A CASE STUDY OF STRATEGIC GROUP MAP APPLICATION USED AS A TOOL FOR KNOWLEDGE MANAGEMENT

MICHAŁ PIETRZAK
Warsaw University of Life Sciences
Poland

JOANNA PALISZKIEWICZ
Warsaw University of Life Sciences
Poland

KRZYSZTOF JAŁOSIŃSKI
ZCH Police
Poland

ANDRZEJ BRZOZOWSKI
BENTEN
Poland

ABSTRACT

The primary objective of this paper is to demonstrate the use of the strategic group map as a tool for knowledge management. If knowledge is understood as the ability to process information into decisions and actions, the strategic group map can be seen as a tool for knowledge management at a strategic level. It enables sector information to be processed into knowledge and, as a consequence, into decisions and actions regarding competitive and growth strategy. This article is based on the industry of the most popular pigment in the world - titanium dioxide. This sector is characterized by a large number of unpredictable changes, which makes it a valuable example in the presentation of the tool that facilitates the strategic knowledge management. The materials used in this article are secondary data and come from a variety of sources, which were the basis for the creation of a strategic group map that made it possible to identify marginal groups, mobility barriers, and, as a result, anticipated strategic changes in the sector.

Keywords: knowledge management (KM), strategy, strategic group map, KM tool

INTRODUCTION

There are numerous ways to understand knowledge. However, the authors of this article are most convinced by the approach of Drucker, who states that knowledge is the effective use of information in action [10]. The definition of knowledge is similar in the case of Demarest—"the actionable information embodied in the set of work practices" [7]. Thus, it can be concluded that the essence of knowledge is the ability to process information into decisions and actions. In the world of post-capitalist economics, knowledge is the basic factor of production, and it is necessary for an effective and efficient realization of processes, thus becoming a key feature of an effective competition [7]. In a popular process classification framework (PCF) designed by the American Productivity & Quality Center [43], the development of vision and strategy is one of five categories of basic processes. Just like any process accomplished in the organization, it requires proper knowledge and knowledge management. Particularly important is to identify potential knowledge gaps needed to close for successful crafting and executing strategy [56]. According to the PCF model, the process of vision and strategy development consists of; *inter allia*, the assessment of the external environment, and especially the analysis and evaluation of the competition [43]. These processes require proper knowledge, which can be called "strategic knowledge." In order to gather such knowledge, proper analytic tools are required to process information from numerous and diffused sources into knowledge useful for managers that allows them to make strategic decisions and put them into effect. One of such tools is the strategic group map, which can provide knowledge necessary in the competition analysis and evaluation.

The basic aim of this article is to present strategic group map as an explicit instance of strategic knowledge about the competitive environment and to show - in practice - the usefulness of it. To achieve this aim authors discuss relations between knowledge management and strategy area and possible cross-fertilization of these two fields. Next, based on the empirical example, they have shown how to create such a map and how to utilize knowledge and build on it. Particularly, knowledge processed from the multidimensional set of industry data and information, by drawing a map allows to anticipate strategic changes in the industry (entrances, exits, internal shifts). This could be eventually transformed into decisions and actions in the areas of competitive strategy (range of competition, competitive advantage) and growth strategy (e.g. exiting the industry, mergers and acquisitions, strategic alliances, joint ventures, etc.).

The article uses the industry of the most popular pigment in the world, titanium white, as an example. It is an interesting example of the chemical sector - which after 18 years (1989-2007) of falling prices ($2740/t to $1470/t) - experienced an unusual rise (2011: $2560/t, adjusted prices, base year—1998) [52]. At the same time, this sector has recently been influenced by globalization processes—with China rising to the position of the main player along with the current leaders from the Triad (USA, EU, Japan). This sector is characterized by a number of turbulent changes, and as such, it is a valuable example in the presentation of the tool that facilitates the strategic knowledge management. The strategic group map is a tool with a large practical usefulness. It allows the users to identify groups with different future prospects. With the awareness of strategic differences, one can more easily predict changes that may happen in the business environment as a result of shifts of individual companies or whole strategic groups and industry entries and leaves. This allows the proper knowledge to be acquired, which enables one to make the right decisions and take specific strategic actions.

