sciendo

Management
2018
Vol. 22, No. 2

ISSN 1429-9321 DOI: **10.2478/manment-2018-0036**

BOGDAN NOGALSKI
PRZEMYSŁAW NIEWIADOMSKI
AGNIESZKA SZPITTER

Technical dynamic capabilities in the opinion of Polish producers from the agricultural machines sector[1]

"We focus on good things
in the company, rather than bad ones.
We do not consider operations of a given
company as unimportant only because
not everything functions perfectly there"

Bill Gates

1. Introduction

Prof. Bogdan Nogalski,
doctor honoris causa
WSB University,
Institute of Management and Finance
Poland

Associate prof. Przemysław
Niewiadomski
University of Zielona Góra
Faculty of Economics
and Management
Poland

Associate prof. Agnieszka Szpitter
The University of Gdańsk
Faculty of Management
Poland

Currently, the companies operate in the extremely turbulent environment, in which changes take place faster and faster (Krzakiewicz, 2014; Nogalski, Niewiadomski, 2018; Cyfert, Bełz, Wawrzynek, 2014; Banaszyk, Cyfert, 2007; Cyfert, Krzakiewicz, 2009; Cyfert, 2012; Cyfert, Krzakiewicz, 2015; Koźmiński, 2016; Zakrzewska-Bielawska, 2012; Blyler, Coff, 2003; Teece, 2007). The degree of novelty of these changes is increasing, and there is the market globalisation and information exchange, and the companies are associated with a large number of various entities with complex dependencies. The growing turbulence of the environment and the need to

1 The article was created as part of the implementation of the scientific project entitled "Strategic dimension of dynamic capabilities of the Polish companies" ["Strategiczny wymiar zdolności dynamicznych polskich przedsiębiorstw"], DEC -2013/11/13/HS4/00697 financed by the National Science Centre.

adapt enterprises' behavior will certainly cause further changes in management practice (Krupski, 2003, p. 11).

Nowadays, it is very difficult to build and maintain a competitive advantage, in a long period of time, which is understood as a set of factors and capabilities that allow the company to consistently outdo competitors by effectively generation of an attractive market offer and effective competition instruments, which ensures the added value formation (Stankiewicz, 2002, p. 172). The scientific approach to the management process, which is based on the complexity of the process of changes and on understanding of the essence and nature of contemporary organisations, gains a specific meaning (Krzakiewicz, Cyfert, 2013, p. 7). However, this scientific character of the approach cannot be reduced only to theoretical speculations, nevertheless, it should be remembered that good management practice requires solid theoretical bases. What is more, in the contemporary world, there are no unambiguous, universal rights, because the problems faced by a modern manager changes in a kaleidoscopic way, and the attempts to solve these problems take place in different conditions, pace, and degree of uncertainty. K. Zimniewicz (2011, p. 54) postulates that it is more and more difficult to be found in today's world of management.

In reference to the above, it is assumed that the most desirable feature of contemporary organisations, as well as an important determinant of its functioning and development is its dynamics in responding to emerging changes. Most often, the dynamics is perceived as the property of an organisation characterised by special ease and speed of responding to upcoming opportunities and the ability to provoke them. It requires the company to be constantly looking for uniqueness, introducing innovations, flexible operation and learning to quickly adapt to changes, as well as strong ability to acquire and allocate resources[2], including technological resources (Eisenhardt, Martin, 2000; Teece, 2012, Christensen, 1995; Garrouste, Saussier, 2005; Wójcik-Karpacz, 2014). Many years ago, J. Schumpeter (1949, p. 68) and R. Solow (1957, p. 312-320) noticed that the technical progress development, in particular, the development of technologies and their implementation in manufacturing processes, constitute a significant lever of competitiveness and leading force of the economic growth and economic development.

2 At the same time, the resources are idiosyncratic and unevenly distributed, therefore, by accumulating valuable, rare and unique resources over time, the companies can generate a competitive advantage (Barney 1991, pp. 99-120; Hunt, Morgan, 1995, pp. 1-16; , 2014, p. 55).

The above considerations lead to the conclusion that the so-called technical dynamic capabilities (Nogalski, Niewiadomski, 2018, p. 76), which are mainly attractive for manufacturing companies looking for flexible specialisation and technology niches (Amin, 1994; Autio, 1997; Carnabuci, Bruggeman, 2009; Hirst, Zeitlin, 1991), are key for the provision of a competitive advantage in such a volatile environment. This is the subject of the presented publication, the main aim of which is to picture a model of key technical dynamic capabilities providing implementation flexibility of manufacturing companies of the Polish agricultural machinery sector[3]. The achievement of the main objective required the implementation of partial objectives, among which the following are distinguished:

- at the theoretical and design level – a query of subject literature remaining in a direct relation to the research topic, which, in the authors' intention, will find its expression in articulating the definition of technical dynamic capabilities, adequate to the research findings,
- at the design level – it is essential to search for the answer to the following question: *which of the mentioned technical dynamic capabilities imply the flexibility of Polish manufacturers of the agricultural machinery sector?*; discussion among the deliberately selected experts operating in the examined sector, aimed at development of a universal model of key technical dynamic capabilities of the manufacturing companies,
- at the empirical level – establishing the importance hierarchy of particular technical dynamic capabilities and determining which inefficiencies in this scope characterise the examined companies.

