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THE CHARACTERISTICS OF EXPORTERS AMONG HIGH-TECHNOLOGY MANUFACTURERS BASED IN WARSAW

Agnieszka Skala, Katarzyna Rostek
Warsaw University of Technology

Abstract. The goal of presented study was to identify and describe the high-tech manufacturing sector (HT) in Warsaw and to indicate the part having the highest market potential. Based on the results of previously executed studies, the sub-sector of HT-exporters (HTME) was identified as the most promising group of companies in the high-technology sector. In the article, the description of this sub-sector is presented and its specifics are discussed. Their legal status is more frequently corporate, their size is larger (in terms of the number of employed), as well as the scope of their cooperation with regard to science and the self-assessment of innovativeness. The assumption that the exporters of high-technology products are elite among HT manufacturers has been confirmed.

Key words: entrepreneurship, high-technology, exporters, manufacturing, identification criteria

INTRODUCTION

The basic classification of the industry, in terms of its technology level, divides it into four categories: high-technology, medium-high technology, medium-low technology, and low-technology [OECD 1995]. The high-technology group is important to the economy and has a significant impact on the nature and pace of economic growth in developed countries. The major distinction splits the HT sector into two groups: manufacturers and service providers. However, the HT-services group is not the subject of this study, which is focused exclusively on the high-tech manufacturing branches, which are electronics, pharmaceuticals, aviation and spacecraft.

Corresponding author: Agnieszka Skala, Warsaw University of Technology, Faculty of Transport, Koszykowa 75, 00-662 Warszawa, Poland, e-mail: askala@wt.pw.edu.pl

Although the statistics and research is conducted on the high-tech sector, the definition of this term continues to be rather ambiguous [Steenhuis and de Bruijn 2006, O'Regan and Sims 2008]. As many as 19 definitions of tech-company have counted Grinstein and Goldman analyzing literature only until 2000 [Grinstein and Goldman 2006]. This ambiguity makes the companies included in the HT sector being drawn as a rather homogeneous group gathering similar entities, when in fact it can be very varied and uneven in terms of market potential and development stage. The boundaries between sectors in the economy gradually disappear in the process of "the industry convergence", which also affects one of the most important HT industries: pharmaceuticals [Gierszewska 2012]. Is an ongoing debate around the question of the criteria under which companies can be considered as belonging to the high-technology industry, and which cannot.

Classification into the high-technology industry may be done on the basis of affiliation to a sector of the economy (the sectorial approach) or goods produced by them (the product approach) [Skala 2014]. According to the sectorial approach, high-tech production category now includes companies, which declares their main activity in any of three kinds of production: pharmaceuticals, electronics, and air- and spacecraft. On the other hand, in the product approach there are nine groups of goods being the result of the production processes: aerospace computers and office machines, electronics/ /telecommunications, pharmacy, scientific instruments, electrical machinery, chemistry, non-electrical machinery and armament.

Given the above, the scope of this study is to explore the criteria that distinguish the HT-sector companies which have a positive impact on the economy.

There are factors characterising the high-tech sector that are mentioned in literature. Among them the high level of the innovativeness of processes or final products is highlighted as well as the fact of creation of the stable well-paid jobs for highly skilled workforce [Stuart 2000, Christensen and Raynor 2003]. These are highly productive and competitive companies [O'Regan and Sims 2008, Zakrzewska-Bielawska 2011], that raise the technological level throughout the entire economy [Nelson 2014] usually having extremely short product lifecycles [Steenhuis and de Bruijn 2006] and cooperating with science. The high market and investment risk in the sector is compensated by a potential profit from successful investment and a long-term benefit for the market and economy [O'Regan and Sims 2008, Olsson and Schuller 2012]. Moreover, irrespectively of the selection criteria used, the HT companies provide an excellent space for research on the latest trends in technologies, management, and marketing [Zakrzewska-Bielawska 2012].

While searching for the criteria distinguishing high-tech companies, the high propensity to export appears often in the research results [Filatotchev et al. 2009]. A popular argument is that firms that export grow faster and stronger. Studies confirm the positive relationship between the export activity and the high productivity [Mostafa et al. 2005, Hessels and van Stel 2011] as well as the share of employees with higher education in total employment and the level of expenditures on R&D [Cieślik et al. 2014]. Simultaneously, all three features: high productivity, raised share of employees with higher education and a high level of R&D expenditure are characteristic of HT companies.

