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TECHNOLOGICAL MATURITY AS AN IMITATION STRATEGY BASIS – RECOGNITION AMONG MANUFACTURERS OF THE AGRICULTURAL MACHINERY SECTOR

Introduction

What resources determine the technological maturity of the manufacturing company? In theory, every owner, manager or even employee knows it. But is it complete and sufficient knowledge adjusted to the needs of a specific sector? Or is it the knowledge that needs to be complemented, and at least specified, which is reflected in this publication?

When searching for optimal methods of the company's development, and assessing the factors that affect organization's maturity, many entrepreneurs talk about a key role of resources and competences in shaping its success [Bratnicki, 2000; Day, Wensley, 1998; Enders, 2000; Grant, 1991; Javidan, 1998; Ljungquist, 2007; Ljungquist, 2008; Sanchez, Heene, 2004; Sanchez, 2004; Srivastava, 2005; Teece, 2009; Teece et al., 1997]. Therefore, it is not surprising that as a remedy for increasing unpredictability of the environment [Blyler, Coff, 2003; Teece, 2007; Zakrzewska-Bielawska, 2012], "business practice" most often chooses resource-based orientation. So, it is appropriate to treat resources in the category of the company's technological maturity [Christensen, 1995; Eisenhardt, Martin, 2000; Garrouste, Saussier, 2005; Teece, 2012; Wójcik-Karpacz, 2013]. However, its efficient functioning requires the possession and use of various

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resources that are transformed in certain work effects, among others, goods and services [Nogalski, Niewiadomski, 2013: 448].

With reference to the above, it should be emphasized that a key achievement in the management theory is a resource-based strategic management school [Romanowska, 2009: 12]. This view is confirmed by A. Zakrzewska-Bielawska [2014: 9–29], who in the course of finding an answer to the question of what strategic management school type dominates in the Polish companies, confirmed the overwhelming dominance of resource-based approach.

The presented considerations on the resource-based orientation of companies confirm the validity of the subject undertaken by the authors of this paper, especially given the fact that the resource-based strategic management school is still developing quite dynamically [Niewiadomski, 2016: 108]. On the one hand, as noted by K. Obłój [2010: 147], one tries to eliminate its various deficiencies, such as: tautological, metaphorical ontology, the lack of operationalization, on the other hand, according to R. Krupski [2012: 131], more and more new theoretical and practical areas are absorbed, which contributes to the links with other perspectives, as well as the resource acquisition and development processes.

The resource-based approach – postulated at the assessment of the manufacturing company's technological maturity – is close to strategic management. Striving for effective management of available resources, the fight against waste and minimization of losses are currently the object of concern of organizers and leaders. After all, the main goal of each industrial company includes manufacturing, in a short time, goods characterized by high quality and low total costs. One of the ways to achieve that is through appropriate selection and effective use of all available resources included in the manufacturing subsystems.

Although innovations are a large driving force for contemporary manufacturers – manifesting their development and maturity – they should not be seen as the only solution for improving the value of a company. Despite the fact that many experts still do not appreciate the imitation strategy, the prospect of imitation is particularly interesting; it aims at a better use of an existing potential, i.a., of work, knowledge and capital, etc. It is seen as an alternative to innovations, however, with a smaller risk, safer and usually less expensive for the entrepreneur, which can materialize meeting business targets. Imitation should not be perceived as an innovative, revolutionary or pioneering creative act but rather a conscious application of what already exists or has been designed in order to reach a new value.

Therefore, a new paradigm of the company, which assumes that technological resources are of central significance for the creative imitation processes, including technology, means of production, competences, as well as working tools and items, is adopted. The mentioned factors – according to the authors – determine the company's technological maturity, and the level of these features implies the perception of the

market opportunities offered to the manufacturers by flexible reconfiguration and integration of the manufacturing process.

With reference to the above, the fundamental objective of this publication is to assess the level of technological maturity that implies the implementation of an imitation strategy. Studies were carried out among manufacturers operating in the agricultural machinery sector. In reference to such an outlined purpose, as a necessary activity, it was recommended: at the theoretical level – using the reconstruction and interpretation method of the subject literature – to nominate the questions giving opinions on the technological maturity level in the sphere of the effective imitation strategy implementation; at the design level – to compile a research tool in the form of an assessment sheet resulting from the literature exploration and assessment among deliberately chosen experts; and at the empirical level – to recognize the technological maturity level among manufacturers of the agricultural machinery sector (self-assessment). In order to carry out the studies, the authors use a method of literature studies, expertise, a creative discussion, participant observation and providing an opinion with the use of a self-assessment questionnaire.

In the result of the conducted study, a decision was made to change the paradigm in thinking about the development of companies, recognizing that imitations do not constitute self-contained strategic objectives but only productivity-improving tools

The publication is a result of our reflection and exploration, and first and foremost, our practical activities in the management of companies operating in the agricultural machinery sector. It is an ambitious attempt to present the knowledge in the field of management and quality science. Thereby, it can play a role of scientific assistance, and at the same time, it can constitute a source of knowledge necessary to manage the maturity of companies.