LITERATURE REVIEW

Knowledge Management and Strategy

Knowledge management has been studied extensively in recent years [e.g. 3, 12, 24,]. Knowledge is one of the key assets to ensure sustained competitive advantage in the highly competitive and global environment of modern organizations [8, 19, 25, 53]. In such environment, employees need relevant knowledge to support their task performance and enterprises can benefit from knowledge dissemination [21]. Companies are increasingly realizing that knowledge is often produced and shared as a by-product of daily interactions with customers, vendors, alliance partners and even competitors. Nowadays, to achieve success,

managers and specialists need to effectively apply knowledge to successfully conduct information-intensive operations and management activities [4, 27, 57]. Studies have shown that precise and timely knowledge support is an important mechanism for increasing both productivity and work effectiveness [22, 26, 27]. Easier access to information can help firms reduce the development cycles and lead times [18]. Thus far, a number of researchers have attempted to classify the major activities of knowledge management. For example Nonaka and Takeuchi [34] focused on the dynamics of knowledge activities and suggested that the four major activities of knowledge management are: socialization, externalization, combination and internalization. Other versions are abundant. For instance, Wigg's [54] version consists of four activities: creation and sourcing, compilation and transformation, dissemination, and application and value realization. Marquardt [29] suggested four activities: acquisition, creation, utilization and storage. Tiwana [50] suggested three fundamental activities: acquisition, sharing and utilization. Such simple division of three processes can be handy for practical purposes. Knowledge management is recognized as a crucial practice for enabling organizations to survive in a knowledge economy era [55]. Knowledge is viewed as a fundamental basis of competition and crucial in competing should be developing the knowledge needed to support a desired strategy [56].

Strategy is defined as a unified, comprehensive, and integrated plan designed to ensure that the basic objectives of the enterprise are achieved [16]. According to Drucker, strategy is "purposeful action" [9]. Strategy is also understood as long-range planning [e.g. 41]. Long-range planning allows an organization to build unique capabilities and skills, to clarify goals and policies of the company, and to allocate resources tailored to its strategy. Mintzberg sees strategy in five dimensions [33]:

- As a plan, strategy deals with how leaders try to establish direction for the organization, to set them on a predetermined course of action;
- As a ploy, strategy takes us into the realm of direct competition, where threats and feints and various other maneuvers are employed to gain advantage;
- As a pattern, strategy focuses on action, reminding us that the concept is an empty one if it does not take behavior into account;
- As a position, strategy encourages us to look at organizations in context, specifically in their competitive environments—how they find their positions and protect them in order to meet competition, avoid it, or subvert it;
- As a perspective, strategy raises intriguing questions about intention and behavior in a collective context.

According to Ronda-Pupo and Guerras-Martin, "The essence of the strategy concept is the dynamics of the firm's relation with its environment for which the necessary actions are taken to achieve its goals and/or to increase performance by means of the rational use of resources" [44].

Planning of strategy is an information-intensive process, which gathers data regarding both the organization and its environment, filters them. and interprets them in order to make strategic decisions [28]. As Makadok and Barney notice, "It is, in many ways, ironic that research in the field of strategic management has proceeded for so many years without a theory of information acquisition" [28]. In fact, as they point out, the matter of information acquisition—which allows the organization to understand its strategic situation and, as a result, create competitive advantage—should attract as much attention as the strategy formulation process itself [28].

When asking the question "Given a firm's strategic situation, what actions should it take?" one should not avoid another question: "What information should a firm collect to understand its strategic situation?" This in fact—from the logical point of view—should be first in line. It is the key question given the necessity of making trade-off choices regarding the type and range of the acquired information. As noticed by March and Simon, gathering more information may help the organization by making better strategic choices, but at the same time, it is expensive, both financially and by drawing the attention of the management board, which is a rare resource [28]. It should be emphasized the need of getting the right balance between gathering information and risk of overwhelming by it.

