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Abstract

Technology management is the planning, organization, coordination and supervision of the development and implementation of technological capabilities that will enable an organization to shape and achieve its strategic and operational goals. In the age of increasing competition and an unbalanced world, successful, efficient and strategic technology management is necessary for organizations to survive.

An important aspect of technology management is technological learning, which is the process of internalizing technological capabilities. By imitating the technology obtained from developed countries through technology transfer, new products are produced, the ability to make changes in existing technologies within the technological learning process with the acquired technology is gained, and it is aimed to gain the ability to produce technology on their own. Organizations must include knowledge management activities and the increasing power of information technologies in this process.

In order to support the decisions of the future today, companies should be able to foresee technologies in line with the needs and innovations that may arise in the future through technology forecasting which can be defined as predicting the future of the elements affected by technology by analyzing all the knowledge, expertise and approaches available from the past to the present and creating policies related to it. Correctly incorporating these predictions into technology transfer processes will provide unpredictable benefits and power to both themselves and their countries in the future. We continue our efforts to use technology management as a management multiplier for HAVELSAN to achieve its strategic goals, with increasing corporate support.

Keywords
Technology management, Technology learning, Technology foresight, Technology acquisition, Technology transfer, Technology intelligence.

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Introduction

The dictionary meaning of technology is "processing of information"; its broad meaning is "to provide better service to people by processing, researching, developing and producing raw information" (Batur & Uygun, 2012). According to another definition, technology is the use of science-based knowledge to meet a need (Karadal & Türk, 2008).

In this context, the concept of technology management in the literature is defined as the planning, organization, coordination and control of the development and implementation of technological capabilities that will shape and realize the strategic and operational goals of the organization and is based on six core activities. These core activities are acquisition, use, identification, learning, preservation and selection of technology (Çetindamar, Phaal, & Probert, 2013).

The discipline of technology management has a history of over fifty years in the literature. Technological developments in companies or countries in the world that have emerged from periods of economic contraction and war have made the concept of "technology management" more pronounced in academia and in the technology sector. The most important point emphasized in the literature and still valid today; "Those who will survive an era of growing competition and current imbalances will be those who will use technology as a strategic corporate weapon." For this reason, the difference between success or failure, efficiency or productivity is primarily based on the use of technology management as a strategy (Crisp, 1984; Kocaoglu, 1994; Thackray, 1983).

Technological learning

Learning is the acquisition and use of existing knowledge and/or the creation of new knowledge to improve performance. Learning can take place at the individual or institutional level. Institutional learning refers to the ability of an organization to create and acquire knowledge, to disseminate knowledge within the organization and to implement it in the form of products, services and systems (Çetindamar et al., 2013; Nonaka & Konno, 1998).

Technological learning, which is one of the core activities of technology management, is defined as the process of acquiring and internalizing technological skills. In this context, technological learning can be seen as a process of technical change achieved through the internalization and development of existing techniques and innovations (Çelik, 2009).

In the context of technological learning, technological capability includes the skills and abilities required to acquire, assimilate, adapt, use and modify technology, as well as to create new technologies, develop new products and processes (Kim, 2001).

Technological learning is directly related to dynamic capabilities and knowledge management. Dynamic capabilities are the ability to reinvent, direct, transform, shape, and combine existing core capabilities with external resources and strategic assets, in response to the challenges of competition and imitation (Teece, Pisano, and Shuen, 1997). Technological learning has been defined as the process of internalizing technological capabilities. This process generally takes place in three stages in developing countries. The first stage is the production of new products by imitating the technology obtained through the transfer of technology from developed countries; the second stage is the acquisition of the ability to make changes in existing technologies as part of the technological learning process with the acquired technology; The third and final stage is the acquisition of the

capacity to produce the technology on its own through the learning effort of the country. This last step requires intense knowledge and effort (Lee, 2004).

Some features of technological learning have come to the fore in developing countries. These characteristics can be listed as follows (Çelik, 2009; Chen & Qu, 2003):

- Technological learning is a conscious process.
- Organizations may not be fully aware of technical options. For this reason, they do not know how to acquire the necessary skills. In this case, the learning process involves risks and uncertainties.
- Since different technologies require different skills, the learning process should have certain characteristics.
- Talent Acquisition; This can happen at any level of process engineering, product engineering, or quality management.
- Technological learning; It must be carried out in interaction with suppliers of inputs and capital goods, suppliers of technology, customers and competitors.
- Although acquired technology is the most important input for technological learning in developing countries, technology acquisition should not be seen as a substitute for the development of domestic talent. It is useful that the imported technology is used domestically according to the talent development effort.
- Technological learning should include multiple sources, topics and methods. Therefore, a more holistic model of technological learning might be better suited to the needs of today's developing countries.
- The growing power of information technology should be actively used in the process of technological learning.