It seems that the complexity of problems and, so far, small scientific identification justify considering these issues as the research subject. The additional confirmation of the need for undertaking the research also results from the following facts:

- in the publishing market, there is a shortage of developments on technical dynamic capabilities of industrial companies, especially in relation to their impact on flexibility of machinery manufacture companies,
- the subject literature usually refers to general descriptions, lists or dynamic capability profiles; a shortage of developments presenting specific suggestions, which can be reflected in the management practice[4], is observed.

3 The main problem, reflecting the described situation and driving the research activities, is the absence of a model of technical dynamic capabilities determining implementation flexibility of manufacturing companies operating in the Polish agricultural machine sector.

4 However, it was adopted that a characteristic of modern management sciences is research work, aiming at ensuring the nature of the present considerations that is much closer to the real economic life (Gorynia, Kowalski, 2013, p. 459).

The research aimed at the identification of factors that shape competitiveness of a manufacturing company, often faces numerous problems connected with the availability of reliable information. Therefore, while starting the research, the authors decided to use expert methods[5], brainstorming, direct interview methods, as well as observation and participating methods (Krzakiewicz, Cyfert, 2013, p. 7). It had its methodological and practical aspect – on the one hand, in constructing a set of technical dynamic capabilities, and on the other hand, it served to formulate an answer to the question to which extent the particular mentioned factors – according to the experts (representatives of the agricultural machinery sector companies) – are the most important from the perspective of their flexibility determining the possibility of using the emerging opportunities. This answer was significantly reflected in this publication, which in its assumption will provide knowledge that could form the basis for activities improving the implementation flexibility of the manufacturing companies. The presented research results have given the direction of the authors' further papers, which will be presented in separate publications.

2. Starting point

Currently, it is difficult to imagine a long-term orientation of the organisation without identifying new ways of conducting the business activity and developing new technologies and products (Bratnicki, 2011, p. 17) especially that the variability and unpredictability of the environment are growing and there is no indication that the trend will reverse (Trzcieliński 2011, p. 23). Therefore, it is assumed that the factors that determine the effectiveness of adapting to changes include solutions related to: a) the use of new manufacturing techniques, b) the use of new manufacturing technologies, c) the development of methods and techniques in the sphere of organisation and management (Malara 2000, p. 5).

The complexity and dynamics of the environment results in the occurrence of many opportunities that should be identified and used by the companies. The implementation perspective is particularly interesting as the development of new products is a condition for its long-term growth[6] . According to K.M.

5 It was assumed that it is an effective method that will allow for forecasting and scientific solving of complex tasks. The combination of the experts' opinions with numerical methods allows to increase the efficiency of solving a given problem (Zając, Izdebski, Skudlarski, 2015, p. 332).

6 Therefore, the research implementation area should focus on the mechanisms and elements that determine the company's activities as well as build a competitive advantage, and thus its success.

Eisenhardt and D.N. Sulla (2001, pp. 107-116), the fast use of the opportunity is encouraged by a strategy in the form of simple rules (principles) created as a result of operationalisation of the process of building and implementing the strategy and – as K. Obłój (2002, pp. 61-74) adds – dominant logic of the management personnel. The creation and implementation of innovative strategies, within which the company will be able to take the opportunities, require specific dynamic capabilities, hence the companies' dynamic capabilities have become the subject of special attention in modern management.

In order to decide about the reality, phenomena and processes related to general management, it is necessary to clearly specify the scope of deadlines implied by the conducted research. Because the term of technical dynamic capabilities rarely occurs both in colloquial thought and scientific developments, the authors considered it legitimate to present a definition that materially corresponds to the subject of the conducted research. It is important to develop, adopt and consistently use and understand the term, especially that its meaning is not precisely determined; The attempts to organise the terminology undertaken in this development were only of cognitive nature, which allowed the authors to capture the indicated areas, dependencies and research approaches.

In the light of the above, it is justified to determine: how the concept of technical dynamic capabilities is understood by the representatives of the manufacturing companies of the agricultural machinery sector operating in Poland?

In-depth reconstruction and analysis of the literature (Nogalski, Niewiadomski, 2018, p. 80) indicates the identification of technical dynamic capabilities with the resource approach[7] , i.e.:

- the ability of the organisation to intentionally create, extend or change its resource base,
- the process of integrating, reconfiguring, acquiring and releasing the resources in order to be able to respond to the market changes or to spontaneously provoke them,
- the use of them to manipulate the existing company resources to create their new configurations.

The organisation's ability or competence includes a combination of resources, people, organisational structures, knowledge and rules, etc., which allow the organisation to implement the thing that the organisation is not capable of

7 In the adopted definition – the term of resources is understood in the sense of each manufacturing factor at the disposal of the company and used in the manufacturing process.

(Krzakiewicz, Cyfert, 2016a, p. 87). It can practically include any resource of the company: brand, location, employees or the understood company's technological capability, that is the ability to perform all relevant functions or technical activities within the company, which always includes the ability to effectively generate new products and processes (Ortega, 2010, p. 1274).

The acceptance of the assumption that technological and managerial competences reflect both individual skills and experience as well as distinctive ways of operation inside the company allows to conclude that the essence of the company is based on the ability to create, transform, collect, integrate and use knowledge as assets (Krzakiewicz, Cyfert, 2016b, p. 51].

In connection with the above, in this study it has been assumed that: The technical dynamic capabilities of the manufacturing company are the sum of its interrelated means of manufacture (machines, devices, tools, instruments) and objects/items of work (raw materials, materials, semi-finished products, energy) and available technology (way of work), engineering knowledge and skills of its use, personal predisposition of executive employees, as well as acquired experience, adopted attitudes and behaviours (technical culture), the proper reconfiguration of which enables the implementation of the manufacturing process aimed at the use of emerging opportunities (Nogalski, Niewiadomski, 2018, p. 81).