Therefore, the main objective of the present research was to indicate the characteristics of the part having the highest market potential. The realization of this goal required the development of the characteristics of the research group, which was the population of Warsaw's high-tech manufacturers. This analysis was used also to search for new, atypical and specific characteristics distinguishing leading companies in the study group. The result is a characterization of the high-tech Warsaw with particular emphasis on the role and importance of exports.

METHODOLOGY

The initial purpose of the research was to provide material for the description of the Warsaw high-tech sector. However, it revealed a major difficulty in identifying the HT entities. Therefore, the first step was to identify HT companies from amongst other business entities registered in Warsaw. The basic criterion for qualifying companies as high-tech, which is based on the PKD declared by the companies, was recognized as not reliable. Therefore, a need arose to define a new method that would provide an unequivocal answer to the question about which companies should, and which should not, be regarded as high-tech. A hybrid method was proposed, which combined the data from GUS, ZUS, and information available online [Rostek and Skala 2014a, Skala 2014]. The second step was aimed at characterizing the HT sector (137 entities) using analytical methods enriched by the data obtained from the companies' websites [Rostek and Skala 2014b]. The goal of the third step was to differentiate it from other sectors, and to find the features that create its special nature [Rostek and Skala 2014c]. In the course of the research, the fact that being an exporter company was indicated as one of the strongest features characterizing the population of the high-technology group of companies. The fourth stage of the research was dedicated to exporters.

At this stage of the research, in addition to the sources of information previously used, a new source of data was used. Analytical Centre of Customs Office (CAAC) has provided the information on exporters among Warsaw companies in 2012. Nine new attributes supplied the information about the range of export value, the main destination of exports, and the number and directions of export destinations. The classification of attributes used in the study follows the structure shown in Table 1.

The first operation to do was to identify the research group of the HTME. The Warsaw population of 137 HT manufacturers was compiled with the population of exporters (16,241 entities) operating in Warsaw as well. It appeared that 110 of the 137 HT entities selected were amongst the companies that showed exports in the period considered. Among them, 61 (55%) have a "Z" value and have been considered as inactive exporters. The type of exported products in the remaining group of 49 companies has been verified and 12 of them did not export any HT products. Hereby, the final population of firms being simultaneously HT manufacturers and HT exporters has been identified in a number of 37. The group of the selected 37 HTME is the subject of this study. The algorithm, which led to the identification of HTME group, is shown at Figure 1.

Table 1. Classification attributes of HTME within all datasets

Used at the number of research stage	Attribute		Data source
	name	description	
1, 2, 3, 4	REGON	REGON number; set identifier	GUS[a]
	HiTech	PKD[b] group	GUS
2, 3, 4	FP	specific legal form	GUS
	FZ	share of foreign capital	GUS
	EMPLN	number of employees (ranges)	GUS
1, 2, 3, 4	WA	activity indicator	ZUS[c]
2, 3, 4	B2B	type of sale: B2B	website_1study
	B2C	type of sale: B2C	website_1study
	CERT	certificates	website_1study
	ACTIV	assessment of activity	website_1study
	LANG	website in foreign language	website_1study
	SCIENCE	cooperation with science centres	website_1study
	PATENT	patents	website_1study
	EMPL	searching for new employees	website_1study
	SOCIAL	social networking service account	website_1study
	EXPORT	export activity	website_1study
	INNO	self-assessment of innovative nature	website_1study
4	EXPORT_12	range of export value in 2012	CAAC[d]
	EXPORT_C	main destination of export in 2012 (country)	CAAC
	E_C/E %	% of the export value to the main destination	CAAC
	E_EU/E %	destination to EU as % of total exports	CAAC
	N_EU	number of exports destinations in EU (countries)	CAAC
	N_nEU	number of exports destinations outside EU (countries)	CAAC
	N_All	number of all exports destinations	CAAC
	HT_G	group of high-tech products exported	CAAC
	E_HT/E %	high-tech products export value as % of total export value	CAAC
	Research-oriented	based on research centre, having laboratory, established by scientists etc.	website_2study
	Successor	the company is continuing activity of ormer state institution or company	website_2study

[a] GUS – National Office of Statistics; [b] PKD – Polish Classification of (business) Activity (NACE codes); [c] ZUS – Social Insurance Institution; [d] CAAC – Analytical Centre of Customs Office.