A successful technology learning process requires a technology effort with principles and goals and a stable long-term presence. The fact that the learning activities of developing countries depend only on developed countries can create the problem of imitation of a particular country in the learning processes of these countries. For this reason, the concerned countries should take measures to prevent this situation and turn to their own internal potentials and resources (Karaöz, 2004).

Organizations that implement technological learning within the organization must take ongoing steps to become a learning organization. The learning organization is defined as "an organization that is constantly learning and changing" and its characteristics are expressed as follows (Garvin, 1993):

- As the learning capacity of individuals in learning organizations increases, the institutional structure, culture and business processes are also reshaped,
- The learning organization expresses the existence of the capacity to learn in an institutional way, and not only of the individuals who learn,
- Employee participation is high in decision-making and information-sharing processes,
- It supports the formation of systematic thinking and institutional memory in the organization.
- Technology is the use of scientific knowledge to meet a need. The effect of globalization is high enough to explain the evolution of rapidly developing technology over time. At first, the evolution of technology brought globalization,

then globalization accelerated the development of technology. For this reason, the most important trigger and companion of the globalization process is technology.

Technological learning, by its nature, includes learning technologies. However, using learning technologies only in the context of learning is not enough. Because one of the most important resources for organizations is people. For this reason, learning must necessarily include technologies and non-technological elements.

Technological learning should include multiple sources, multiple topics, and multiple methods. Therefore, a holistic technological learning model supported by information technology is considered more suitable for today's developing world and globalization. By using the growing power of information technology, technological learning processes can be made easier and more efficient. In this context, organizations should definitely include knowledge management activities as part of technological learning.

Technology Foresight

Technology foresight is a concept that emerged when people wondered about the future and wanted to create that future and asked questions. It aims to start the work by setting a goal for the achievement of technology foresight, which can be faced with more developing technology in the future or extraordinary situations such as Covid-19. Also, the forecast will reduce the foggy weather a bit in the future and add commitment to action.

It would be a bad approach to consider technological foresight as a fortune. By analyzing all the knowledge, expertise and approaches available from the past to the present, it provides the activity of predicting the future in the elements where technology is affected and creating and implementing policies related to this.

The benefits of foresight can only be obtained through active participation. Most of the forward-looking effort must be made to bring people from different communities into direct contact. Technological insights will also encourage multi-dimensional thinking by linking unrelated departments when managed in a multi-stakeholder fashion. Being more descriptive for people from other disciplines will also be an important factor that will increase participation. However, acting with intuition can be beneficial for the individual, but for a company or a country, it should come from a more complex analytical perspective than intuition.

In this context, technological forecasting methods based on data should be used. These methods will make important contributions to determining technological developments, identifying and evaluating markets for new technologies, defining possible strategies of competitors and predicting the effects of these developments on the way of doing business.

In addition, it is important to ask the right questions when making technological predictions. For example, "Which technologies are most important?" or "How is the added value of technology achieved on a global scale?" questions can provide good analysis.

It should be remembered that the forecasts determined will come true in the medium and long term and they will be correct to reassess them in certain periods. The most important criterion that companies must pay attention to in order to support decisions for the future today is the ability to predict technologies in line with the needs and innovations that may arise in the future.

Companies that can make their technology predictions correctly and incorporate those predictions into technology transfer processes will provide unpredictable benefits and

power to themselves and their countries in the future. The companies that shape the future, just like the companies we see today, will be the companies that can make the most accurate predictions and acquire technology that is consistent with those predictions.

Technology Acquisition

Considering that technology is so important, it is essential for companies to precisely define the technologies they need within their processes in order to benefit from these advantages of technology, to choose the most appropriate technologies according to these definitions and to achieve the most appropriate technology acquisition method taking into account factors such as environment, economy and time.

There are many methods used in the acquisition of technologies. However, three of these methods will be briefly explained as they are focal points in the literature.

