MILITARY MODERNIZATION THROUGH TRANSFER OF TECHNOLOGY

Petar Nikolov Valkanov
National Military University "Vasil Levski", Bulgaria, petar.valkanov@outlook.com

Abstract: The last two decades of the 21st century more than ever have been marked by a contradictory, uncertain and dynamic global security environment accompanied by unpredictable risks and threats (EEAS, 2023). Humanity is currently bearing the negative effects of globalization facing serious challenges and threats. Subsequently, new military alliances are emerging on the global stage (EDIDP, 2024) combined with defense industry expansion in those countries highlighting the need of future transfers of military technology (Vergun, 2023). The demand for new technologies is present, enabling technological transfers between defense industry enterprises domestically and abroad a goal that most countries strife for (Ankit, 2024). According to OCIO (2021) there is a growing need for digital technology adaptation programs due to an expanding need for being prepared against threats such as cybersecurity attacks and military digitalization. Furthermore, most armies must adapt a data-driven mindset and embrace digital transformation to successfully respond to the threat of great power competition and win decisively in a larger scale confrontation. On the other hand, some countries are facing manufacturing difficulties to support current national demand due to current conflicts around the world and their dependency on foreign suppliers (GAO, 2024). One of the three main objectives of NATO (2023) till 2030 is improving understanding which according to their strategic approach is based on "Leveraging innovation and connectivity between Nations, Academia, and Industry, Allied Command Transformation focuses on shaping the environment, ensuring the Alliance is prepared to handle emerging trends, opportunities and threats." Consequently, transfer of technology is needed not only to keep up to date with new technologies but also to adapt already proved products in order to achieve supply independence from foreign forces. This in turn, presents new unexplored fields for scientific thought, reflection and discussion which defines the relevance of this publication. In line with this, the main research question is what a transfer of technology is and how to successfully carry it out between defense industry enterprises in order to achieve military modernization. The study will explore acquiring technology from a foreign provider in order to understand what barriers a company can face. The goal of this publication is to explore the theoretical foundations of technology transfer. The following factors were decided to be crucial in order for this study to aid the company in a successful transfer of technology: clear definition of transfer, absorptive capacity, desorptive capacity, barriers for transfer of technology, management stability, cultural factors, and legal perspective. Future work would continue with an analysis of the state and problem areas of technology transfer and the definition of strategic solutions for effective technology transfer. Due to the space limitations of this publication, the focus will primarily be on the theory, preceding a more detailed analysis.
Keywords: military modernization, transfer of technology, manufacturing independence

1. INTRODUCTION

The last two decades of the 21st century more than ever have been marked by a contradictory, uncertain and dynamic global security environment accompanied by unpredictable risks and threats (EEAS, 2023). Consequently, new military alliances are emerging on the global stage (EDIDP, 2024) combined with defense industry modernization in those countries highlights the need of future transfers of military technology (Vergun, 2023). According to Kamara (2023) military modernization is the gradual evolution of key elements that shape how a Ministry of Defense defines, structures, and operates itself specifically: doctrine, organization, training, materiel, leadership, education, personnel, facilities, and policy. This process transitions these elements from their current or traditional state to a future - oriented approach. In essence, modernization happens when successful changes across all sectors collectively improve the military capability to achieve its mission. According to AUSA (2023) modernization theory explores how societies develop politically and socioeconomically. Various theorists have debated the causes, direction, stages, and impacts of societal modernization. Despite differing perspectives, a common thread in the literature is the recognition of modernization as a gradual shift from the present state to a future-oriented one, affecting various aspects of human life, including politics, economics, society, and military affairs. Thus the topic of this article is exploring this evolution through transferring technology into the military manufacturing capabilities of a country or military industry complex considering such process is a must due to the evolving ways of facilitating modern warfare. This research considered models applied in a similar manner or in similar industries. As a result the article triangulated the model's eligibility and applicability to a military industry in order to establish a framework and base point for future research.