This issue is a key to conduct strategic knowledge acquisition (see Tiwana classification above [50]) in a proper way. It should base on filtering and combining data, information and external knowledge gathered for creating a deep understanding of the organization's strategic situation. As such, it is a prerequisite of strategic knowledge sharing and utilization what cause to decisions and actions and ultimately as a result in superior performance (figure 1).

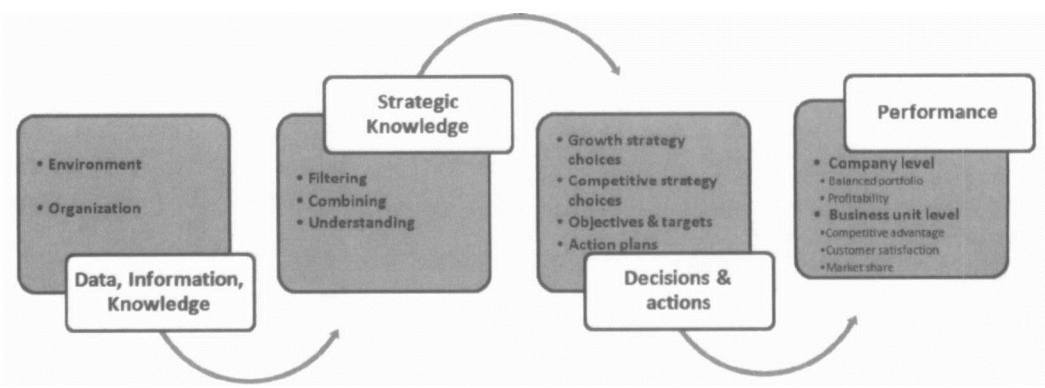

FIGURE 1. Strategic knowledge acquisition as a key element of creating superior performance

The linking between knowledge management and strategy is viewed as the key element for successful management in many organizations [34, 56]. The primary objective of any corporate knowledge management program is to support the achievement of strategic business objectives [56]. Davenport and Prusak [6] point to the benefits of establishing a knowledge culture to get a competitive advantage.

Environment as Key Driver of Strategy

As Barney notices, organizations that are consistently better informed may expect better results from implementing strategies than less informed ones. The source of this informational advantage may rest in the analysis of the competitive environment of the organization and the analysis of the potential positioning within the company's reach [2]. There is a general agreement that companies should gather information about their competitive environment in order to make strategic choices that are profitable [28] – compare figure 1. It should be noticed that the results of the research based on the analysis of 91 definitions of strategy

formulated during the almost 50-year-long development of strategic management indicate that the organization's environment is consistently one of the core terms comprising the definitions of strategy (Table 1).

TABLE 1. Core Terms Comprising the Definitions of the Strategy Concept over the Period 1962-2008

Stage I (1962-1977)	Stage II (1978-1992)	Stage III (1993-2008)
1. Firm	1. Firm	1. Firm
2. Environment	2. Environment	2. Resources
3. Actions	3. Characteristics	3. Characteristics
	4. Resources	4. Environment
	5. Actions	5. Actions

Source: Based on Ronda-Pupo, G.A. & Guerras-Martin, L.A., "Dynamics of the Evolution of the Strategy Concept 1962-2008: A Co-Word Analysis," Strategic Management Journal (33), 2012, p. 178.

According to Porter, the first key problem lying at the base of strategic choices regarding competitive strategy is the attractiveness of the industry in terms of profitability and its determining factors, for "competitive strategy is the search for a favorable competitive position in an industry, the fundamental arena in which competition occurs" [38]. Such reasoning is similar to the classical approach of Industrial Organization (IO), a branch of economics that strongly influenced the development of the strategic management theory, also through Porter [14, 39, 56].