1. Technological maturity vs. imitation strategy – starting point

Many researchers and managers have wondered about the essence, creation mechanisms and maturity limits of companies. At this point, the authors of this paper raise the question: *how to understand the technological maturity concept and what is its relationship with the imitation strategy?*

In our understanding, the company that through the acquired experience, outlined and adopted models, values and attitudes, in a far effective manner, can use the financial, relational, technological and knowledge based resources at its disposal, is mature. T.B. Kalinowski [2011: 173] believes that maturity is the ability of an organization and processes implemented by it to systematically provide increasingly better activity outcomes. Maturity is a degree to which all resources of the organization

are optimally allocated within stable processes, which enable the achievement of strategic objectives of the organization. The maturity is also defined as "a state of being complete, perfect or ready" [Lahrmann et al., 2010]. Maturity is developed gradually as a result of the process, during which the desired features are shaped, enabling the implementation of certain tasks [Kania, 2013: 84]. In particular, the technological maturity refers to the organization's resources, i.e., tangible (property, financial) and intangible (informational, relational) ones. These are the resources that are the main tool for shaping flexibility of the organization as a whole. In the context of the cited definition, it is believed that the maturity is presented as a reaction to changes in the environment or in the company's inside, and it is correlated with a resource potential of the organization (including the possibility of access to foreign resources).

The technological maturity determines the ability of the organization to cope with the changes. Instead of affecting the environment, organization tries to respond to them – mainly by increasing the liquidity of the company's resources. Technological maturity definition presented in this study – refers to the imitation strategy, including efficient, successful and effective management of resources necessary for its rapid implementation constituting a response to the demand variability challenges and increasing requirements of clients. Therefore, maturity is associated with an appropriate range of resources, which are good for modification of current activities of the organization as a result of relatively permanent changes in the environment. Technological maturity is the ability to reallocate manufacturing resources so as to effectively imitate while ensuring the acceptable quality. In the long term, technological maturity measures the ability to introduce new products, new resources and manufacturing methods and their integration with the existing manufacturing systems: it constitutes the manufacturing system's capability to change or react, when incurring low expenditure in terms of time, cost or performance of the activity. Despite emphasising the importance of maturity to maintain a long-term competitive advantage, it is difficult to find a clear way of understanding this category in the subject literature. By creating the organization's ability to prepare, react and adapt the resources to the current needs, company is allowed not only to constantly develop, but it is also provided with the possibility of using the emerging opportunities and occasions.

The technological maturity is based on three main factors: organization and management structures, empowered employees equipped with knowledge and flexible manufacturing technologies. Technological maturity is achieved through the integration and development of these three interdependent resources into a single coordinated system. Mature company is built on the following competitive bases: constant change, rapid response, quality improvement, responsibility for employees and the environment and comprehensive orientation towards the client.

The technological maturity in the area of the effective imitation implementation constitutes the company's ability to effectively choose the selected tools and management methods so that their implementation supports organization's objectives and strategy in order to achieve high quality of the imitated processes, products. Technological maturity essence can be presented in brief with the use of the short statement: "*imitate the proper activities in the right way*". Along with an increase in the technological maturity, that is the achievement of its next levels, the company's imitative potential increases in its individual areas; resources are used in a more efficient way. "Mature Imitators" know how to imitate and effectively use available solutions. They are able to conduct the extensive search for available real-time management tools, concepts or methods, as well as to operate on the basis of several business models, and rapidly and efficiently implement the planned projects, flexibly modifying them according to the changing ambient conditions. Therefore, they carry out "*mature imitation*", integrating copied elements with an innovative approach and the knowledge of situational conditions. It is characterized by high creativity and it is usually associated with incurring large investment expenditures. Unquestionably, the "mature imitations" can be a great driving force of the companies; they demonstrate their maturity, and therefore, play an important role in building the management strategies. The perception of the innovative activity as the only panacea for raising the value of the company – according to the authors – is a big mistake. There is nothing wrong in the imitations and they should be perceived as the action strategy [Shane, 2008; Cieślik, 2014; Quiamzade, 2007].

There is no unambiguous consent in case of the meaning of the technological maturity concept. Although, virtually every author gives his own definitions, providing such or other justification, it is not a task of the authors of this or any other publication to develop a commonly acceptable definition. The attempts to organize the terminology undertaken in this study were only of cognitive nature, which allowed us to capture the common areas, dependencies and research approaches.

2. Research method

2.1. Preparatory study

In the first stage of the studies – constituting preparatory study – authors applied a brainstorming method supported by the presentation and creative discussion. 16 persons directly associated with the Polish companies functioning in the agricultural machinery sector were invited to discussions, where: 9 persons are the owners and co-owners of companies (1 person represented a large company, 7 persons are representatives of medium-size companies, while 4 persons represented small

enterprises); 3 persons are managers directly involved in the management of the company, which they come from or they act for, while other persons represent institutions indirectly involved in the development processes of the studied sector entities (Table 1).