The components articulated in the developed definition through reciprocal coupling form a certain system. By using the terminology from the theory of systems, it can be concluded that:

1. The technical dynamic capabilities are a coherent (consistent) set, i.e. one in which the change of one element (e.g. the purchase of a new machine) changes other - not necessarily all - components, e.g. the new technology affected the attitude towards work implying, in turn, a change of behaviours towards the organisation.
2. The technical dynamic capabilities are a probabilistic set, i.e. one that cannot be accurately and completely predicted in the current state of knowledge.

Attention is drawn to the fact that the "leaner" the company is, the greater its flexibility in the context of emerging opportunities is. In other words, the lean production conditioning the implementation flexibility of the company implies the necessity to acquire the specific technical dynamic capabilities.

3. Research model

The research, referred to in this part of the paper, was conducted within the period from 15 September to 10 October 2016. At the first stage of the research

constituting a preparatory study, the authors applied the method of literature studies and brainstorming[8] among 14 people directly related to the manufacturing companies operating in the agricultural machinery sector, in which: 1 person represented the scientific environment of the university (research issues in the field of strategic management), 1 person represented the scientific environment of the industry institute dealing with the issues of designing the agricultural machinery structures, 9 people are owners of manufacturing companies of the examined sector, 3 people are managers responsible for performance of the implementation processes (production manager and the main constructor – technologist[9]). When selecting the experts, their professional and scientific experience in the field of management was taken into account above all. In each case, these were the professionally active people, actively involved in the implementation processes of the organisation, which they originate from or which they work for.

The preparatory study determined the conduct of the actual research; the authors intended to determine a list – model – of technical dynamic capabilities of the manufacturing companies of the agricultural machinery sector. The basic purpose of the research came down to developing a list of technical dynamic capabilities and discussing them with regard to the method of interpretation. The selected TDCs are not fixed categories – the model has been built so that it could be modified and supplemented as required. The authors are aware that establishment of lists is very difficult, different researchers create wide lists of TDC areas, without ranking them, naming and interpreting them differently. In addition, selection of the factors is always a matter of convention and depends on the demands of the authors or the institution for which the list is created.

Before brainstorming, the team was familiarised with its basic principles – which due to the limited publishing requirements – will not be described in this paper.

When the designated session time was over (the meeting lasted 45 minutes), the number of reported determinants accounted for 73 factors. Immediately after the session, the authors grouped similar ideas, which allowed them to determine the final list consisting of 42 technical dynamic capabilities.

8 The purpose of the brainstorming method was to obtain as many ideas as possible from which it will be possible to select those that are most relevant to the problem in question.

9 These were people working in the manufacturing organisations of the agricultural mechanisation sector for at least 5 years and supervising work on the implementation, maintenance and improvement of a product consistent with the market requirements.

As the introduction of more variables significantly complicates and prevents the formulation of relevant conclusions, the previously prepared list consisting of 52 technical dynamic capabilities was discussed (B2) among 12 deliberately selected experts (8 – owners, 2 – management personnel, 1 – president of the management board, 1 – proxy). As a result of this research, a list of 35 technical dynamic capabilities, which was transferred to a special questionnaire structure, was prepared. In this way, a tool aimed at proper testing (B3) within the framework of which the interviews were conducted among 49 deliberately selected experts (management personnel – 17 people[10], owners – 32 people)[11] of the manufacturing companies operating in the agricultural machinery sector[12].

When deciding on the selection of experts (purposeful selection), an important criterion was direct acquaintance of an expert with the researchers – supported by partner co-operation with the Production Plant of Agricultural Spare Parts and Machines "Fortschritt" as a research partner. This allowed to determine whether the assessing representative of a given company is independent in the presented judgements and issued opinions and whether he/she has sufficient expertise on the undertaken issue supported by well-established practical experience in the industry.

However, the entire interview with experts was carried out on 23-26 September 2016 during the AGRO SHOW 2016 International Agricultural Fair. The experts invited for the research were asked to indicate the impact of technical dynamic capabilities on the possibility of taking the opportunity. The significance was marked on a five-point scale, where 1 – is not important, and 5 – is very important.

4. Research results

4.1. Desired state – relevance hierarchy

In the market economy conditions characterised by high variability of the environment, an increasing level of competitiveness and internationalisation

10 The answers were provided by: general managers – 9 people, production managers – 4 people, main technologist/constructor – 4 people. The authors included people holding managerial positions in the company but holding no more than 10% of ownership in the group of managers. If someone had more, he or she was already included in the group of co-owners.

11 In the case of seventeen entities, which are a family-owned company, the questions were answered by future successors or co-owners.

12 The experts represented: micro - 5 people (10.2%), small - 15 people (30.61%), medium - 27 people (55.10%) and large - 2 people (4.08%) companies. Small and medium companies occupy a key place in the agricultural machinery sector, hence such entities constituted a substantial majority (85.71%).

of the economy, the implementation of the management process by the management personnel in an appropriate manner requires the continuous improvement of the organisation (Krzakiewicz, 2008, p. 9). The organisation management has never been a simple art (Borowiecki, Kiełtyka, 2011, p. 9). Currently, despite the applied technologies, the situation is even more complex due to the wealth of their supporting concepts. Therefore, the considerations regarding the concept of technical dynamic capabilities should be carried out in terms of their consistency with other currently used management techniques.