The classical IO paradigm included in the SCP model (Structure-Conduct-Performance), which was developed in the 1930s by Mason and Bain, implies that the structure of the industry determines the conduct/strategies of the organizations within this industry. The conduct/strategies of the organizations in turn influence the results of the industry defined in terms of profitability and effectiveness [23, 39]. The IO paradigm states that differences between the sectors' structure should explain most of the differences in profitability between sectors [30]. The validity of that statement was verified many times in numerous empirical studies, including the pioneer research of the model's co-author, Bain, as well as many others, especially that of Schmalensee, Rumelt, and McGahan and Porter.

Bain proved that the average profitability of organizations in the industry is higher in more concentrated sectors [1]. Schmalensee used the variance analysis to study 1,775 business units managed by 456 organizations operating in 242 industries [47]. In his research, the author analyzed the influence of three variables on the profitability (measured at accounting rate of return): the industry, market share, and the firm effectiveness [47]. The most important variable turned out to be the industry, which explained 19.46% of the business units' profitability variance [47]. Another study—conducted on a sample analogical to Schmalensee's—including 457 organizations operating in 242 industries, but in a period of four years (i.e., 6932 observations in total) showed that the industry variable explains 16.12% of the unit's profitability variance, and after getting rid of the time factor—8.28% of the profitability variance [45] The results of the research of McGahan and Porter, in turn, based on 58,132 observations indicate that the industry variable explains 18.68% of the business units' profitability variance [30]. All the quoted studies confirm the important role of the industry attractiveness in shaping the profitability [30, 45, 47].

Nevertheless, one has to agree with Schmalensee, that "while industry differences matter, they are clearly not all that matters" [47] and with Rumelt, who states that "business-units within industries differ from one another a great deal more than industries differ from one another" [45]. It is crucial to understand not only the essence of the inter-industry differences (which the SCP paradigm or the related five competitive forces model by Porter try to explain [14, 39, 40, 46]), but most of all the intra-industry differences. The concept of strategic groups is one of the possible explanations of these differences.

The concept of strategic groups is related to studies conducted by the Harvard Department of Economics, where students of Richard Caves were modifying the traditional Mason/Bain paradigm in order to include the difference of the organizations' position within the industry [46]. Hunt first proposed the term "strategic groups" in 1972 to describe "a group of firms within the industry that are highly symmetric with respect to cost structure, the degree of vertical integration, and the degree of product differentiation, formal organization, control systems, management rewards / punishments, and the personal views and preferences for various possible outcomes" (cited by 31). Since then, the most commonly used definition of strategic groups has been that provided by Porter: "A strategic group is the group of firms in an industry following the same or a similar strategy along the strategic dimensions" [38].

The concept of strategic groups has an important implication for industrial organization and strategic management as well: in particular, it offers an explanation for differences in profitability within industry [31, 41]. This explanation is based on the assumption that industry success is primarily derived from the intra - industry structure. The different industry positions of strategic groups results in differences in profit rate of group members. Such different industry positions of attractive groups are separated by mobility barriers, which create protection of persistent superior performance. Mobility barriers have grown from differences in market related strategies (e.g., product lines, brands, distribution channels), the characteristics of the supply side of the industry (e.g., manufacturing processes, R&D capability), and characteristics of firms (e.g., ownership, structure, size) [31]. According to our previous discussion the concept of strategic groups could be useful for filtering data, information and external knowledge in the process of strategic knowledge acquisition (compare figure 1). Crucial are those of them, which allow to recognize and understand mobility barriers. Of course the prerequisite of conducting such filtering is to have a more general view and to understand the industry as a whole (e.g. by employing SCP model or Porter's five forces).