Table 1. Characteristics of experts participating in the research

Institution/Position	Number	Speciality	Share [%]
Owners and co-owners	9	Organization and Management, owner's supervision	48.15
Managers (executives)	3	Management of product, technological and organizational innovations	25.93
Industrial Institute of Agricultural Engineering – Testing Laboratory – Manager	1	Modeling of the machinery safety and assessment of conformity with requirements of the EU directives and standards harmonized at the concept and product designing stage	25.92
Department of Regional Policy of Marshal's Office of the Wielkopolska Province – Deputy Director	1	Innovative Wielkopolska, including the development strategy for Wielkopolska and provincial programme projects; active participation in creating their execution conditions	
Consultant	1	Manufacturing management, including optimization of manufacturing processes, designing and improvement of management systems with the use of lean management rules and instruments	
Business Centre Club expert	1	Management strategies, innovativeness of SME, science-business cooperation	
In total			**100%**

Source: own study.

The purpose of the discussion was to present the greatest number of ideas, from which it will be possible to choose the ones that best suit the problem presented in the study. In addition – qualitative studies – of phenomenological nature (based on experience) allowed to identify the opinions, feelings and associations, which in the analyzed case resulted from a number of factors related to the technological maturity problem. The carried-out discussions helped to generate the areas for further studies, formulate problems and specific issues. They provided interesting information on the language that "industry experts" use to describe the phenomena constituting the subject matter of the research. Authors believe this allowed to avoid mistakes at the level of constructing questions and to adapt the language to the potential respondents. The conversations significantly made it easier for the researchers to approach the natural world of respondents, and to understand their attitudes, language, which greatly helped to properly carry out the quantitative studies while ensuring full understanding of the studied phenomena among the potential respondents.

In the next stage – based on the carried-out discussion – the experts were asked to nominate questions giving opinion on the technological maturity level in the field of effective implementation of the imitation strategy; within 3 minutes, they had the opportunity to write down 3 important – in their opinion – desiderata on a sheet of paper. Then, after 3 minutes they gave the sheet to the subsequent person who added his/her observations. After next 3 minutes, the sheet went to the hands of the subsequent expert. Therefore, after 3 rounds, a group of 15 experts generated 135 variables. After the end of the session, the assessment of the obtained results was summed up. The authors of the studies wrote down all the mentioned features, grouped the suggestions, which, in retrospect, allowed them to determine the final list of 52 variables providing opinions on the technological maturity level in the field of effective implementation of the imitation strategy.

The self-assessment on the basis of such a great number of variables would be biased, hence the originally prepared model was verified among 80 deliberately selected manufacturing companies operating in the agricultural machinery sector[1]. Respondents were asked to identify fifteen – in their opinion – most important variables giving opinions on the technological maturity level in the field of effective implementation of the imitation strategy. The significance was marked by sorting out the variables (in the specially prepared table) in the order from the most to the least important ones. In response, 61 properly completed questionnaires were received, which means that 76.25% of the invited companies participated in the study.

The study involved the respondents directly associated with micro – 9 persons (14.75%), small – 21 persons (34.43%), medium – 26 persons (42.62%) and large – 5 persons (8.20%) manufacturing companies operating in the agricultural machinery sector. The analysis of the structure of companies shows that the companies based only on the Polish capital (more than 80%), present in the market for more than 10 years (90%) dominate among them. More than a half of the companies participating in the study is organized in the form of a business partnership, and a vast majority (90%) declares the activity both in the domestic and foreign markets.

Among the respondents, a group of persons with secondary and higher education was dominant (90%); 57.38% of the respondents had higher education, while 34.43% – had secondary education, and 8.20% had vocational education (Table 2).

The age of the respondents varied between 25 and 73; including 13.11% of the respondents in the age range up to 30 years, 24.59% in the range from 31 to 40 years, 32.79% in the age range from 41 to 50 years, 18.03% in the range from 51 to 60 years, and 11.48% of experts was more than 60 years old (Table 3).

[1] While taking the decision on selecting the respondents, an important criterion was the cooperation declaration between the companies and the researchers. The study involved manufacturers of tractors, combine harvesters, trailers, seedbed cultivators, seeders, manure spreaders and any equipment used in livestock rearing and breading, such as feeder wagons and feeder conveyors.

Table 2. Characteristics of the studied population by education (N=61)

Education	Number of participants	%
Primary	N=0	0
Basic vocational	N=5	8.20
Secondary	N=21	34.43
Higher	N=35	57.38
In total:	**N=61**	**100.00**

Source: own study.

Table 3. Characteristics of the studied population by age (N=61)

Age	Number of participants	%
up to 30	N=2	13.11
from 31 to 40	N=7	24.59
from 41 to 50	N=11	32.79
from 51 to 60	N=5	18.03
more than 60	N=3	11.48
In total:	**N=61**	**100.00**

Source: own study.

Among the 52 identified variables providing opinions on the technological maturity level in the field of effective implementation of the imitation strategy, based on the created hierarchy, the authors qualified 17 variables to the next stage of the studies that allow to measure the extent, to which the companies have a particular resource (Table 4). Taking into account the importance criterion of individual factors, the following solution was adopted by the authors for the essential stage of the study: lower limit of the value range for the group of critical features was at least 20 indications.