Source: The authors' research.

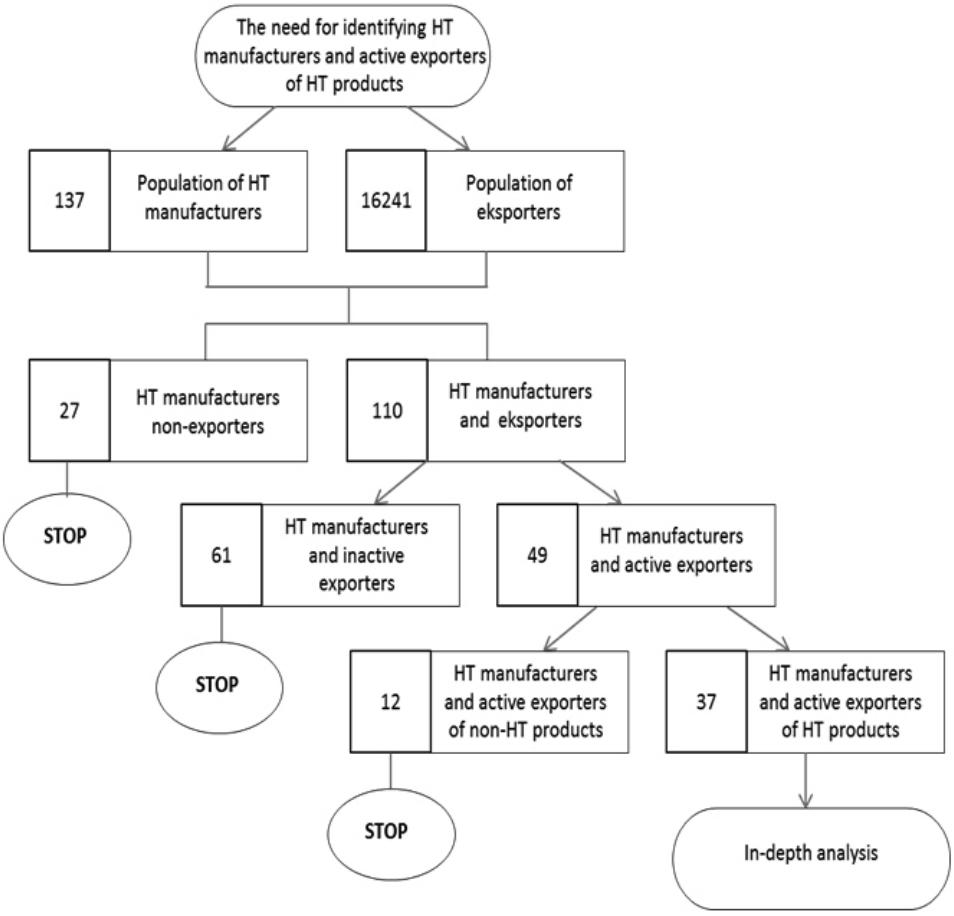

Fig. 1. The algorithm that led to the identification of HTME
Source: The authors' research.

RESULTS AND CHARACTERISTIC OF HTME

The analysis of the HTME group will be divided into parts corresponding to the sources of data. The results of the first part of the analysis, which was based on information from GUS and ZUS are shown (Table 2).

There are four types of businesses that dominate among the HTME entities. These are manufacturers of instruments and appliances for measuring, testing and navigation (nine entities), manufactures of computers and peripheral equipment, manufacturers of pharmaceutical preparations, and manufacturers of electronic components.

This structure is similar to that which occurs in the whole group of HT manufacturers, although it is worth noting the total lack of aircraft and aerospace industries in the HTME group. As many as 26 out of 37 (70%) HTME entities have chosen the legal

Table 2. Attributes distribution characterizing HTME (within GUS/ZUS datasets)