Table 1 shows the most important findings of the conducted research.

Table 1. Technical dynamic capabilities in the opportunity category – importance hierarchy

Item	Technical Dynamic Capabilities	Implementation level (% of indications)					Aver.
		1	2	3	4	5	
	Having own manufacturing technologies; development and implementation of own methods for the processing of raw materials, materials and objects; own way of performing the tasks; having own machine tools and equipment for processing and manufacturing	-	-	-	4.1	95.9	**4.96**
	The ability to manufacture the equipment on its own	-	-	-	8.2	91.8	**4.92**
	Having a material base; possession of a network/ base of suppliers	-	-	-	10.2	89.8	**4.90**
	Team's technical culture; ability to shape appropriate attitudes in the company that will cause acceptance or resistance to new technologies; creation of appropriate rules conducive to the activity in solving technical problems	-	-	2.0	18.4	79.6	**4.78**
	Company's technical potential/degree of automation; Having technical means and automatic devices operating by way of self-regulation and working without human participation or with its limited participation	-	-	-	28.6	71.4	**4.71**

	Low production costs/low operating costs/ aiming to reduce the costs; the ability to introduce solutions that reduce the working time, which should lead to the reduction of costs and greater efficiency; striving to eliminate any waste	-	-	-	36.7	63.3	**4.63**
	Dealing with the change	-	-	2.0	34.7	63.3	**4.61**
	Availability of the own office/project team	-	-	2.0	34.7	63.3	**4.61**
	Organisation's ability to learn quickly	-	-	4.1	32.7	63.3	**4.59**
	Creativity of employees; thinking that leads to original and appropriate solutions; the ability to create something new	-	-	2.0	36.7	61.2	**4.59**
	Competence/technological knowledge; a degree of adjusting the employees' competences to the manufacturing process; knowledge in the field of technology, construction and operation of machines. It covers theoretical foundations, expertise and the ability to use modern computer-aided design (CAD / CAM) techniques	-	-	2.0	42.9	55.1	**4.53**
	Constant improvement of the technological process	-	-	2.0	46.9	51.0	**4.49**
	Maintenance. Preventive and supervising maintenance; maintaining machines in good technical condition	-	-	4.1	49.0	46.9	**4.43**
	The possessed control and measurement systems, e.g. hardness testers; remaining at the disposal of the equipment as well as control and measurement modules	-	-	4.1	51.0	44.9	**4.41**
	Management of the production tooling	-	-	4.1	53.1	42.9	**4.39**
	The company's ability to cooperate with other entities	-	-	8.2	53.1	38.8	**4.31**
	Production tooling belonging to the customer	-	-	8.2	57.1	34.7	**4.27**
	Advanced product quality planning	2.0	4.1	8.2	36.7	49.0	**4.27**
	Engagement of employees; ability to create a situation in which subordinates identify themselves with the performed work	-	2.0	10.2	49.0	38.8	**4.24**

	Having formally defined product requirements	-	-	8.2	59.2	32.7	**4.24**
	Ability to organise the work of a team of contractors; implementation of specific activities (building cycle); the ability to delegate rights and tasks to employees	-	2.0	10.2	53.1	34.7	**4.20**
	Availability of the operating instructions	-	-	10.2	59.2	30.6	**4.20**
	Motivation of employees; existence of incentive systems in the company	-	2.0	8.2	59.2	30.6	**4.18**
	Storage capabilities and stock status; keeping stocks at the level of 20% of annual demand	-	-	34.7	30.6	34.7	**4.00**
	Supplier's quality management system – qualification of deliveries	-	-	16.3	69.4	14.3	**3.98**
	Completeness of technological documentation/ supervision of employees on technological documentation	4.1	6.1	20.4	46.9	22.4	**3.78**
	Co-workers' readiness for self-development and competence improvement	2.0	4.1	38.8	36.7	18.4	**3.65**
	The effect of the primary production scale; mass production ensuring a decrease in costs along with an increase in the production volume	4.1	6.1	28.6	46.9	14.3	**3.61**
	Ability to solve conflicts in the company	2.0	4.1	38.8	42.9	12.2	**3.59**
	Ability to schedule the production; Application of ERP system calculation algorithms enabling the production planning that takes into account the availability of tools required to implement the production process at a given time	2.0	10.2	34.7	38.8	14.3	**3.53**
	Having the implemented quality management system/quality book	4.1	14.3	53.1	16.3	12.2	**3.18**
	Holding certificates, approvals, permits,	4.1	10.2	59.2	18.4	8.2	**3.16**
	Professional experience in the industry	4.1	12.2	53.1	26.5	4.1	**3.14**
	Having own transport/logistic resources	4.1	4.1	69.4	18.4	4.1	**3.14**
	Cleanliness of the work place, e.g. machining station	4.1	22.4	59.2	8.2	6.1	**2.90**

Source: own development on the basis of research

Each manufacturing process consists of technological and auxiliary operation, repetitive and lasting a certain time. A thorough analysis of each manufacturing activity allows for detailed identification of the needed material and personal manufacturing resources. The technologist analyses the available means of manufacture and objects of work. He or she analyses the manufacturing capacity and determines the potential demand for new machines or work tools. After recognising the available solutions regarding the method of implementation of the manufacturing process, the most favourable one in terms of the selection criteria (e.g. implementation time) is chosen. In view of the above, the use of modern technological solutions, holding of advanced manufacturing methods as well as the use of the latest scientific discoveries, in practice, are technical dynamic capabilities that significantly determine the implementation capabilities of the manufacturing company (average rating of 4.96; 95.9% of indications for the assessment of 5 points).