2. MATERIALS AND METHODS

The main reason for formulating the topic of this article in such a way was to consider the models and tools discussed in this study both from academic and practical perspective in order to aid a relevant entity in its decision making in this dynamic global security environment. As the research topic indicates, the target of this paper is to look at military modernization from the aspect of acquiring new technology and enhancing its capabilities by absorbing foreign technology into its industrial military complex. For the sake of avoiding any assumptions and bypassing ambiguity in the audience not familiar with the concept of Transfer of Technology, this paper will analyze the essence of one and describe it briefly from different aspects. Furthermore, this paper was prepared with the idea in mind to provide future readers with basics on how to approach military modernization when it comes to manufacturing products locally in order to aid different aspect of the country's or strategic alliance defense capabilities. This paper looks into the theories related to how and why a transfer of technology should be considered and provides the reader with the guidelines which steps must be taken. Different techniques and models are taken into account but however, due to the limited available studies and empirical data in the public domain, it notices the importance and describes the necessity of this topic. Secondary research was the main method of constructing this paper in the form of analyzing market summaries, collecting and utilizing synthesis of existing researches, journals and studies about military modernization, technology transfers, cultural and managerial issues. In the following chapters the outcomes will be discusses in a manner that represents the secondary research results and points of view on the discussed topics.

The research comprises the following seven sub-questions:

1. What is a military modernization?
2. Why is military modernization crucial for a Ministry of Defense?
2. What is Transfer of Technology?
3. What are the elements which shape the degree of success of a Transfer of Technology?
4. What is a clear definition of the transfer?
5. What is absorptive and desorptive capacity?

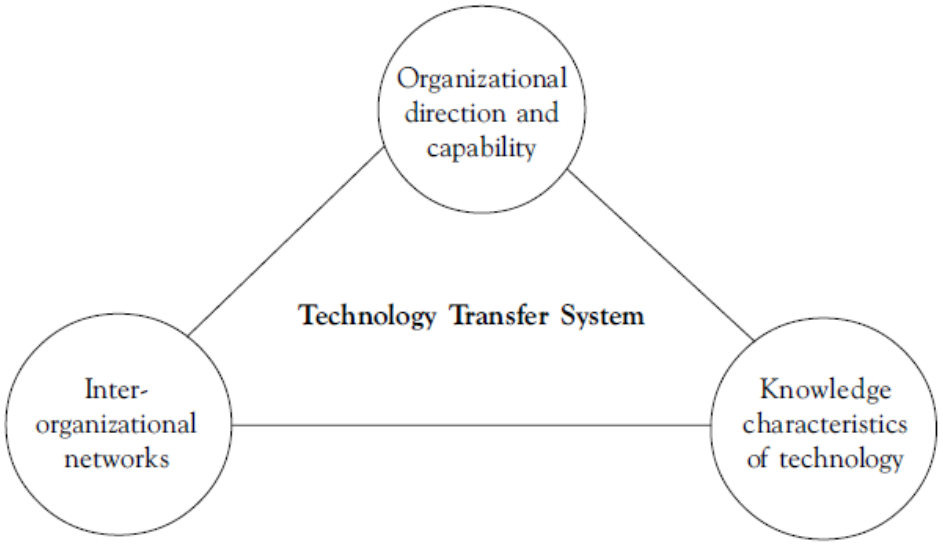
3. RESULTS

According to Bernard (2020) when a military organization initiates a modernization program, it is natural to anticipate that current capabilities will be upgraded with more advanced ones. Implicit in this expectation is the idea that enhanced lethality, while not the only requirement, is a crucial component for achieving greater strategic effectiveness in the military. It is considered a common opinion that military organizations globally are established to safeguard their nation's security. In peacetime, they achieve this by deterring potential adversaries from engaging in conflict. In wartime, their role shifts to defeating these adversaries if conflict arises. These two objectives are interconnected: "The best way to prevent war is to be prepared to win one." thus being prepared with modernized military industry is crucial. Future research should aim to develop an optimal model for military modernization. This model should be grounded in the key questions that policymakers and military planners need to consider when determining how to modernize their country's military forces. Buzan (1987) contemplated that the arms dynamic and the process of military modernization, as an example of this phenomenon, is driven by three factors: the action-reaction relationship between a state and its perceived adversary, the domestic structures within the state that may not always align with this action-reaction relationship, and the technological imperative that frames and influences both of these elements. Since the primary role of any military organization is to protect the state from external and sometimes existential threats, the pursuit of "modernized" weapons systems is both intuitive and essential. "Modernized" generally means advancements in military technology that often translate into increased lethality. According to the National Defense Strategy of the United States (2022) lethality is influenced by several key factors. First, precision sensing and targeting are crucial, as they enable you to detect the enemy before they detect your forces, allowing for more accurate and effective strikes. This precision is especially important given the high costs of modern weaponry. Second, in the era of computer networks and joint military operations, data linkages and bandwidths play a vital role. They facilitate the elimination of traditional inter-service rivalries, enabling the military to operate as a unified entity and to deploy any available weapons systems from air, land, or sea platforms against enemy forces. The third factor is survivability. If your weapons systems are more resilient than those of your adversaries, your military can maintain a higher level of lethality, as it can continue to operate effectively even under threat. The lethality of a military organization plays a crucial role in both peacetime and wartime operations. During peacetime, the military aims to dissuade or, more specifically, deter potential adversaries from launching hostile actions against the state. In wartime, its objective shifts to defeating, or more precisely achieving strategic success against, its enemies. According to Goure (2018) military modernization is a process aimed at closing gaps in current capabilities by providing enhanced, higher-quality systems while lowering institutional costs. As a result, it