The collaboration of public institutions, universities, R&D organizations and private sector companies for technology development, especially in developing countries, is considered an effective method of technology development due to criteria such as revealing all sorts of expectations when developing innovative products that benefit from different perspectives. With this method, the development of technology can result in inexpensive and rapid results for companies, since more than one party is efficient in the process and is generally supported by public institutions. This method, in particular, increases the R&D investments of the countries in order to produce their own national technologies and to benefit from them in terms of economic and intellectual capital, not only in a commercial sense in the private sector, but also in many public sectors with benefits such as environment, health, safety and the development of national capitals. It is one of the most preferred methods in areas where many secondary benefits such as tax exemptions and capital grants are also obtained using this method. Working in cooperation with public institutions and universities results in better technology forecasts through more comprehensive analyzes and assessments, allowing companies to increase their competitive power internationally while providing technologies that they can use long term.

R&D collaborations also have disadvantages such as the sharing of company information and processes, not always having a monopoly on the right to license the acquired technology, external dependence in the development of technology and the inability to increase competitiveness to the level desired at the national level in cases where the technology can be used by other companies in the country.

R&D contracts, on the other hand, are the methods by which companies finance or recruit universities, R&D companies and organizations to carry out technological development and research processes in order to acquire the technologies defined in technology acquisition processes. Since this method is mainly implemented for the purpose of research or development, it may not always be applicable for the acquisition of new technologies. It may be more preferred if there is a need to improve production processes or increase input efficiency. This method is an effective method in terms of developing companies' existing technologies and accessing technologies that are close to the latest technology. It is not preferred as a very effective method in terms of achieving expected results in extended technology acquisition processes.

R&D activities form the basis of technology production. However, using the internal resources necessary for R&D is not easy for all companies and these resources are not only caused by the cost but also by the lack of trained personnel.

Issues such as generating knowledge, commercializing that knowledge with research projects, conducting research and even providing trained R&D personnel to work in this process, human capital accumulation and funding create obstacles and dead ends for businesses individually and as much as possible. All these processes are essentially based on "the human" and "human action" (Tiryakioglu, 2011).

On the other hand, although technology transfer seems like an easy way, it is not costless or cheaper than R&D activities. On the contrary, technology transfer, which is a very complex and costly process, is a resource that will make technology available in the short term, but we must not forget that it contains both opportunities and threats. Receiving information does not guarantee proper use. It depends entirely on the human, social, cultural and economic resources available to the receiving party. If the transfer is not tailored properly, it can lead to foreign dependency and lead to unnecessary financial losses by making technology transfer continuous and mandatory. This process involves risks such as technological, financial and political dependence. In summary, a transfer process that is limited to the use of technology (knowledge) will lead to many dependencies, mainly technological, a fortiori ensuring technological development (Tiryakioğlu, 2010).

Technology Management Principles

Technological opportunities and threats must be identified early.

Technology opportunities and threats to a manufacturing business should be identified early in order to take targeted action regarding the future use of a technology in the manufacturing environment. Manufacturers operate in a global environment that is increasingly grappling with multiple dynamic influences. These are for example; increased customer demands, differentiated production life cycles or the emergence of alternative production technologies. To cope with these influences and remain competitive over the long term, companies must adapt their technological bases. Thus, by applying production technologies that meet current and future requirements, they can take advantage of technological opportunities and prevent emerging threats. In this context, technologies are defined as the emerging and established production processes needed to manufacture a product. Identifying and identifying technologies that meet the requirements of the future is not systematic and therefore resource-intensive, as companies often do not know exactly what type of technologies they need and are faced with the density of the information.

By analyzing future technology needs and systematically researching established emerging technologies, opportunities can be exploited while minimizing threats. To support effective and efficient technological research, the exact derivation and definition of the specific technological need is necessary.

Technology intelligence should be created.

Early detection of technologies is one of the key tasks of technology management to identify technological opportunities and threats. Thus, enough information about emerging and established technologies and trends is collected and evaluated. It is communicated to decision makers to facilitate management decisions, such as deciding for or against a technology to invest in. This type of process is commonly referred to as technology intelligence. It includes many areas of research, including technology analysis, technology monitoring, technology discovery, and technology identification.

The technology requirements analysis as part of the technology description indicates the anticipation of possible environmental conditions for the development of technology areas

identified as business related research areas which are then prioritized, selected and detailed for further development. new technological research.

