, and credit and tax incentives. From Israel's experience,

it is the development of military production that can become a prerequisite for the technological development of civilian industries and progressive changes in the structure of exports. Further development of Ukraine's agricultural sector and high-tech industries should be linked to the development of dual-use technologies.

At the same time, only a country that supports science and education can become high-tech. There can be no innovative production without adequate R&D funding. In Israel, the widespread application of R&D results in traditional sectors of the economy created the foundation for the development of high-tech industries. Despite public investment, it is important to establish a system of venture capital funds, startup accelerators and incubators, to ensure cooperation between different sectors - public, private and scientific, as was done in Israel. In Ukraine, the "Golden Triangle" mechanism has considerable potential for implementation, for example, through the creation of technological and innovative clusters. There is already a strong cluster "Dniester 1362" (established in 2019) in the western region, a tourism development center in Lviv, Ivano-Frankivsk, Ternopil, Khmelnytskyi, Vinnytsia, Chernivtsi and Odesa regions, which aims at smart tourism specialization to promote recreation on the Dniester. Today this cluster unites scientific institutions, state bodies and more than 3,000 representatives of small businesses from 65 territorial communities. Approximate positive results include a 20-25% job increase, expansion of local budget revenues by 40-50%, and an increase in the number of foreign tourists by 20%⁵. Such clusters are vital today in the military, agricultural, pharmaceutical, transport and logistics sectors in order to accumulate the available natural, production and human potential and direct it towards strategic development priorities, since it is impossible to ensure a high-tech export orientation of the economy without an appropriate production base.

Mechanisms and tools of successful economic transformation, practices of transition from agrarian to high-tech exports in conditions of constant military threats have been worked out and ready for use. The main prerequisite for the successful implementation of Israel's positive experience in Ukraine is the political will of the government and the consolidation of society based on the certainty of higher goals - protection of the sovereign Ukrainian state, building an effective competitive economy and achieving public security and public welfare.

⁵ More information is here: Centre for the Development of Tourism on the Dniester and the "Dniester 1362" Cluster Initiative. URL: <https://dnister.travel/business-5/search-for-partners>

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**ПОЛІТИКА ПЕРЕХОДУ ВІД АГРАРНОГО ДО
ВИСОКОТЕХНОЛОГІЧНОГО ЕКСПОРТУ В УМОВАХ
ПОСТІЙНИХ ВОЄННИХ ЗАГРОЗ: ДОСВІД ДЕРЖАВИ ІЗРАЇЛЬ
ДЛЯ УКРАЇНИ**

Російсько-українська війна призводить до втрати значної частини виробництва та потенціалу сировинно-продовольчого експорту України, що становить загрозу економічній безпеці у коротко- та довгостроковій перспективах. Водночас нові виклики спонукають до реструктуризації національної економіки у напрямі розвитку високотехнологічних виробництв і посилення наукоемності традиційних галузей. Питання на сьогодні стоїть у виборі найбільш ефективного інституційно-економічного механізму такої трансформації, прикладом у чому є Держава Ізраїль.

Стаття присвячена представленню ізраїльського досвіду переходу до виробництва та експорту високотехнологічних товарів. Автор ставить за мету з'ясувати умови, чинники, механізми та інструменти успішної економічної трансформації Держави Ізраїль та оцінити можливості імплементації позитивного досвіду в Україні.

Основу методології цього дослідження становить системний підхід, який полягає у розгляді трансформації економіки Ізраїлю як сукупності тісно взаємопов'язаних елементів і процесів (історичні умови, інституційні чинники, державна політика, наявний ресурсно-економічний потенціал тощо). Важливим є застосування історично-еволюційного та історико-порівняльного аналізу для виявлення особливостей і тенденцій поетапного переходу країни від традиційного до високотехнологічного виробництва.

Основною прогресивних змін в економіці та зовнішній

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торгівлі Ізраїлю стала розбудова потужних наукоємних комплексів власного аграрного та оборонного виробництва через механізми цільового державного й приватного інвестування, субсидування та кредитування виробників, стимулювання освіти та наукових досліджень, створення унікальної системи державно-приватно-наукового партнерства ("золотого трикутника"). Визначено, що використання військових технологій для виробництва продукції "подвійного призначення" (зокрема, в космічній та авіаційній галузях, сфері кібербезпеки), перетікання інтелектуального капіталу та сформована науково-дослідницька база стали підґрунтям для розвитку електроніки, мікроелектроніки, виробництва комп'ютерного обладнання та програмного забезпечення тощо.

Доведено, що ключову роль у переході Ізраїлю до високотехнологічного виробництва та експорту відіграла державна політика підтримки, реалізована через інструменти грантового фінансування освіти та НДДКР, програми стимулювання венчурного інвестування, податкові та кредитні пільги для малого й середнього бізнесу, розгалужену систему інституційних органів цільової допомоги виробникам, ефективне нормативно-правове врегулювання ділового середовища щодо захисту прав інтелектуальної власності, надання спеціальних привілеїв, спрощення процедури репатріації прибутків, забезпечення високої якості продукції тощо. Формуванню конкурентних переваг Держави Ізраїль на ринках високотехнологічної продукції сприяли політика "дипломатії озброєння", торговельна лібералізація, податково-кредитна та інституційна підтримка експортерів, укладення системи угод про міжнародне торговельно-економічне та науково-технічне співробітництво⁷.

Ключові слова: Держава Ізраїль, сільськогосподарське виробництво, оборонно-промисловий комплекс, виробництво та експорт високотехнологічної продукції, політика державної підтримки, торговельно-економічна лібералізація

⁷ Публікацію підготовлено в рамках виконання НДР "Еволюція парадигми і доктрин економічної взаємодії держави та ринку" (№ держреєстрації 0119U10362).