involves replacing outdated military technology with significantly more advanced and capable alternatives. However, modernization goes beyond merely acquiring new equipment and according to Vera Delzo (2019) achieving greater military effectiveness requires that this new materiel be integrated with the right organizational structure, operational concepts, tactics, command-and-control systems, and supporting infrastructure, among other essential elements. In other words, military modernization involves changes across various areas, including doctrine, organization, training, equipment, leadership and education, personnel, facilities, and policy. However, these changes are not as profound as those brought about by military transformation, especially in terms of organizational culture. While scientific advances drive the development of new technologies that bring undeniable benefits to humanity, they can also give rise to new security threats. Today, states must effectively confront these emerging challenges by strategically utilizing all elements of national power. To do so, armed forces must be equipped not only to address evolving security threats but also to carry out complementary roles assigned by the state. As a result, adapting to new roles and technological progress compels military institutions to undergo modernization or transformation processes that enable them to support the state's objectives. A transfer of technology according to Blakeney (1989) is the process by which commercial technology is disseminated. The "disseminated" according to the United Nations Conference on Trade and Development (1996a, vol.I), involves the communication of the relevant knowledge from the transferor to the transferee. The draft TOT Code provided by UNCTAD (1996, vol. I) defines technology as "systematic knowledge for the manufacture of a product, for the application of a process or for the rendering of service. "Technology" also includes the "entrepreneurial expertise and professional know-how" (Santikarn, 1981). The Draft International Transfer of Technology Code lists the provision of know-how and technical expertise in the form of feasibility studies, plans, diagrams, models, instructions, guides, formulae, basic or detailed engineering designs, specifications and equipment for training, services involving technical advisory and managerial personnel, and personal training as a type of transfer transaction. According to Barrett and Sexton (1999) whether based on explicit or tacit knowledge, some technologies are just more complex than others. The more complex a technology is, the more difficult it is to decompose it. Inter-organizational technological transfer according to scholars (Mowery, Oxley and Silverman, 1996) is a major managerial challenge because of its complexity. More specifically the nature of the technological knowledge complicates its transfer across the organizational boundaries. In general for simplicity and convenience such transfer can be described according to Naito (1989) by using four elements namely: information, human resources, capital and resources. On the contrary, Sung and Gibson (2000) indicate that the following elements to be crucial in order to shape the degree of success for a Transfer of Technology (TOT): attitude and values; understanding the nature of business; person-to-person contacts; variety of communication channels; knowing whom to contact; a sense of common purpose; increase in awareness of transfer; concreteness of knowledge/technology; setting up transfer office or committee; clear definition of transfer; provision of incentives for transfer and product champions. Furthermore, as a result of the data analysis it was revealed that also monitoring systems, management stability and cultural problems are predominant in TOT among the factors known in foreign markets (Baskaran, 2004). Furthermore, Baskaran (2004), argues that while there is no doubt that certain technologies can be successfully transferred, some defense industries failed to acquire skills which are sufficient to close the technological gap with developed countries and keep up in the race with technological changes in this particular industry. A major problem happened to be that technology transfers at the level of the systems as a whole, worked less efficiently than at component level as sellers tended to maintain their core technologies. Key elements can be highlighted in order to further consider a possible transfer including: clear definition of transfer, absorptive capacity, desorptive capacity, barriers for transfer of technology, management stability, cultural factors, and legal perspective. In order for us to continue we will assume that a clear definition on the transfer can be already targeted by the Ministry of Defense which trying to modernize its defense capabilities. According to Lichtenthaler (2010), for inward technology transfer the technology receivers have to develop absorptive capacity, which in our case is the military's ability to acquire and utilize external skills and knowledge. The concept was developed by Cohen and Levinthal (2001) and they explain it as the company's ability to recognize, assimilate, and apply external knowledge in the context of innovation and learning processes. Basically this is to possessing prior technological knowledge which is needed to successfully acquire external for the company technologies. The same prior knowledge helps an absorbing company to identify needed external knowledge in order to try and absorb it. According to NATO (2023) some of its members have been far too long depended on foreign suppliers for its military equipment and that the desire to achieve self-sufficiency has always been present. Based on Lichtenthaler (2010) definition of desorptive capacity, we can describe it as the organization's ability to identify technology transfer opportunities based on the company's strategic objectives and to settle the application of this technology at the obtaining company. Furthermore, desorptive capacity defines the potential volume of technology transfer based on the company's technology portfolio and consists of two process stages namely: identification and transfer. According to Lichtenthaler (2010) the identification of TOT opportunities is most of the