Technology requirements analysis is an important aspect of technology intelligence and an important step towards limiting resources and costs in pursuing technology. However, today some shortcomings of the application of technology intelligence on behalf of companies are problematic. Due to the lack of distinction between different types of technology, for example; Product technologies and production technologies and the non-specific formulation of a company's technology needs are more difficult in terms of demand-based determination of production technologies that meet future product and production requirements. Moreover, as a company has to develop and manufacture products to meet challenges such as possible customer requirements, it is necessary to anticipate possible events occurring in a company's environment. For this reason, a company must adapt its technological infrastructure and ensure that it can produce current and future products. For manufacturers to be economically efficient in the long term, they must adapt their technological bases according to the current and future products they will produce. Therefore, these companies must implement the technologies that best meet the requirements. However, they have difficulty in allocating and identifying future technology needs and the technologies that should be available to meet the requirements.

Effective cooperation must be established with universities.

In order to survive and thrive in today's rapidly developing market, businesses must actively pursue innovation. However, the traditional fundamental/applied research activities carried out in corporate R&D centers are insufficient to cope with the continuous pressure of new inventions to shorten time to market and meet specific and identifiable customer needs. This often forces companies to outsource technology to achieve greater scale and scope of business, improve their ability to manage complexity, and share cost and risk. Suppliers, competitors, companies from other sectors, universities and research institutes are all part of technology outsourcing. In this context, the role of universities as partners in the value chain is becoming increasingly important.

University staff contribute their expertise in new application concepts or solve specific industrial problems of high commercial value to the company. Industry is achieved by the provision of technologies developed by universities; it can maintain the competitive advantages of core technologies, carry out complementary research, save R&D time and cost, and establish a relational image with academic partners.

The roles of universities in technology transfer; science parks or research centers, joint research, contract research, consultancy, patent licensing, open science pathways, academic by-products and skilled labor transfer.

Universities provide many opportunities for private sector organizations with their broad areas of work, as research centers and material capabilities. The private sector, with its market and its knowledge of the market and its forecasting capabilities, can determine the demands that arise or will arise. Universities, on the other hand, provide options for the private sector to jointly produce, purchase or co-create technologies that will meet this demand. In this way, the private sector can save resources such as transaction costs and time, while universities have the opportunity to market their work more effectively. This mutual relationship is beneficial for both parties and can contribute to the economy of the region where it is located. In order to establish this relationship, it will be advantageous for companies to closely follow academic publications in terms of knowledge of studies in

universities, while universities value publications and participate in scientific conferences, which will make the industry more likely to realize themselves.

His knowledge of technology management progresses through university studies in this field and analyzes of the current situation of companies. It is believed that bringing these two experiences together can help fill the aforementioned void in the field of technology management. In this context, international and national publications were treated according to their origins in developed and developing countries, and it aimed to develop national policy recommendations following the review of the use of tools and technology management capabilities used in business. Following this study, in articles on developed and developing countries; organization, technology policy and the acquisition, dissemination and adaptation of technology. As problems that stand out in developed countries and are less common in developing countries; technology strategy and new product management, design innovation; Topics that come to the fore in developing countries and are less studied in developed countries are; R&D management and technological change are determined as technological development. In Türkiye, on the other hand, technological change and development, organizational studies, emerging technologies or production technologies such as nanotechnology, biotechnology, IT, technology policy and innovation system approach, as well as new product management and design innovation are at the forefront (Ansal et al., 2009).

In the firm-based study in Türkiye, firms; It has been determined that technology strategy, R&D management, information management, organization of technology activities, commercialization and marketing of technology are the most important elements for the success of the company. We have seen that the subject on which they spend the most time is R&D management (Ansal et al., 2009). In this context, although companies give importance to R&D management and devote time to it, it should be noted that R&D management has lagged behind in academic studies in Türkiye.