Table 4. Model and its empirical verification

Item	Competence	Number of indications	Acronym
1.	Holding own manufacturing technologies; implementation of modern technological solutions	45	MTech_[1]
2.	The ability to manufacture the equipment on its own	41	MTech_[2]
3.	Availability of the own office/project team	39	MTech_[3]
4.	Technological knowledge; the degree of adapting the employees to the manufacturing process	39	MTech_[4]
5.	Possession of a material base; possession of a network of active suppliers	36	MTech_[5]
6.	Partnership; building trust and cooperation between employees	36	MTech_[6]

Item	Competence	Number of indications	Acronym
7.	Freedom of action; creative ideas	33	MTech_[7]
8.	Changes in a manufacturing method in line with the needs	33	MTech_[8]
9.	Implementation of the lean management culture principles	32	MTech_[9]
10.	Holding formally defined product requirements	31	MTech_[10]
11.	Automation degree	27	MTech_[11]
12.	Team's technical culture	25	MTech_[12]
13.	Technological cooperation	24	MTech_[13]
14.	Operation standardization	23	MTech_[14]
15.	Multi-position scheme	22	MTech_[15]
16.	Maintenance. Preventative and supervising maintenance	22	MTech_[16]
17.	Flat organizational structure; reduction of management levels	21	MTech_[17]

Source: own study.

The determination of improvement areas requires the technological maturity level assessment. Maturity assessment is quite difficult, however, we attempted to perform it in the study. Already at the stage of designing the assessment method, any solution should be considered in terms of efficiency, i.e., the advantages possible to be obtained. According to the assumption, the proposed assessment method, should constitute a versatile and useful way of assessing the company's maturity level, as well as a significant support of the imitation activity. As a result, the companies can make self-assessment and determine which resources have good future perspectives, and which of them should be subject to improvement.

2.2. Proper study

The technological maturity level recognition among the Polish manufacturers of the agricultural machinery sector (self-assessment), was carried out on a group of 79 deliberately selected companies. The study was conducted in the period from November 2018 to January 2019. For this purpose, the direct meetings (41.77%), as well as – with the ambition to achieve greater representativeness of the surveyed target group and to receive possibly rapid responses – the questionnaires were additionally transferred to the selected manufacturing companies associated with the agricultural machinery sector (58.23%).

A look through the prism of competences and resources requires taking into account various perspectives and points of view. Therefore, the assessment was conducted among the managers of particular levels and functional areas within the company, which would allow the authors to refer to the widely understood resources (tangible and intangible ones, including competences). We are aware that the self-assessment

method application may raise some doubts regarding the veracity of the study results. Even by maintaining the appropriate study results, it can be assumed that the respondents may not need to falsify them[2]. The ability to assess weaknesses and strengths constitutes a key competence of the modern manager. In addition, it is assumed that the management board is a "selected professional elite", which owing to its profession (daily contact with the environment and its related feedback) has many opportunities to collect information on the company, which they originate from or they work for.

In the light of the above, the studies involved only the owners (40.51%) and managers (59.49%) directly associated with micro – 8 persons (10.13%), small – 29 persons (36.71%), medium – 39 persons (49.37%) and large – 3 persons (3.80%) manufacturing companies operating in the agricultural machinery sector (Table 5).

Table 5. Characteristics of the tested companies (N=79)

Company	Age					
	Owners		Managers		In total	
	40.51%		59.49%		100%	
	N	%	N	%	N	%
micro	N=5	15.63	N=3	6.38	N=8	10.13
small	N=12	37.50	N=17	36.17	N=29	36.71
medium	N=15	46.88	N=24	51.06	N=39	49.37
large	N=0	0	N=3	6.38	N=3	3.80
In total:	**N=32**	**100%**	**N=47**	**100%**	**N=79**	**100%**

Source: own study.

The structure analysis of the companies shows that the companies based only on the Polish capital (90%), present on the market for over 10 years (86.07%), dominate among them. More than a half of the companies participating in the study is organized in the form of a business partnership and a vast majority declares the activity also on the international market.

The age of the respondents varied between 25 and 76 (11.39% of the surveyed were under 30 years old, 36.71% in the 31–40 age range, 35.44% in the 41–50 age range, and 12.66% in the 51–60 age range). In the group of the owners, 25% was more than 50 years old, 37.50% of the owners was in the 41–50 age range, while 37.50% of the

[2] The respondents should be provided with confidentiality while completing the survey and confidentiality of the results. The way of using the study results is also crucial. A tendency to false the information intensifies especially when the information may be used contrary to its purpose. Therefore, an important criterion was the direct acquaintance of the respondents with the researchers.

owners were under 40 years old. In case of the group of managers, the distribution was as follows: 10.64% were older than 50 years old, 34.04% were in the 41–50 age group, 44.68% of the managers were 31–40 years old, while 10.64% were under 30 years old. Detailed characteristics are shown in Table 6.