time underestimated, although it combines a major managerial challenge for a company's strategic planning. According to (Davis and Harrison, 2001) because of badly identified transfer opportunities most of the countries fail with their planned alliances and licensing approaches. Lichtenthaler (2010) identifies the second step of developing a company's desorptive capacity as the ability to facilitate the transfer of technological knowledge at the receiving company. Such transfer might be a reason for the military to learn, accumulate and leverage management heuristics in their effort to develop their desorptive capacity. The same scholar states that company's performance in outward technology transfer will not increase automatically as a result of planning an active strategy. Rivette and Kline (2000) state that desorptive capacity, withholds relatively limited additional costs for an entity once the technology is already developed. The barriers which a Ministry of Defense is supposed to face in their efforts to execute TOT can be views as a "Technology Transfer System model designed by Barrett and Sexton (1999) shown in figure 1.

Figure 1: The Technology Transfer System



Source: Barrett and Sexton (2003)

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The part "Organizational direction and capability" has to do in the case of this paper with the motivation and the ability for military modernization in order to absorb and innovate from new technologies. These capabilities have to come from within them through envisioning technology strategies and supporting organizational capabilities. Furthermore, "Knowledge characteristics of technology" refers to the extent to which the new technology can be effectively absorbed by producers which are substantially influenced by the characteristics of the technology being transferred. In our case we already mentioned this analyzing absorptive capacity. The part "Inter-organizational networks" is in our case is the capability of a supplier to communicate and transfer the required knowledge. This is a potential threat for the desorptive company for which a solution should be further analyzed in a managerial stability discussion. According to Barrett and Sexton (1999), a technology transfer will only be effective if a company manages to appropriately focus and achieve a specific aim in accordance with three main parts discussed above.

4. DISCUSSIONS AND CONCLUSIONS

According to Levin (1997) the major management difficulties is to apply technology transfer processes as a vehicle for creating a learning environment. The insides of a technology transfer process, includes ascertains relationships, transferring information to people at the right organizational levels and delivering the know-how, which can be established as a set of routines used in educating of the targeted employees. Furthermore, Gilbert and Cordey-Hayes (1996) invented a model that observes the stages of the transferred knowledge as a movement within the organization in order to lead to the development of a set routines, which can be seen in the behavior and practices in the employees of the receiving organization in order to become a part of the core routines, or in other words –

assimilation occurs. The stages of this model are namely: "acquisition" of knowledge, "communication", "application" and "assimilation". The importance is indicated to be the process of transfer seen as the assimilation of the results and efforts for applying the gained know-how. Focusing on the distribution of knowledge and the different methods of communication channels applied, an adequate starting point according to Malik (2001) is to think for a "broadcasting analogy" for the transferring process. The ones who are targeting at a diffusion of technology are referred as the transmitters, who are with the idea in mind to transfer the appropriate information for the technological nature of the product. In October 2020, the current Army Chief of Staff of the Unites States Army - General James McConville stated that army modernization should continue with the quote "We must modernize now. It is not about fighting the last fight but better. It is about winning the next fight. To do that, we must transform." Such transformation in recent times globally can be achieved with transferring, acquiring, purchasing or developing new technologies. This article hopes to set base for future research tailored to specific nation or strategic alliance that can benefit from more precise plan. Next step should be interviews with representatives of entities who wish to be involved in military modernization aimed at the military industrial complex.

REFERENCES

Ankit, K., (2024), Indian Army's year of technological advancement in 2024, Available: https://www.orfonline.org/expert-speak/indian-army-s-year-of-technological-advancement-in-2024

Army Digital Transformation Strategy (2021), Headquarters, Department of the US Army, Available: https://api.army.mil/e2/c/downloads/2021/10/20/3b64248b/army-digital-transformation-strategy.pdf

Barrett, P. & Sexton, M., (1999), "The Transmission of Out-of-Industry Knowledge into Pharmaceutical Industry Wisdom", Linking Pharmaceutical Research and Innovation in Other Sectors, Pharmaceutical Research and Innovation Strategy Panel, London.