The strategic approaches of companies are the determinants of the orientation and speed of innovation of companies. At the same time, they create different organizational structures and processes to develop new products (DNP) based on the diversity of their strategic approaches (Acur, Kandemir, & Boer, 2012). For many branches of industry these days, DNP; This is the only important factor that determines whether the business will succeed or not. The importance of new products; encouraged DNP studies in strategic management, engineering, marketing and other disciplines. To be successful in most product development, a company must achieve two important goals: alignment with customer needs and reduced time to market. Although these two goals place conflicting demands on the business, there is growing evidence that companies can implement effective strategies to achieve these goals. Companies that articulate their strategic intentions well and align their R&D portfolios to DNP goals with their current capabilities and resources are successful. The compatibility of the new core capabilities provided by the new technology areas they have entered with the long-term direction of the business is also important to business success. Strategic alliances to acquire new technologies can shorten the development process, but partners must be carefully selected and vetted. When companies choose to outsource technology, they must also consider the significance of the learning outcomes they will derive from in-house project development and its impact on the future success of the business. Other mandatory factors can be listed as follows; Use parallel (rather than sequential) development processes, which will shorten the cycle time and also ensure that customer and supplier needs are better covered in product/process

design, and that projects get the necessary resources and organizational stability so that they can be supplemented with the support of leaders (Schilling & Hill, 1998).

Technology Management at HAVELSAN

In the technology management of HAVELSAN, covering the principles of "Technology Management" that we have stated theoretically, meeting the need for effective identification, selection, acquisition, development, operation and protection of technologies (on the basis of product, process and infrastructure) and maintaining (expanding) its position and operational performance in the market, in line with the company's objectives.) was intended. Technology management at HAVELSAN includes details on the evaluation and management of activities carried out by strategic business units with a common understanding throughout the organization. It is a management process that includes tools and applications used in all the basic processes currently being implemented in order to create and maintain a managed infrastructure that is used jointly in areas such as time, effort, cost and product delivery quality in all project/product development processes. With Technology Management, it is also aimed to support innovation by evaluating innovative ideas more soundly and to manage cost and target efficiency especially in R&D studies. Basic tools and applications of Technology Management at HAVELSAN;

- Technology Taxonomy,
- Technological Competence,
- Technology Readiness Level,
- Technology Asset Inventory,
- Technology Roadmap

designated and put into use. Technology Management is included in all the basic processes of HAVELSAN, from the preparation of the Technology Roadmap (TR) at the strategic level to the product development process at the operational level, such as ecosystem evaluation, competency management, component cost and reuse tracking.

The Technology Roadmap is the main implementation plan that forms the basis of the basic activity plans of all strategic business units and the activity plans of all common business units that support basic activities. This plan is prepared in five-year periods and is reviewed and updated at least once a year.

In the adopted model, TR, as basic inputs; Organizational resources (infrastructure, organization, human resources, competence, financial preferences), together with opportunities for cooperation with technology suppliers. In this model, the use of technology required for a product to reach the target market and the planned projects can be viewed on a map view.

The main point of reference for the technology component of TR is the HAVELSAN taxonomy library. For each product of TR, with reference to the taxonomy, the initial (entry) and target (exit) technological readiness level is evaluated, on the one hand, the product and market targets are monitored from a financial point of view, on the other hand, technology -the development of the product can be monitored.

The technology roadmap is the main point of reference for all project studies and project-TR compatibility is essential at the start of project studies. TR is updated with actual information at project completion stage and used as a strategic management tool.

The Taxonomy 2.0 of Defense Industry Technologies, published by the Defense Industries Presidency (SSB), was used as a reference to create the HAVELSAN technology. The

taxonomy can be detailed up to four interconnected hierarchical levels, depending on the definition and depth of the technological domain. For each technology domain defined, the calculations of the technological readiness level were carried out at the lowest hierarchical level where the definition is located, and these calculations were also recorded in order to follow the historical evolution of the domain concerned. The taxonomy is used in technology, product and project level in the HAVELSAN technology roadmap, in project/product level in the project/product development process and in component level in the HAVELSAN library. technological assets.

Technology Competency was created with reference to HAVELSAN Technology Taxonomy to monitor and manage the basic level of competence in relevant technology usage/application areas based on strategic business units. The competency does not address a competency on an employee basis, but it shows the business competency of the relevant business unit against employees in any area. The skill level is expressed in nine maturity levels, 1 (minimum), 9 (highest). Technology competence is used in the technology, product and project details in the HAVELSAN technology roadmap, and at the work package level in the project/product details in the project/product development process. The Technology Readiness Level (THS) is used in the technology roadmap and project/product development processes for technology, product, project, and vendor assessment and planning.