Table 6. Characteristics of the studied population by age (N=79)

Age	Owners		Managers		In total	
	40.51%		59.49%		100%	
	N	%	N	%	N	%
up to 30	N=4	12.50	N=5	10.64	N=9	11.39
from 31 to 40	N=8	25.00	N=21	44.68	N=29	36.71
from 41 to 50	N=12	37.50	N=16	34.04	N=28	35.44
from 51 to 60	N=5	15.63	N=5	10.64	N=10	12.66
more than 60	N=3	9.38	N=0	0	N=3	3.80
In total:	**N=32**	**100**	**N=47**	**100**	**N=79**	**100**

Source: own study.

Among the respondents, a group of persons with secondary (29.11%) and higher (63.29%) education was the biggest; 56.25% of the owners had higher education, 28.13% – secondary education and 15.63% – vocational education. In case of the managers, 68.09% had higher education, 29.79% – secondary education and 2.13% – graduated from vocational schools. Detailed characteristics are shown in Table 7.

Table 7. Characteristics of the studied population by education (N=79)

Education	Owners		Managers		In total	
	40.51%		59.49%		100%	
	N	%	N	%	N	%
Vocational	N=5	15.63	N=1	2.13	N=6	7.59
Secondary	N=9	28.13	N=14	29.79	N=23	29.11
Higher	N=18	56.25	N=32	68.09	N=50	63.29
In total:	**N=32**	**100**	**N=47**	**100**	**N=79**	**100**

Source: own study.

One of the most important stages in the research process is an analysis and interpretation of the study results. In the further part of the paper, an attempt of the assessment based on the respondents' declarations was made. In order to carry out the assessment, a five-point scale describing the technological maturity level of individual descriptors corresponding to the separated fields was adopted, where

5 – is a very high level of knowledge and use of technology in the area of effective imitation, and 1 – is a tool, objects, technology or operating resources, virtually unknown and unused. The analysis proceeded in accordance with the previously assumed stages, which include the material segregation, combination of designates in the corresponding groups, rejection of the data that occurred to be unimportant from the perspective of the studied problem, and the description of the obtained opinions with their interpretation, as in the following part of the paper.

3. Technological maturity self-assessment (imitation context)

The technological maturity develops gradually as a result of the process, during which the desired features are shaped, and the specific competences and resources, which allow to perform specific manufacturing tasks, are acquired. However, in order to make it possible to determine the extent to which the phenomenon is rated, it is necessary to codify knowledge about how good processes or activities should look like, as well as how to assess (criteria) and improve them [Kania, 2013: 79]. The properly conducted assessment allows to obtain systematic guidelines and a clear assessment method of the implemented solutions. In the context of the above, the studies, the primary purpose of which was the attempt to answer the following question, were started: *what is the technological maturity level of the Polish companies operating in the agricultural machinery sector in the area of effective simulation (imitation)?* The study results were presented in Table 8.

The increasing competition, and the growing awareness of consumers, and thus an increase in requirements result in the situation that the company must keep up with the dynamics of changes, meet the needs and requirements, and invariably diversify their offer in order to meet the expectations of the market. Currently, it mainly comes down to the introduction of the broadly understood manufacturing technologies. The dynamic development of new technologies creates completely new opportunities for the imitation implementation. In the sectors, where there is a need for a rapid response to the changing conditions, new technologies are an essential element in the company development. Owing to the use of modern technological solutions – the companies subjected to the study – become much more flexible in this scope (average rating of 4.42; 51.9% of indications on the 5 point scale). Although the techniques that are the most efficient in economic terms, which offer a good return on investments, are the most popular, the increasing attention is paid to the processes that reduce the manufacturing time and energy consumption.

An increase in the range of activities of machines and devices used in the manufacturing processes requires the use of appropriate manufacturing equipment.

Table 8. Technological maturity assessment (imitation context)

Technological maturity descriptors (imitation context)	ACRONYM	1	2	3	4	5	Aver.
		%					
	M_Tech_[1]	–	1.0	6.0	31.0	41.0	4.42
		–	1.3	7.6	39.2	51.9	
	M_Tech_[2]	–	2.0	5.0	29.0	43.0	4.43
		–	2.5	6.3	36.7	54.4	
	M_Tech_[3]	3.0	5.0	12.0	28.0	31.0	4.00
		3.8	6.3	15.2	35.4	39.2	
	M_Tech_[4]	1.0	3.0	7.0	37.0	31.0	4.19
		1.3	3.8	8.9	46.8	39.2	
	M_Tech_[5]	–	3.0	5.0	38.0	33.0	4.28
		–	3.8	6.3	48.1	41.8	
	M_Tech_[6]	1.0	4.0	7.0	38.0	29.0	4.14
		1.3	5.1	8.9	48.1	36.7	
	M_Tech_[7]	1.0	3.0	9.0	34.0	32.0	4.18
		1.3	3.8	11.4	43.0	40.5	
	M_Tech_[8]	–	2.0	8.0	36.0	34.0	4.33
		–	2.5	10.1	45.6	43.0	
	M_Tech_[9]	1.0	3.0	7.0	31.0	37.0	4.27
		1.3	3.8	8.9	39.2	46.8	
	M_Tech_[10]	–	3.0	11.0	36.0	29.0	4.15
		–	3.8	13.9	45.6	36.7	
	M_Tech_[11]	4.0	8.0	16.0	29.0	22.0	3.72
		5.1	10.1	20.3	36.7	27.8	
	M_Tech_[12]	2.0	3.0	9.0	33.0	32.0	4.14
		2.5	3.8	11.4	41.8	40.5	
	M_Tech_[13]	–	2.0	7.0	33.0	37.0	4.33
		–	2.5	8.9	41.8	46.8	
	M_Tech_[14]	1.0	4.0	11.0	33.0	30.0	4.00
		1.3	5.1	13.9	41.8	38.0	
	M_Tech_[15]	1.0	3.0	11.0	33.0	31.0	4.14
		1.3	3.8	13.9	41.8	39.2	
	M_Tech_[16]	1.0	7.0	10.0	32.0	29.0	4.03
		1.3	8.9	12.7	40.5	36.7	
	M_Tech_[17]	–	2.0	7.0	37.0	33.0	4.28
		–	2.5	8.9	46.8	41.8	