Attribute		Distribution of value		
name (REGON)	description (REGON number; set identifier)	value (Individual number)	quantity	% of population
HiTech	PKD group, main activity executed	2,110 manufacture of basis pharmaceutical substances	3	8.1
		2,120 manufacture of medicines and other pharmaceutical products	5	13.5
		2,611 manufacture of electronic components	4	10.8
		2,612 manufacture of electronic printed circuits	2	5.4
		2,620 manufacture of computer and periferal equipment	5	13.5
		2,630 manufacture of telecommunication equipment	3	8.1
		2,640 manufacture of consumer electronic equipment	2	5.4
		2,651 manufacture of measuring control and navigational instruments and equipment	9	24.3
		2,660 manufacture of radiating equipment, electromedical and electrotherapeutical equipment	2	5.4
		2,670 manufacture of optical instruments and photografic equipment	2	5.4
		2,680 manufacture of inrecorded magnetic and optical media	0	0
		3,030 manufacture of aircrafts, spacecrafts and similar machinery	0	0
FP	Specific legal form	16 joint-stock company	10	27
		17 limited liability company	16	43.2
		18 general partnership	3	8.1
		19 civil law partnership	1	2.7
		99 one-man business	7	18.9
FZ	Share of foreign capital	0	34	91.9
		1	3	8.1
EMPLN	Number of employees (ranges)	0–9	14	37.8
		10–49	11	29.7
		50–249	7	18.9
		250–999	3	8.1
		> 999	2	5.4
WA	Activity indicator	0	0	0
		1	37	100

Source: The authors' research.

form of a corporation (stock corp. or limited liability company), while in the HT group, this share is also high, but reaches only 50%. Only three companies in the HTME population have foreign equity participation (two pharmaceutical companies and one electronics manufacturer), which is similar for the entire group of HT also dominated by Polish capital.

Information about the size of employment in HTME indicates values greater than the average, but the data is not very reliable, because it refers to the situation at the time of registration of the company. All surveyed companies pay contributions to ZUS, which means that they are active and that they employ workers.

The results of the second part of the analysis, which is based on information from the first screening of the companies' websites_1study, are shown in Figure 2.

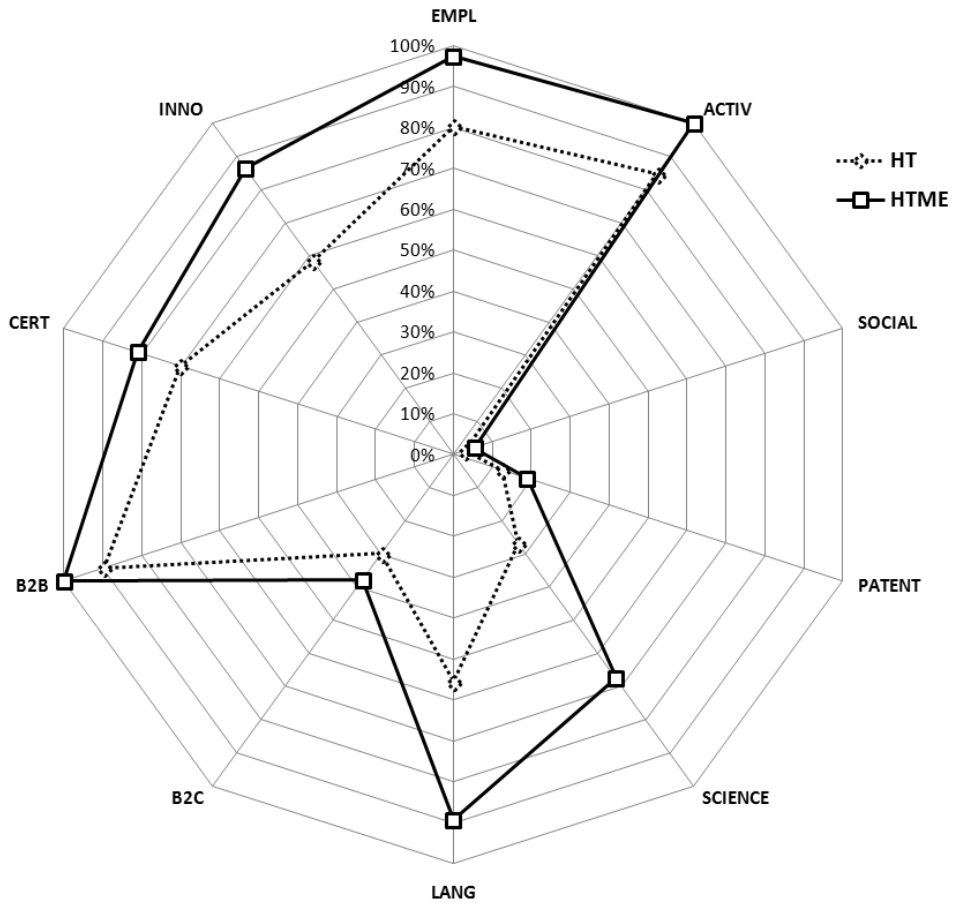

Fig. 2. A comparison of the HT and HTME groups in terms of attributes obtained from the first websites screening

Source: The authors' research.