In the THS assessment, the 9-point assessment, which is used as the standard in the defense and aerospace industry, was preferred. As a calculation approach, the two calculators produced by NASA for calculations based on technology components, but a new version of the product was released over time, were used separately for technology and product. For this purpose, a special version adapted for HAVELSAN has been prepared by evaluating the original calculation approaches as definitions and the question sets it contains. THS Calculation as THS-Product calculation approach for project and product in technology, product and project detail in HAVELSAN Technology Roadmap, project/product detail in Project/Product Development Process and supplier evaluation stages, and THS-Technology calculation approach for technology and supplier is used.

TVK (Türkiye Varlık Kütüphanesi) is a library that includes all components produced during HAVELSAN's core activities and that are subject to reuse, together with their development effort and costs. It was created and put into use in order to ensure that the advantage of the use of components in terms of project effort cost by other projects other than the projects they are produced, is traceable and measurable. Components (software components, software and hardware design documents, algorithms and models) are included in the TVK together with the Component Maturity Level evaluation from a 6-point scale in order to monitor the development maturity.

Conclusion

Technology management ensures that current technology is used in the most effective way, innovative and disruptive technologies are followed and predicted, and used in the development of products/solutions/projects in line with corporate goals. We are constantly improving and institutionalizing our processes in this regard.

As a technology company that is aware of the importance of this issue, we continue our efforts to use technology management as a management multiplier for HAVELSAN to achieve its strategic goals, with increasing corporate support.

References

Acur, N., Kandemir, D., & Boer, H. (2012). Strategic alignment and new product development: Drivers and performance effects. Journal of Product Innovation Management, 29(2), 304-318.

Ansal, H., Aygören, H., Beyhan, B., Çetindamar, D., Ekmekçi, U., & Wasti, N. (2009). Türkiye'de teknoloji yönetiminin analizi ve gelişmesi için öneriler.

Batur, Z., ve Uygun, K. (2012). Iki Neslin Bir Kavram Algisi: Teknoloji. *Uşak Üniversitesi Sosyal Bilimler Dergisi*, *5/1*, 74–88. https://doi.org/10.12780/uusbd106

Chen, J., & Qu, W. G. (2003). A new technological learning in China. Technovation, 23(11), 861-867.

Crisp, J. D. C. (1984). Perspective: The neglect of technology management. *The Journal of Product Innovation Management*. https://doi.org/10.1016/S0737-6782(84)80007-7

Çelik, N. (2009). Gelişmekte Olan Ülkelerin Sanayileşme Süreçlerinde Teknolojik Öğrenme Deneyimleri: Güney Kore Örneği ve Çin'in "Yetişme" Çabaları. *Electronic Journal of Social Sciences*, *8*(28), 91–109.

Çetindamar, D., Phaal, R., & Probert, D. (2013). *Teknoloji Yönetimi Faaliyetleri ve Araçları* (1. Baskı). Ankara: Efil Yayınevi.

Hackray, J. (1983). Reassessing technology management. *Planning Review*, 11(4), 14-18. https://doi.org/10.1108/eb054026

Karadal, F. ve Türk, M. (2008). İşletmelerde Teknoloji Yönetiminin Geleceği. *Niğde Üniversitesi İİBF Dergisi*, *1*(1), 59–71.

Karaöz, m. (2004). İmalat sanayiinde teknolojik öğrenme. Gazi Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 6(3), 97-112.

Kim, L. (2001). The dynamics of technological learning in industrialisation. International Social Science Journal, 53(168), 297-308.

Kocaoglu, D. F. (1994). Technology Management: Educational Trends. *IEEE Transactions on Engineering Management*. https://doi.org/10.1109/17.364557

Lee, T. J. (2004). Technological learning by national R&D: the case of Korea in CANDU-type nuclear fuel. Technovation, 24(4), 287-297.

Nonaka, I., & Konno, N. (1998). The concept of "Ba": Building a foundation for knowledge creation. *California Management Review*, *40*(3), 40. https://doi.org/10.2307/41165942

Schilling, M. A., & Hill, C. W. (1998). Managing the new product development process: Strategic imperatives. Academy of Management Perspectives, 12(3), 67-81.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, *18*(7).

Tiryakioğlu, M. (2011). Teknoloji transferi, teknoloji yoksulluğu mu? Ankara Üniversitesi SBF Dergisi, 66(02), 169-199.

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