Source: own study.

The manufacture of various types of products is possible with the use of appropriate equipment adjusted to the specific machine. The equipment is dedicated to the specific machines and manufacturing processes, so the possibility of its implementation constitutes key competence in case of implementation of a new range of products (average rating of 4.43; 54.4% of indications on the 5 point scale). Many instrumentation elements are created on the basis of the manufacturing experience and the demand reported by the operators of specific machines. The instrumentation manufacture is often associated with the necessity of having proper tools, the purchase of which is necessary for the manufacturer facing the need to manufacture even a few pieces of the required elements. The instrumentation design is a process similar to designing of special tools and it is primarily based on the need to increase the functionality of tools, devices and machines taking part in the company's manufacturing process. The instrumentation design begins with a detailed technical drawing and selection of the raw material for manufacturing that complies with the requirements of the specific project. In practice of the tested companies, in order to obtain high quality of the implemented solutions, they are supervised by a team of qualified engineers involved in the process until the final implementation of the taken imitation; the design and technological office allows for support during the performance of the implementation projects (average rating of 4.00; 39.2% of indications for the assessment on the 5 point scale).

A key determinant of the technological maturity, which the respondents paid attention to, is the issue of the executive board's potential and its competences (average rating of 4.19; 39.2% of indications for the assessment on the 5 point scale). The particular attention should be paid to the employment of professionals in the key positions for the company. The positions, which have a decisive impact on the level of technical and organizational solutions, and thus on the imitation potential, are considered crucial. It was pointed to the fact that the employees among various basic competences should be characterized by:

- Knowledge on manufacturing processes – it covers a wide area of the company's activity, starting from the market information, through the manufacture planning, and ending with the specifications of the finished goods;
- Knowledge on manufacturing systems – analysis of these knowledge resources leads to the characteristics of the manufacturing capacities of the company and owned manufacturing positions.

An essential condition, and at the same time, the first stage in the imitation creation process is an effectively operating chain of supply, including the disposal of a network of active suppliers (average rating of 4.28; 41.8% of indications for the assessment on the 5 point scale). Owing to the network cooperation through the use of complementary skills – the studied companies – can significantly reduce transaction costs, quickly adapt to changes in the environment and develop more creative ways of meeting the client's needs.

The imitation implementation requires the cooperation between the employees. The cooperation based on trust is the basis for smooth functioning of a team of executive employees, which obviously contributes to efficiency of the organization and performance of its implementation processes. It is confirmed by the study results, in which the companies indicate a high level of trust and cooperation in the imitation activity management (average rating of 4.14; 36.7% of indications for the assessment on the 5 point scale).

In order to make the companies competitive, the atmosphere taking into account the imitations, which allows them to use the scientific achievements, B+R activities, new organizational and technical solutions in the companies, should be created in them. If such activities take place, a unique atmosphere, which would allow the companies to imitate innovative solutions – making the organization flexible – will be created. The imitation emergence consists of two human activities: creativity that leads to finding the idea of better use of the existing solutions, and entrepreneurship, through which the imitated ideas are materialized obtaining its place in the economic reality. Ingenuity – ideation, that is the ability to come up with many solutions to the open problems, to generate new and valuable ideas and concepts, create a high level of technological maturity of the studied companies (average rating of 4.18; 40.5% of indications for the assessment on the 5 point scale).

Changes in the manufacture organization are inseparably associated with the activity of every manufacturing company. The manufacturing processes should be changed because the environment, in which the company operates, changes. The organization that cannot change and communicate these changes to its environment ceases to count in the modern economy. The introduction of changes in the way of manufacture that constitutes a response to the emerging needs, in the studied companies, is usually a conscious process organized and controlled by the manager (average rating of 4.33; 43.0% of indications for the assessment on the 5 point scale).

In the context of the technological maturity constituting a substrate of the imitation strategy, attention is paid to the company management system that allows to gain higher and higher profits by the improvement of processes oriented towards the clients' needs, i.e., lean management. The company that operates according to the Lean principles is a company focused on creating the maximum value for the client with the use of minimum resources, which is possible owing to the well-organised processes, which are, in turn, the effect of utilizing the talents of people at every level of the organization. It is assumed that the competitive advantage growth and above-average profits are obtained by the companies subjected to the study through meeting the client's needs, which can be simply reduced to three requirements, i.e., the appropriate level of costs, excellent quality of products and short delivery time (average rating of 4.27; 46.8% of indications for the assessment on the 5 point scale).