MATERIALS AND METHODS

Most of the studies coming from the Structure-Conduct-Performance paradigm, all the way from the first empirical study by Bain are statistical research based on data from many industries. That approach was different from the original approach by Mason, Bain's mentor. Mason preferred, including more factors determining the structure of the industry, which was contrary to the simplified approach of Bain, which was based on a limited number of structural parameters. Furthermore, Mason preferred the case study method within a specific industry instead of cross-sectional statistical research [23, 39]. Also in relation to the concept of strategic groups, McGee and Thomas, based on a wide literature review, notice that most research in that field is based on quantitative methods without enough emphasis being put on detailed knowledge and the understanding of the particular industry context, which should be a necessary condition in choosing strategic variables used to classify groups [31]. They point out that "fewer researchers have chosen to build their own industry expertise from which variable identification and specification can proceed . . . We need a more careful specification of the sources of dissimilarity between firms" [31]. These authors also indicate at the conclusion of their article the need for deepening study of the organizations and sectors in which they

operate, in order to explore the essence of strategic choices by means, which are beyond the reach of statistical study [31].

Following this argument, the authors of this study decided to use the case study method and perform the in-depth analysis of the internal structure of the chosen industry. They chose the titanium dioxide industry, which is an interesting industry as a research object for many reasons. It is a global sector, so the analysis will not be limited to a single country or a geographic region, but will be conducted from a worldwide perspective. The product of this industry is familiar to all of us—it is present in paints on the walls, car lacquers, furniture and floor coatings, most plastic products, high quality paper and paper laminates, printer inks, and even chewing gums, toothpaste, and cosmetics. The titanium dioxide industry is characterized by a large number of turbulent changes, and that is what makes it a valuable example in the presentation of a tool that facilitates the strategic knowledge management.

The authors of this article placed particular emphasis on building an expert knowledge of the sector that enables a justified choice of dimensions for a strategic group map. This choice was preceded by an in-depth analysis of the industry structure and its determinants, including the globalization potential analysis according to Yip's model, PEST analysis, and Porter's five competitive forces analysis [35]. One of the authors is the CEO of an organization that has a business unit that has produced titanium white for over 30 years. The materials used in the article are secondary data and come from a range of sources, including elaborations and newsletters of consulting companies (TZMI, Euro Pacific Canada), results of geologic reports (USGS), in-house media of the ZCh Police titanium dioxide producer, and many others. All these materials have been processed in order to create the strategic group map.

The strategic group map is a tool used to evaluate the competitive position of the sector members. It is a convenient bridge between seeing a sector as a whole and looking at individual firms as separate units [48]. The procedure of creating a strategic group map consists of four stages [48]:

- Identification of dimensions that differentiate firms within the industry,
- Plotting firms on a two-dimensional map based on two dimensions from the list identified above,
- Assigning firms that fall into a similar space on this map to the same strategy group, and
- Drawing circles around each group.

By using this procedure, one acquires the strategic group map, which is a graphic illustration of the strategic diversity of firms functioning in the industry. The dimensions used to draw the map do not have to be continuous variables, but they should not be strongly correlated. Strategic groups are symbolized on the map by circles or spheres (bubbles). The size of the circle/sphere indicates the importance of the particular group in the sector. The size of the spheres on the map developed for this article has been based on the production capacity of the firms included in each strategic group.

The strategic group map is a tool of great practical use that allows one to identify groups with different perspectives for the future. Being aware of the differences in strategies may be key to predicting the changes that may occur in the industry due to the movement of individual companies or entire strategic groups. This allows one to get the right knowledge for making the right decisions and concrete policy actions. In this article, we assert that strategic group map can be used as a strategic knowledge management tool to process information in making decisions.

Considering strategic group map as knowledge management tool one should mentioned about IT solutions and their possible support for creating and using this tool. It is worthy to start with a short discussion about desired functionalities of such software. These features could be broadly divided into two categories.

Firstly, desired software should enable to draw visually attractive and easy to modify charts. It should allow using different sources of information based on both qualitative as quantitative methods of data aggregation. It should be easy to put in such chart or attached any additional information or graphics as needed.

Secondly, desired software should allow using sophisticated statistical methods to aggregate multidimensional data sets about firms into user-friendly and easy to interpret two-dimensional picture. In fact, such smart simplification is a fundamental issue for processing information into decisions and actions, what is the core of our meaning of knowledge. This functionality should include such methods as: cluster analysis, factor analysis, discriminant function and possibly others multidimensional statistical techniques.