All HTME have active websites and lead sales in the B2B model. Only in one case, the website was not clear that the company is looking for and employ new workers. The vast majority has certificates (81.1% of the population), defines itself as innovative (86.5% of the population), and also maintains a website in a foreign language (89.2% of the population).

All of the HTME companies have active websites and are selling in the B2B model. Only in one case was the website information unclear as to whether or not the company employed workers. The vast majority of firms have different types of certificates, self-define themselves as innovative, and conduct their website a in a foreign language. The HTME companies outperformed the HT group in terms of holding patents and, remarkably, in cooperation with science. The share of firms holding patents has increased from 12 (HT) to 19% (HTME) and, respectively, from 27 to 70% in the second discussed. It shows that cooperation with science, defined as running a research laboratory, having an R&D department, or hiring scientists, is an important distinctive factor for companies that build their competitive advantage in foreign markets. This kind of cooperation may be related as well to the possession of the certificates, which have up to 80% HTME (compared to 58% in the HT group). A comparison of the HT and HTME groups in terms of attributes obtained from the first websites screening is shown in Figure 2. It indicates better performance of HTME compared to HT group, which justifies further, in-depth studies of this subgroup.

The results of the third part of the analysis, which is based on exports information from the CAAC, are shown in Table 3. Among the HT products exported by HTME companies, four products clearly dominate with regard to distribution of value: electronics and telecommunications equipment, scientific instruments, and pharmaceuticals. With regard to the value of the exports, the population has been divided evenly between exporters who sold abroad goods worth up to 1 million PLN in 2012 (19 companies) and those who exceeded this value (18 companies). No HTME company sold HT products for more than 128 million PLN.

The attribute EEPORT_C means a country where the largest share of a company's exports is sold. During this research, 23 countries were identified, of which four countries were indicated by more than one firm. Results indicated Germany: twice times, UK: three times, and Russia and the Ukraine: five times each. This means that in the HTME population there is a significant group of companies (10 entities), whose primary foreign trade partners are Russia or the Ukraine. Other 10 entities indicated EU countries as the primary destinations for their exports. On the other hand, 22 companies (60%) did not export to the EU at all. With regards to the number of countries being export destinations, 22 companies exported to up to 10 countries, but the record holder showed as many as 57 countries as destinations (the company sells industrial measurement and control equipment). The last indicator (E_HT/E %) reflects the percentage of HT products in the total value of export. For 12 firms (1/3 of HTME) HT products represented 100% of the exports. For 2/3 of them, HT products represented at least 50% of the export value.

While screening HTME websites, two additional attributes of the group were identified (Table 4). The first concerns the cooperation with science. The attribute Research-oriented characterizes companies that were established based on scientific institutes

Table 3. Attributes distribution characterizing HTME (CAAC datasets)

Attribute		Distribution of value		
name	description	value	quantity	% of population
EXPORT_12	range of export value in 2012 (million PLN)	< 1	**19**	**51.4**
		1–8	7	18.9
		8–64	8	21.6
		> 64	3	8.1
EXPORT_C	Main destination of export in 2012 (country)	Russia	**5**	**13.5**
		Ukraine	**5**	**13.5**
		Great Britain	3	8.1
		USA	3	8.1
		Germany	2	5.4
		Lithuania	2	5.4
		other (12 countries)	1 each	2.7 (× 17)
E_C/Exp %	% of the export value to the main destination	**1–50**	**16**	**43.2**
		51–99	14	37.8
		100	7	18.9
E_EU/E %	destination to EU as % of total exports	0	**22**	**59.5**
		1–50	6	16.2
		51–100	9	24.3
N_EU	number of exports destinations in EU (countries)	0	**22**	**59.5**
		1–10	6	16.2
		11–20	8	21.6
		> 20	1	2.7
N_nEU	number of exports destinations outside EU (countries)	1–10	**30**	**81.1**
		11–20	4	10.8
		> 20	3	8.1
N_All	number of all exports destinations	1	7	18.9
		2–10	**15**	**40.5**
		11–20	8	21.6
		> 20	7	18.9
HT_G	group of high-tech products exported	1 – aerospace	1	2.7
		2 – computers	2	5.4
		3 – electronics / telecommunications	**13**	**35.1**
		4 – pharmacy	**8**	**21.6**
		5 – scientific instruments	**10**	**27**
		6 – electrical machinery	2	5.4
		7 – chemistry	1	2.7
		8 – non-electrical machinery	0	0
		9 – armement	0	0
E_HT/E %	high-tech products export value as % of total export value	< 25	10	27.0
		25–49	3	8.1
		50–74	1	2.7
		75–100	**23**	**62.2**