The imitation strategy includes the implementation and supervision of processes, the objective of which is to determine the requirements, acceptance criteria of the processes and implemented goods, provide specific human and material resources and to implement the supervision over the processes in order to ensure appropriate quality. The evidence of the product conformity with the requirements and the confirmation that it was manufactured in accordance with the plan is properly documented. Product requirements are very much focused on contact with a client. Therefore, they constitute an essential criterion for the technological maturity assessment; a relatively great ability to obtain documented information on the properties of goods and results, which can be obtained, is postulated (average rating of 4.15; 36.7% of indications for the assessment on the 5 point scale).

In the context of the carried-out studies, attention was paid to the fact that the introduction of technical measures and automatic devices operating on the principle of self-regulation and without or with limited human intervention, to the industrial manufacture, is not a prerequisite for taking the imitation activity. Paradoxically, the transfer of the entirety of the process control functions to the specialized devices, typically computers, may reduce the company's capability of imitation. Nevertheless, the companies indicate the technological maturity in this regard (average rating of 4.14; 39.2% of indications for the assessment on the 5 point scale). From the perspective of the imitation activity, attention was paid to the necessity of shaping the appropriate attitudes among the employees, which will result in the acceptance of new technologies; but this acceptance cannot be associated with blind imitation. Therefore, it is essential to create appropriate principles conducive to the activity in solving technical problems, which the studied companies seem to remember (average rating of 4.14; 40.5% of indications for the assessment on the 5 point scale).

In the process of the imitation creation, only one company, which would perform all the activities within the so-called value chain, is rarely involved. Thus, the effectiveness in terms of satisfying the clients' needs and achieving success in the market depends on the process of cooperation of many partners, i.e., suppliers, component manufacturers and other service providers who indirectly affect the imitation implementation. Cooperative relation may include only fragmentary parts of the entire manufacturing process, including specific technological operations, which, due to the lack of potential and/or expertise necessary for their performance, are implemented outside the company. The studied companies developed the ability to find the most appropriate forms of cooperative relations, which open new possibilities and action opportunities for it (average rating of 4.33; 46.8% of indications for the assessment on the 5 point scale).

The right approach to standardization, in particular the creation of a certain infrastructure, can support the imitative capacities and facilitate their distribution in the learning process of the entire organization. Attention is paid to building the infrastructure that creates the right environment for the creative work. One element

of this infrastructure is the right system for measuring and assessing the results. In the imitation processes, it is important to separate the main tasks that require creativity, where a new value for the client is created, from the auxiliary tasks that should be standardized. The imitations that do not meet the expectations should be analyzed in order to identify the causes of failure and to find the ways of their elimination, e.g., through standardization of auxiliary activities. In the studied companies, there are specific task categories, which are standardized with the use of appropriate methods and tools (average rating of 4.00; 38.0% of indications for the assessment on the 5 point scale). The focus on the most important aspects of the performed tasks and strict enforcement of the way of their implementation plays an important role. Leaving a certain degree of freedom constitutes a condition that the standards are properly used and serve both the employees and the organization.

In the context of the imitative activity and its related technological maturity – in case of the studied companies – attention is paid to the executive employees' skills in the field of aggregation of obligations and switching from one task to another. It involves the capability of selecting tasks, excellent planning and maintenance of focus on performing one task until its completion, and then, taking the next technological activity (average rating of 4.14; 39.2% of indications for the assessment on the 5 point scale). The studied companies are characterized by a strong emphasis on improving the availability and reliability of machines (average rating of 4.03; 36.7% of indications for the assessment on the 5 point scale). In the context of the imitation activity of the company, they use knowledge and they are focused on creative learning. It results in the need to streamline the organizational structures and gives them features like, among others, flexibility, vitality and dynamics, self-organization, self-similarity and self-optimization [Zakrzewska-Bielawska, 2008: 128]. Organizational structure of the studied companies is characterized by a lean hierarchy and low centralization, specialization and formalization (average rating of 4.28; 41.8% of indications for the assessment on the 5 point scale).

Conclusion

New challenges urge Polish companies to take active measures related to the technological revolution. It is possible to distinguish several such trends. One of the most important is a new wave of digitization, which affects an increasing number of life areas. Today, we already hear about the digitization of the entire manufacturing process. In the industry area, the expression of new digitization is the concept of the fourth industrial revolution. Therefore, it is required to define a new approach to data which become the manufacturing resource creating value. The economy of the future forces the manufacturing factors to enable the manufacture of goods of the

highest added value, at the same time, mitigating the adverse impact of the processes involving the manufacture and application of these goods on the environment and the society, and maintaining the ability to increase productivity. Therefore, the aim should be to improve the management efficiency regarding all resources. It will be possible to achieve through implementing the solutions within the framework of two guiding concepts: mature imitations or innovations.