When designing a given manufacturing process, one should take into account that the collected system resources may differ from the resources needed for its implementation. In relation to the above, the ability to manufacture the equipment on its own (average rating of 4.92, 91.8% of indications for the assessment of 5 points), as well as having a material base - the base of suppliers (average rating of 4.90; 89.8% of indications for the assessment 5 points) - they significantly imply the implementation possibilities of the company, i.e. its flexibility.

The shaping of appropriate attitudes among the contractors, which will result in acceptance in relation to new technologies, and resulting in the situation that the appropriate attitudes can reveal in a proper way, that is the creation of appropriate principles conductive to the activity in solving technical problems by them, as well as raising the level of responsibility among manufacturers and users of the technique are perceived as essential from the perspective of the manufacturer's ability to take the opportunity (average rating of 4.78; 79.6% of indications for the assessment of 5 points). Additionally, the standards developed in the team of employees result in the improvement of the customer service quality, high efficiency and profitability of the company. The rapid increase in manufacture, which is characterised by the modern industry development, requires a systematic increase in the level of organisation and automation of the manufacturing processes (average rating of 4.71; 71.4% of indications for the assessment of 5 points). The automation allows the companies to manufacture more products in shorter time, as well as to manufacture with less waste, and in economic terms, to optimally manage the process and monitor at every stage of the process. Faster and more efficient

production brings large financial benefits for the manufacturer and customer satisfaction.

The introduction of solutions that reduce the working time, which leads to a gradual decrease of costs and greater production performance significantly determine the implementation possibilities of companies (average rating of 4.63; 63.3% of indications for the assessment of 5 points). However, it should be emphasised that all the automation elements, before their final installation in the target control system, should be subjected to detailed tests; sometimes too much automation – through the introduction of technical means and automatic devices operating in terms of self-regulation and operating without the human participation or with its limited participation – prevents flexible manufacturing. The transfer of the entire control function of the process to the specialised devices, most often to computers, causes a decrease in the implementation possibilities. The process of improving activities owing to the greater knowledge of employees and their deeper understanding of the principles and objectives of the organisation operation is limited. From a practical point of view, small organisations that focus on standard forms of production can quickly adapt the product to specific customer requirements. Therefore, they have a better chance to become companies that take the opportunities. By referring to the problem of mutual dependencies between lean and flexible approaches, it should be emphasised that there is even the need to move the organisation through a lean manufacturing phase to become a flexible manufacturer.

According to the experts, it is important for the company to be able to identify the need for a change, resulting from the company's situation, the market needs, strategies or the expectations of the management, employees or clients. It is important to be able to assess whether it is worth making revolutionary, evolutionary changes in a given situation, or just nothing should be changed. It means that the manufacturers should: develop alternative change scenarios and select the best one, as well as plan the implementation of changes, communicate changes in a convincing way and in a way positively received by the employees, recognise different reaction styles to a change among employees and reach each group of people with an adjusted message, recognise various forms of resistance and unwillingness to changes and minimise them, and then convince various groups of employees to changes, motivate the employees to cooperation at the stage of the implementation of changes, as well as plan support for the crew in the period after changes, prepare support that helps to find itself in a new situation (average rating of 4.61; 63.34% of indications for the assessment of 5 points). The availability of the own office and design team (average rating of 4.61; 63.34% of

indications for the assessment of 5 points) allows the manufacturer to: know the manufacturing conditions, analyse the construction in terms of its technology and possible consultations with a constructor, select a semi-finished product, develop a framework technological process, divide the technological process into components, select tools and machining parameters as well as design or select the instruments and machining grips, develop the control programme, develop the standardisation documentation, determine additional technological conditions, conduct the trial run on the machine, correct the technology (if necessary), confirm the process documentation and start the production, as well as normalise the working time necessary to perform a given activity. Therefore, the fact that the above-mentioned feature belongs to the model of key dynamic capabilities is not surprising.

4.2. Actual state – an attempt of the improvement direction assessment

The determination of the improvement areas requires the assessment of the level of current technical dynamic capabilities assimilated by the companies. The entrepreneurs are reluctant to reveal their weakness, and they are more likely to talk about their strength. The examined experts – in addition to the required level of acquiring the technical dynamic capabilities – in the next stage (B4), assessed the extent to which their represented companies have them at their disposal.

Among 35 technical dynamic capabilities identified in total (tab. 1) comprising the efficiency of using the opportunities by the manufacturing companies of the agricultural machinery sector (implementation flexibility), to the further stage of the research (tab. 2) - on the basis of the created hierarchy - the authors qualified 8 factors. The operationalisation of technical dynamic capabilities forming the model was carried out on the basis of the ABC method assumptions[13]. The research results are shown in table 2. After considering the assessment results of the currently held technical dynamic capabilities, the next stage in the improvement

13 In the ABC method, based on Pareto's law (20/80), it is assumed that 20% of the elements of any collectivity represents approx. 80% of the cumulative feature value, in terms of which a given collectivity is analysed. The paper assumes that the key technical dynamic capabilities will be determined by a subset representing 20% of their entire set. As coping with the change and availability of the own design office obtained the same number of indications – for further research – 8 factors were qualified.

process is to determine the gap [14]. In case of the improvement of companies, the information about the gap is a basis for determining the need and scope of changes. On the basis of the assessment made by the experts, weaknesses of the adopted opportunity management strategy can be distinguished.