To employ these statistical methods should be an option but not the only possible way of creating strategic group map. According to the authors experience statistical tools could be indispensable for drawing maps in non-concentrated industries with substantial number of players [36]. Moreover, when map creator have not deep knowledge about the firms and patterns of their strategic behavior such techniques (i.e. statistical clustering) could be useful for deciding how many groups should be clustered and where to draw boundaries between groups. However, the authors are convinced that when one have a substantial portion of deep knowledge about the industry and firms it could be justified and even preferred to base on qualitative judgment in classification firms into strategic groups rather than on statistical procedures. In the case of titanium dioxide industry authors have used a qualitative approach in drawing boundaries between groups, however, they employed some simple methods to aggregate strategic dimensions, as it will be described in the following sections.

According to first functionality, to visualize the strategic group map one should use typically bubble chart. This kind of chart enables positioning groups on two-axis coordinate system. Additionally the diameter of bubble bears the information about the size of the group (usually expressed in terms of members' cumulative sales or capacity). There are plenty accessible solutions to create bubble charts, including popular spreadsheets (i.e. MS Excel, Numbers) and many others like: Google Charts, Bubble Chart Pro, Chart FX, Dundas Data Visualization, Cognos etc.

According to second functionality, there are also a lot of statistical software packages, which enables to use tools which are helpful in creating strategic group maps. Popular packages such as SPSS, Statgraphics, Statistica and many others include cluster analysis, factor analysis, discriminant analysis etc.

Although there is not a problem to find any solution for each of the discussed functionality separately, there is a gap in conduct this feature collectively. Particularly, it will be desired to automate processing of multidimensional data sets into visualization in the form of bubble chart. In other words the elimination of this gap will allow to automatically process data into knowledge and to communicate it in an attractive visual form.

RESULTS

Basic Characteristics and the Industry Background

Titanium white, or titanium dioxide (TiO_2), is a non-volatile, non-flammable, non-toxic crystalline solid, characterized by a high chemical and thermal stability. The TiO_2 pigment is a product that is used to increase the functional properties of a pigmented product by adding color, opaqueness, and shine. In the industrial production, it can be found in two crystallographic forms: rutile (a preferred form for most uses) and anatase. Titanium white

is obtained in two alternative technological processes: sulfate process and chloride process (more economical and preferred by most clients because of its quality). The optical qualities (e.g., increased scattering of light ability) and the ability to add various physicochemical properties make TiO_2 the most commonly used pigment in the modern times [49]. The main fields in which titanium dioxide is used are as follows [49]:

- Paints and coatings (56% of TiO_2 demand) —a diversified group of recipients, including construction and decorative paints as well as coatings and other finish paints; high quality demands;
- Plastics (25%) —most plastics are transparent and require opacification for most applications, hence the use of TiO_2; lower quality demands;
- Paper (9%) —TiO_2 is used as a filler (low quality demands) and a pigment for laminates and coated papers (high quality demands);
- Printing inks (the anatase form is preferred in this field) and other fields such as gum, synthetic fibers, pharmaceuticals, food, etc. (10% in total).

In 2010, the worldwide production of TiO_2 reached 5.33 million tons (with the capacity of 5.99 million tons) [49]. The value of titanium white market in the same year was estimated to be 12 billion dollars [15]. There is an estimated increase of the market by 3-4% per year in the near future [17].