Barrett, P. & Sexton, M., (2003), "A literature synthesis of innovation in small construction firms: insights, ambiguities and questions", The Technology Transfer System

Barry Buzan, (1987), "An Introduction to Strategic Studies: Military Technology and International Politics", Studies in International Security (SIS)

Bernard F.W. Loo, (2020), "The Challenges Facing 21st Century Military Modernization". Available: https://ndupress.ndu.edu/Media/News/News-Article-View/Article/2054165/the-challenges-facing-21st-century-military-modernization/

Blakeney, M. (1989). "Legal Aspects of Technology Transfer to Developing Countries" (Oxford: ESC Publishing).

Cohen & Levinthal, op. cit.; W. Tsai, (2001), "Knowledge Transfer in Intraorganizational Networks: Effects of Network Position and Absorptive Capacity on Business Unit Innovation and Performance," Academy of Management Journal, 44/5 (October 2001): 996-1004; U.

Commission Regulation (EC) No 772/2004 of 27 April 2004 on the application of Article 81(3) of the Treaty to categories of technology transfer agreements Article 1

Daniel Gouré, "Winning Future Wars: Modernization and a 21st Century Defense Industrial Base," The Heritage Foundation, 4 October 2018, accessed 16 March 2019, https://www.heritage.org/military-strength/topical-essays/winning-future-wars-modernization-and-21st-century-defense.

Davis, J.L., & Harrison, S. S., (2001), "Edison in the Boardroom: How Leading Companies Realize Value from Their Intellectual Assets" (New York, NY: John Wiley & Sons, 2001);

European Defence Industrial Development Programme (2024), Available: https://defence-industry-space.ec.europa.eu/eu-defence-industry/european-defence-industrial-development-programme-edidp_en

Gilbert, M., & Cordey-Hayes, M., (1996), Understanding the process of knowledge transfer to achieve successful technological innovation. Technovation 16 (6), 301–312.

Hassan M. Kamara, (2023), "Tenets of Army Modernization", Association of United States Army. Available: https://www.ausa.org/publications/tenets-army-modernization

Lichtenthaler, (2009), "Absorptive Capacity, Environmental Turbulence, and the Complementarity of Organizational Learning Processes," Academy of Management Journal, 52/4 (August 2009): 822-846;

Levin, M., (1997), "Technology transfer is organisational development: an investigation into the relationship between technology transfer and organisational change." International Journal of Technology Management 14 (2-4), 297–308

Mowery, D. C., Oxley J. E., & Silverman, B. S., (1996), "Strategic Alliances and Interfirm Knowledge Transfer," Strategic Management Journal, 17 (Winter Special Issue 1996): 77-91;

NATO (2023), Ongoing Military Transformation, Leading to NATO 2030 – Multi-Domain Operations, Deterrence and Defence, Improved Understanding. Available: https://www.act.nato.int/article/ongoing-military-

transformation-leading-to-nato-2030-multi-domain-operations-deterrence-and-defence-improved-understanding/

National Defense Strategy, USA, (2022), Available: https://media.defense.gov/2022/Oct/27/2003103845/-1/-1/1/2022-NATIONAL-DEFENSE-STRATEGY-NPR-MDR.PDF

Strategic Communication Editorial Team (2023), EU Peace, Security and Defence, Available: https://www.eeas.europa.eu/taxonomy/term/400164_en

Santikarn, Miagsam (1981). Technology Transfer (Singapore:Singapore University Press).

Sung, T. K. and Gibson, D. V. (2000), "Knowledge and Technology Transfer: Levels and Key Factors", Proceedings of the 4th International Conference on Technology Policy and Innovation, Brazil, August.

Paul E. Vera Delzo, (2019), Peruvian Army, Military Transformation, Effort and Institutional Commitment. Available: https://www.armyupress.army.mil/Journals/Military-Review/English-Edition-Archives/November-December-2019/Delzo-Military-Transformation/

Rivette, K.G., and Kline, D., (2000), "Rembrandts in the Attic: Unlocking the Hidden Value of Patents" (Boston, MA: Harvard Business School Press, 2000).

Vergun, D., (2023), DOD Modernization Relies on Rapidly Leveraging Commercial Technology, Available: https://www.defense.gov/News/News-Stories/Article/Article/3277453/dod-modernization-relies-on-rapidly-leveraging-commercial-technology/

U.S. Gouverment Accountability Office (2024), Army Modernization: Actions Needed to Support Fielding New Equipment, Available: https://www.gao.gov/products/gao-24-107566