Table 2. Technical dynamic capabilities - current level of acquisition

Item	Technical Dynamic Capabilities	Desired level	Current level	Gap
	Team's technical culture; ability to shape appropriate attitudes in the company that will cause acceptance or resistance to new technologies; creation of appropriate rules conducive to the activity in solving technical problems	4.78	4.22	**0.56**
	Company's technical potential/degree of automation; Having technical means and automatic devices operating by way of self-regulation and working without human participation or with its limited participation	4.71	4.35	**0.36**
	Low production costs/low operating costs/aiming to reduce the costs; the ability to introduce solutions that reduce the working time, which should lead to the reduction of costs and greater efficiency; striving to eliminate any waste	4.63	4.47	**0.16**
	Dealing with the change	4.61	4.51	**0.1**
	Having own manufacturing technologies; development and implementation of own methods for the processing of raw materials, materials and objects; own way of performing the tasks; having own machines, tools and equipment for processing and manufacturing,	4.96	4.92	**0.04**
	The ability to manufacture the equipment on its own	4.92	4.90	**0.02**
	Having a material base; possession of a network/base of suppliers	4.90	4.94	**-0.04**
	Availability of the own office/project team	4.61	4.73	**-0.12**

Source: own development on the basis of research

14 In the conducted analysis of the obtained results, it was important to find differences between the required and held level of the technical dynamic capabilities. Therefore, the statistical verification of the significance of the found differences was not conducted.

Among eight identified technical dynamic capabilities – the experts – relatively most critically, in terms of the requirements, assess the technical culture (average rating of 4.22, 34.7% of indications for the assessment of 5 points) and the degree of automation (average rating of 4.35; 46.9% of indications for the assessment of 5 points). In both cases, the difference between the desired and actual state fluctuates around 0.5 point. In case of the ability to reduce costs and increased efficiency (average rating of 4.47; 57.1 % of indications for the assessment of 5 points), dealing with a change (average rating of 4.51; 57.1% of indications for the assessment of 5 points) and having the own manufacturing technologies (average rating of 4.92; 91.8% of indications for the assessment of 5 points), as well as the ability to individually manufacture the equipment (average rating of 4.90; 91.8% of indications for the assessment of 5 points), the level of the held dynamic capabilities minimally deviates from the required level of their acquisition. A negative value in case of having a material base and availability of the own design team means that the experts assess the required degree of technical dynamic capabilities lower than the one held by the company.

5. Conclusion

The research described in the publication intended to identify the actual and anticipated level of the technical dynamic capabilities of the companies operating in the Polish agricultural machinery sector.

The adopted research methodology allowed the authors to identify the quantitative and qualitative status of technical dynamic capabilities of the selected companies operating on the agricultural machinery market and to design a model of the anticipated capabilities. The material collected during the research procedure allowed to draw conclusions of a general and cognitive nature. In the paper, the procedures and tools that allow to identify key technical dynamic capabilities and determine the gap, which according to the authors contributes to the partial completion of the lack of knowledge in this field.

There is a need to conduct further research work on the determinants of the development of technical dynamic capabilities and the criteria for their formation, which will allow for the design of business models that are more and more adequate to the conditions of a given company. The research on the technical culture of companies and the demand for knowledge on the conditions of shaping it in companies will be also important.

Summary

Technical dynamic capabilities in the opinion of Polish producers from the agricultural machines sector

The main aim of this paper is to develop a model of key technical dynamic capabilities providing implementation flexibility of manufacturing companies of the Polish agricultural sector. Achieving the main target required to formulate sub-targets, to which the following have been included: the query of subject literature remaining in a direct relation to the topic of the research, which, in the authors' intention, will find its expression in the developed definition of technical dynamic capabilities. At the design level, it is essential to search for the answer to the question: what technical capabilities imply dynamic flexibility of the Polish manufacturers of the agricultural machinery sector?, while, at the empirical level, to prioritize individual technical dynamic capabilities and determine what deficiencies in this area are characteristic for the studied companies.

Keywords: *Technical dynamic capabilities, implementation flexibility, opportunity, chance.*

Streszczenie

Techniczne zdolności dynamiczne w opinii polskich wytwórców sektora maszyn rolniczych

Zasadniczym celem badań jest opracowanie modelu kluczowych technicznych zdolności dynamicznych zapewniających elastyczność implementacyjną przedsiębiorstw wytwórczych polskiego sektora maszyn rolniczych. Osiągnięcie celu głównego wymagało zrealizowania celów pośrednich, wśród których wyróżniono: kwerendę literatury przedmiotu pozostającą w bezpośredniej relacji z tematem badań; w zamierzeniu autorów znalazło to swój wyraz w proponowanej definicji technicznych zdolności dynamicznych. Na płaszczyźnie projektowej istotne jest poszukiwanie odpowiedzi na pytanie: jakie techniczne zdolności dynamiczne implikują elastyczność polskich wytwórców sektora maszyn rolniczych? Natomiast na płaszczyźnie – empirycznej ustalenie hierarchii ważności poszczególnych technicznych zdolności dynamicznych oraz ustalenie jakie niedomagania w tym zakresie cechują badane przedsiębiorstwa.