Source: The authors' research.

Table 4. Attributes distribution characterizing HTME (within website_2study datasets)

Name of attribute	Description of attribute	Distribution of value		
		value	quantity	% of population
Research-oriented	based on research centre, having laboratory, established by scientists etc.	1	22	59.5
		0 or ?	15	40.5
Successor	based on research centre, having laboratory, established by scientists etc.	1	9	24.3
		0	28	75.7

Source: The authors' research.

cooperating with them, running their own scientific labs, or entities founded by (former) scientists. The second attribute Successor, characterizes entities that continue the tradition of the former state companies or institutions, established long before the Polish economy transformation in 1989. The analysis shows that the so-defined HTME subgroup is relatively significant and particularly interesting.

The results of the last part of the study showed that 59% of the HTME companies have close relationships with the world of science, and every fourth entity was founded on the basis of the old state-owned enterprises or institutes.

CONCLUSIONS

To sum up the findings of the study, we must conclude that the high-tech manufacturers and exporters based in Warsaw are mainly producers of pharmaceuticals, electronics and electronic components, subsequently. They sell exclusively to other business entities (B2B type of transaction). Their legal status is more frequently corporate, their size is larger (in terms of the employment). They show strong cooperation with science, including certificates or patent holdings. It is worth noting that their export destination to the East is more popular than to the West, and this tendency includes the highest value exports as well. HTME companies export their products to EU countries uncommonly.

A particularly interesting result noted was that one in four analyzed HTME companies was founded on the basis of the old state-owned enterprises or research institutes. Four of them dealt with the pharmaceutical industry and five with electronics. All of them have their own laboratories, and all are commercial companies with a status of being at least a medium-sized firm (in terms of employment). These companies are continuing the old tradition of the Polish R&D and manufacturing units (like Warsaw Pharmaceutical Works, "OMIG" Radio Components Plant, "Polfa" Tarchomin Pharmaceutical Company, "Cemat," a State Company, Polish Optical Company, "FARUM" X-ray Apparatus and Medical Equipment State Company).

The research are another approximation the problems distinguishing characteristics of Polish high-tech companies after presentations in the articles Rostek and Skala [2014a, b,

c]. Further research should focus on the latter group of companies for which a rich history is likely to be important in the process of building their market position. They can help to find answers to the question of how to effectively operate in the market and flexibly adapt to changes in the environment inevitably following the economic, social and political life. This is particularly important due to the current concentration of European production financing in these areas.

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CHARAKTERYSTYKA GRUPY EKSPORTERÓW NA PRZYKŁADZIE WARSZAWSKICH PRODUCENTÓW WYROBÓW HIGH-TECH

Streszczenie: Celem prezentowanych badań było wyselekcjonowanie i opisanie przedstawicieli warszawskich producentów high-tech (HT) oraz zidentyfikowanie ich wewnętrznej podgrupy o największym potencjale rynkowym. Na podstawie wyników badań wskazano eksporterów wyrobów HT (HTME) jako najbardziej obiecującą podgrupę w zakresie zdefiniowanego celu. W artykule zamieszczono szczegółową jej charakterystykę oraz określono jej specyfikę na tle wszystkich HT. Firmy te dominują zarówno pod względem obowiązującej formy prawnej, jak i liczby osób zatrudnionych. Istotne jest, że znacznie częściej i w większym zakresie współpracują z ośrodkami naukowo-badawczymi, a w swojej ocenie są innowacyjne. Wstępna hipoteza, że eksporterzy produktów HT są elitą wśród producentów HT, została potwierdzona w toku prowadzonych badań.

Słowa kluczowe: przedsiębiorczość, high-tech, eksporterzy, produkcja, kryteria identyfikacji

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