Although innovations are a large driving force for contemporary manufacturers – manifesting their development and maturity – they should not be perceived as the sole solution for improving the company value. The agricultural machinery sector is dominated by enterprises, which inspired by innovations and observing a pioneer, focus on competitive, efficient and mature imitation. The article constitutes the foundation for discussions on innovativeness of the Polish companies and effectiveness of their innovation policy. The carried-out discussions should motivate entrepreneurs to reflect on their technological maturity, which will allow to decrease the degree of difficulty in making and implementing the investments, reduce the degree of risk and uncertainty, and help in making the optimal choice for entrepreneurs, who are not fully familiar with the mechanisms of the imitation introduction.

The studies described in the publication were aimed at preliminary identification of the actual technological maturity level in the face of imitations implemented by the companies. The adopted research methodology allowed the authors to recognise the quantitative and qualitative status among the selected companies operating in the Polish agricultural machinery market. The collected research material allowed to draw conclusions of a general and cognitive nature. In the paper, a procedure and a tool that allow to assess the level of key resources and competences were proposed, which, as the authors believe, will contribute, to some extent, to filling the knowledge gap in this area.

Notwithstanding the above, the authors recognise the need for further, even more in-depth studies. The problems solved in subsequent stages of the research process may be the subject of separate studies. According to the authors, the subject of further research should be the system of managers training. Of course, the higher education system offers managerial specialities, but usually, they are not associated with professional knowledge about manufacturing technology. The research on technological culture and the related demand for technological (engineering) competences, which the market will require from professional managers, will be significant, in particular, in the globalization era.

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TECHNOLOGICAL MATURITY AS AN IMITATION STRATEGY BASIS – RECOGNITION AMONG MANUFACTURERS OF THE AGRICULTURAL MACHINERY SECTOR

Abstract

The fundamental objective of this publication is to assess the level of technological maturity that implies the implementation of an imitation strategy. The studies were carried out among manufacturers operating in the agricultural machinery sector. In reference to such an outlined purpose, as a necessary activity, it was recommended: at the theoretical level – using the methods of reconstruction and literature interpretation – to nominate the questions giving opinions on the technological maturity level in the sphere of the effective imitation strategy implementation; at the design level – to compile a research tool in the form of an assessment sheet resulting from the literature exploration and assessment among deliberately chosen experts; and at the empirical level – to recognize the technological maturity level among manufacturers of the agricultural machinery sector (self-assessment). In order to carry out the studies, the authors use a method of literature studies, expertise, a creative discussion, participant observation as well as providing opinions with the use of a self-assessment questionnaire. It seems that the complexity of problems and small, so far, scientific recognition justify treating these issues as the research subject. Additional confirmation of the need to undertake research also results from the fact that on the publishing market there is a shortage of scientific studies on the organization maturity, especially, in relation to – used by machinery construction companies – technologies.

Keywords: technological maturity, imitations, strategy, agricultural machinery sector

JEL classification codes: O32, O33, L23, L61

DOJRZAŁOŚĆ TECHNOLOGICZNA JAKO PODSTAWA STRATEGII IMITACJI – ROZPOZNANIE WŚRÓD WYTWÓRCÓW SEKTORA MASZYN ROLNICZYCH

Streszczenie

Fundamentalnym celem publikacji jest ocena poziomu dojrzałości technologicznej implikującej realizację strategii imitacji. Badania prowadzono wśród przedsiębiorstw wytwórczych działających w sektorze maszyn rolniczych. W nawiązaniu do tak nakreślonego celu, jako działanie niezbędne, zarekomendowano: na płaszczyźnie teoretycznej – wykorzystując metodę rekonstrukcji i interpretacji literatury przedmiotu – nominowanie pytań opiniujących poziom dojrzałości technologicznej w sferze skutecznego wdrażania strategii imitacji; na płaszczyźnie projektowej – skompilowanie narzędzia badawczego w postaci arkusza oceny stanowiącego wypadkową eksploracji piśmiennictwa oraz oceny wśród celowo dobranych ekspertów; na płaszczyźnie empirycznej – rozpoznanie poziomu dojrzałości technologicznej wśród producentów sektora maszyn rolniczych (samoocena). W celu realizacji badań autorzy wykorzystują metodę studiów literaturowych, wiedzę ekspercką, twórczą dyskusję, obserwację uczestniczącą oraz zaopiniowanie przy wykorzystaniu kwestionariusza samooceny. Wydaje się, że złożoność problemów i małe, jak dotychczas, naukowe rozpoznanie uzasadniają traktowanie tych kwestii jako przedmiotu badań. Dodatkowe potwierdzenie potrzeby podjęcia badań wynika również z faktu, że na rynku wydawniczym zauważa się niedostatek naukowych opracowań na temat dojrzałości organizacji zwłaszcza w odniesieniu do – stosowanych przez przedsiębiorstwa budowy maszyn – technologii.

Słowa kluczowe: dojrzałość technologiczna, imitacje, strategia, sektor maszyn rolniczych

Kody klasyfikacji JEL: O32, O33, L23, L61