Słowa kluczowe: *Techniczne zdolności dynamiczne, elastyczność implementacyjna, okazja, szansa.*

JEL Classification: E20, I12, E24

References:

1. Agarwal R., Helfat C.E. (2009), *Strategic renewal of organizations*, "Organization Science", Vol. 20, No. 2, pp. 281–293.
2. Amin A. (Eds.) (1994), *Post-Fordism. A Reader*, Blackwell Publishers, Oxford, Malden.
3. Autio E. (1997), *New Technology – Based Firms in Innovation Networks Symplectic and Generative Impacts*, "Research Policy", Vol. 26, pp. 263-281.
4. Banaszyk P., Cyfert S. (2007), *Strategiczna odnowa organizacji [Strategic renewal of the organisation],* Difin, Warsaw.
5. Barney J. B. (1991), *Firm Resources and Sustained Competitive Advantage*, "Journal of Management", Vol. 17, pp. 99-120.
6. Blyler M., Coff R. (2003), *Dynamic capabilities, social capital and rent appropriation: Ties that split pies*, "Strategic Management Journal", Vol. 24, No. 7, pp. 677-686.
7. Borowiecki R., Kiełtyka L. (2011), *Przedmowa [Preface]*, [in:] Borowiecki R., Kiełtyka L. (ed.), *Przełomy w zarządzaniu. Zarządzanie procesowe [Breakthroughs in management. Process management]*, TNOiK [Scientific Society For Organization And Management] "Dom Organizatora", Toruń.
8. Bratnicki M. (2011) *Nadawanie sensu, improwizacja i przedsiębiorczy rozwój organizacji: Budowanie domeny badań [Giving sense, improvisation and entrepreneurial development of the organization: Building a research domain],* [in:] Krzakiewicz K. (ed.), *Praca kierownicza w nowoczesnym zarządzaniu [Managerial work in modern management]*, Publishing House of Poznań University of Economics and Business, Poznań, pp. 16-24.
9. Carnabuci J., Bruggeman J. (2009), *Knowledge Specialization, Knowledge Brokerage and the Uneven Growth of Technology Domains*, "Social Forces", Vol. 88, no. 2, pp. 607-641.
10. Christensen J. F. (1995), *Asset Profiles for Technological Innovation*, "Research Policy", Vol. 24, pp. 727-745.
11. Cyfert S. (2012), *Systemowy model organizacji: perspektywa procesów odnowy organizacyjnej [Organisation systemic model: the prospect of organisational renewal processes]*, [in:] Bełz G., Cyfert S. (ed.), *Strategie i mechanizmy odnowy przedsiębiorstw [Strategies and mechanisms of enterprise renewal]*, Publishing House of the Wrocław University of Economics, Wrocław, pp. 123-129.

12. Cyfert S., Bełz G., Wawrzynek Ł. (2014), *Wpływ burzliwości otoczenia na efektywność procesów odnowy organizacyjnej [The influence of the environment turbulence on effectiveness of the organisational renewal processes]*, "Organizacja i Kierowanie" ["Organisation and Management"], No. 1A(159), pp. 15-26.
13. Cyfert S., Krzakiewicz K. (2009), *Nauka o organizacji [Organisation science]*, Towarzystwo Naukowe Organizacji i Kierownictwa [Scientific Society for Organization and Management], Poznań.
14. Cyfert S., Krzakiewicz K. (2015), *Model procesu odnowy organizacyjnej [Model of the organisational renewal process]*, "Management Forum", Vol. 3, no. 1, pp. 10-14.
15. Eisenhardt K. M., Martin J. A. (2000), *Dynamic Capabilities: What are They?*, "Strategic Management Journal", Vol. 21, pp. 1105-1121.
16. Eisenhardt K.M., Martin J.A.M. (2000), Dynamic capabilities: What are they?, "Strategic Management Journal", Vol. 21, No. 10/11, pp. 1105–1121.
17. Garrouste P., Saussier S. (2005), *Looking for a Theory of the firm: Future Challenges*, "Journal of Economics Behavior & Organization", Vol. 58, pp. 178-199.
18. Gorynia M., Kowalski T. (2013), *Nauki ekonomiczne i ich klasyfikacja a wyzwania współczesnej gospodarki [Economic sciences and their classification versus modern economy challenges]*, "Ekonomista" ["Economist"], no. 4, pp. 457-474.
19. Grudzewski W. M., Hejduk I. (2008), *Zarządzanie technologiamii [Technology management]*, Difin, Warsaw.
20. Hirst P., Zeitlin J. (1991), *Flexible Specialization versus Post-Fordism: Theory, Evidence and Policy Implications*, "Journal Economy and Society", Volume 20, Issue 1, pp. 5-9.
21. Hunt S.D., Morgan R.M. (1995), *The Comparative Advantage Theory of Competition*, "Journal of Marketing", Vol. 59, pp. 1-16.
22. Johnson G., Scholes K., Whittington R. (2010), *Podstawy strategii [Fundamentals of the strategy]*, PWE [Polish Economic Publishers], Warsaw.
23. Karpacz J., 2014, *Zdolność technologiczna i innowacje produktów: Ujęcie teoretyczne i wyniki badań empirycznych [Technological capability and product innovations: Theoretical approach and empirical research results]*, [in:] Kraśnicka T. (ed.), *Innowacyjność współczesnych organizacji. Cz. 2, Kierunki i wyniki badań [Innovation of modern organisations. Part 2, Research directions and results]*, Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach "Studia Ekonomiczne" [Scientific Journals of University of Economics in Katowice "Economic Studies"], No. 183, Katowice, pp. 55-67.
24. Krupski R. (ed.) (2003), *Zarządzanie strategiczne. Koncepcje – metody [Strategic management. Concepts – methods]*, Publishing House of the Wrocław University of Economics, Wrocław.

25. Krzakiewicz K. (2009), *Wstęp [Introduction]*, [in:] Krzakiewicz K. (ed.), *Problemy pracy kierowniczej we współczesnym przedsiębiorstwie [Managerial work problems in a modern company]*, TNOiK [Scientific Society For Organization And Management], Poznań.
26. Krzakiewicz K. (2014), *Iluzje w procesie badania sukcesu organizacji [Illusions in the organisation success research process]*, "Organizacja i Kierowanie" ["Organisation and Management"], no. 1A(159), pp. 99-110.
27. Krzakiewicz K., Cyfert S. (2013), *Teoretyczne problemy zarządzania organizacjami [Theoretical problems of the organisation management]*, Publishing House of Poznań University of Economics and Business, Poznań.
28. Krzakiewicz K., Cyfert S. (2016a), *Dylematy kształtowania strategicznego w ujęciu teorii Firmy – na przykładzie zarządzania strategicznego [Dilemmas of strategic shaping in terms of the theory of the Company – on the example of strategic management]*, [in:] Osbert-Pociecha G., Nowosielski S. (ed.), *Meandry teorii i praktyki zarządzania [Meanders of management theory and practice]*, Publishing House of the Wrocław University of Economics, Wrocław, pp. 83-94.
29. Krzakiewicz K., Cyfert S. (2016b), *Strategiczny potencjał organizacji uczącej się w aspekcie koncepcji dynamicznych zdolności [Strategic potential of the learning organisation in the aspect of the concept of dynamic abilities]*, "Studia i Prace Kolegium Zarządzania i Finansów" ["Studies and Papers at the Collegium of Management and Finance"], Zeszyt Naukowy 149 [Scientific Journal 149], the Warsaw School of Economics in Warsaw, pp. 44-59.
30. Malara Z. (2000), *Metody i doskonalenie organizacji i zarządzania przedsiębiorstwem [Methods and improvement of the organisation and company management]*, Publishing House: Oficyna Wydawnicza Ośrodka Postępu Organizacyjnego, Bydgoszcz.
31. Nogalski B., Niewiadomski P. (2018), *Elastyczność polskich wytwórców sektora maszyn rolniczych jako implikator dyskusji o modelu technicznych zdolności dynamicznych* [Flexibility of Polish producers from the agricultural machines sector as the stimulant for a discussion about the model of technical dynamic capabilities], [in:] Krzakiewicz K., Cyfert S. (ed.), *Dynamiczne zdolności polskich przedsiębiorstw*, TNOiK, Poznań, pp. 74-96.
32. Obłój K. (2002), *Dominująca logika działania jako strategia firmy: studium polskich przedsiębiorców [Dominant logic of operation as company's strategy: a study of Polish entrepreneurs]*, "Organizacja i Kierowanie" [Organisation and Management"], no. 4 (110), pp. 60-75.
33. Ortega M. J. R. (2010), *Competitive Strategies and Firm Performance: Technological Capabilities' Moderating Roles*. "Journal of Business Research", Vol. 63, issue 12, pp. 1273-1281.

34. Schumpeter J. A. (1949), *The Theory of Economic Development*, Harvard University Press, Cambridge, Massachusetts.
35. Solow R. M. (1957), *Technical change and the aggregate production function*, "Review of Economics and Statistics", Vol. 39, pp. 312-320.
36. Stankiewicz M. J. (2002), *Konkurencyjność przedsiębiorstwa [Competitiveness of the company]*, "Dom Organizatora", Toruń.
37. Teece D. J. (2007), *Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance,* "Strategic Management Journal", Volume 28, Issue 13, pp. 1267–1369.
38. Teece D. J. (2012), *Dynamic Capabilities: Routines versus Entrepreneurial Action,* "Journal of Management Studies", Volume 49, Issue 8, pp. 1395-1401.
39. Teece D., Pisano G., Shuen A. (1997), *Dynamic capabilities and strategic management*, "Strategic Management Journal", Vol. 18, No. 7, pp. 1395-1401.
40. Trzcieliński S. (2011), *Przedsiębiorstwo zwinne [Agile company]*, Publishing House of Poznań University of Technology, Poznań.
41. Zając S., Izdebski W., Skudlarski J. (2015), *Metoda ekspercko-matematyczna jako narzędzie wspomagające prognozowanie i naukowe rozwiązywanie skomplikowanych zadań [The expert-mathematical method as a tool that supports forecasting and scientific solving of complicated tasks],* "Prace Naukowo-Dydaktyczne PWSZ im. S. Pigonia w Krośnie" ["Scientific and Educational Papers of State Higher Vocational School in Krosno], Krosno, Z. 68, pp. 331 – 355,
42. Zakrzewska-Bielawska A. (2012), *Zarządzanie strategiczne w przedsiębiorstwach wysokich technologii [Strategic management in high-technology companies]*, [in:] Werewka *J.* (ed.), *Zarządzanie projektami w przedsiębiorstwie informatycznym. Metodologia i strategia zarządzania [Management of projects in the IT company. Management methodology and strategy]*, Publishing House of AGH University of Science and Technology], Kraków, pp. 87-116.
43. Zimniewicz K. (2011), *Wszystko zależy od wszystkiego [Everything depends on everything]*, [in:] Dworzecki Z., Nogalski B. (ed.) *Przełomy w zarządzaniu. Kontekst strategiczny [Breakthroughs in management. Strategic context]*, TNOiK [Scientific Society For Organization And Management] "Dom Organizatora", Toruń, pp. 49-59.