Choice of Dimensions of Strategic Group Map

Based on the analysis of the current situation in the industry, its historical evolution, and relations resulting from the globalization potential and macro environment trends [35], the following list of variables has been approved as important dimensions conditioning the strategic position of the organizations in the titanium white sector:

- *Technology*—organizations using chloride technology gain a lot of advantages toward their rivals using sulfate technology:
  - Absolute costs advantage: 15% to 19% advantage in unit costs in relation to sulfate method [13, 49];
  - Relative cost advantage: the scale and learning effects in the chloride technology are greater than those in the sulfate technology [13];
  - Many recipients regard chloride white better in quality (regardless of the substantial controversies in this matter) [49];
  - Lower environment pollution [49];
- *The scale of the plant* and *scale the firm*—titanium white is a sector where significant static scale effects and lesser dynamic scale effects, or learning effect, occur [13, 49]. Additionally, plants that are integrated as a group under one company name can be treated in market relations as a whole—such a large firm increases its bargaining power towards suppliers and buyers.
- *Labor cost advantage* resulting from localization—working costs in countries producing TiO_2 are very diversified. For example, an hour of work in Norway costs USD 64; in Germany, USD 47; in USA, USD 36; in the CEE countries (Poland, Czech Republic), USD 9-13; in Mexico, USD 6; in China, USD 1.4; and in India, USD 1.1 [20].
- *Environment protection cost advantage* resulting from localization—considering the environmental costs, the EU is the worst place to run the chemical business, including the TiO_2 production; the environmental cost problem is especially important in the sulfate technology production, which creates more pollution, especially if there is a need to compete with such countries as China or Ukraine (where the regulations are not as severe as in the EU).
- *Vertical integration*—in the times of dramatic price increases for titaniferous raw materials, vertical integration may provide a great advantage. For example, the vertical integration of the TRONOX firm in the business providing mineral sands (titanium feedstock) taken from the Exxaro company in 2012—provides advantage of $300-400 per titanium dioxide ton—related to the ability to buy the raw materials "at cost" [32, 51].
- *Business internationalization*—enables using and benefitting from the multinational or global strategy.

The strategic group map construction procedure requires choosing two variables from the identified strategic dimensions, so that the two-dimensional presentation of the strategic groups could be possible [48]. At the beginning, seven strategic dimensions, mentioned above, were selected. The analysis of the preparation of prototype strategic group maps based on different sets of strategic dimensions [see 48] has shown that the firms are differentiated mostly by five variables: technology, plant scale, firm scale, labor cost advantage resulting from localized, and environment protection cost advantage resulting from localization. At the same time, some positive relations between some of these variables were noticed. Firms that have the chloride technology are at the biggest organizations in the industry, and at the same time, they operate in the big plants. Firms located in countries with low labor costs usually also have lower environmental protection costs (e.g., China and Ukraine). Although one has to remember that it is not a close correlation—for example, in Poland and the Czech Republic, labor costs are several times lower than in other countries of the European Union, but the environmental regulations are the same.

Based on the identified relations, two integrated dimensions containing the information about all five aforementioned dimensions have been created. In order to integrate the dimensions, they have been standardized by unitarization. Afterward, the values of the integrated variables have been calculated as weighted averages of standardized strategic dimensions. That way, two integrated strategic dimensions were created:

- Dimension 1: ADVANTAGE OF SCALE AND TECHNOLOGY—calculated as a weighted average of standardized values of the scale of the plant (capacity in kilotons), the scale of the firm (market share in %), and dominance of chloride technology (share of chloride technology capacity in total capacity). All of the aforementioned variables were weighted as 1/3.
- Dimension 2: COMPARATIVE ADVANTAGE—reflecting differences in business costs, but not related to higher effectiveness, but because of the cost advantage of a given country in relation to other countries; the variable 2 is measured as a weighted average of the standardized values of graded attractiveness of the country with respect of labor costs and graded attractiveness of the country with respect of environmental protection costs, which weigh, respectively, 75% and 25%.

The Strategic Group Map

Based on the strategic dimensions 1 (X axis) and 2 (Y axis), a coordinate system has been created. Then, positions of firms from the titanium white industry have been placed on that system. Firms with similar positions of the system were considered members of the same strategic group. As a result, a strategic group map has been created, as presented in Figure 2. The spheres symbolize individual groups, with the center of the sphere marking the location of the strategic group toward the variables (advantage of scale and technology and comparative advantage), and the size of the sphere symbolizes the total importance of all the firms

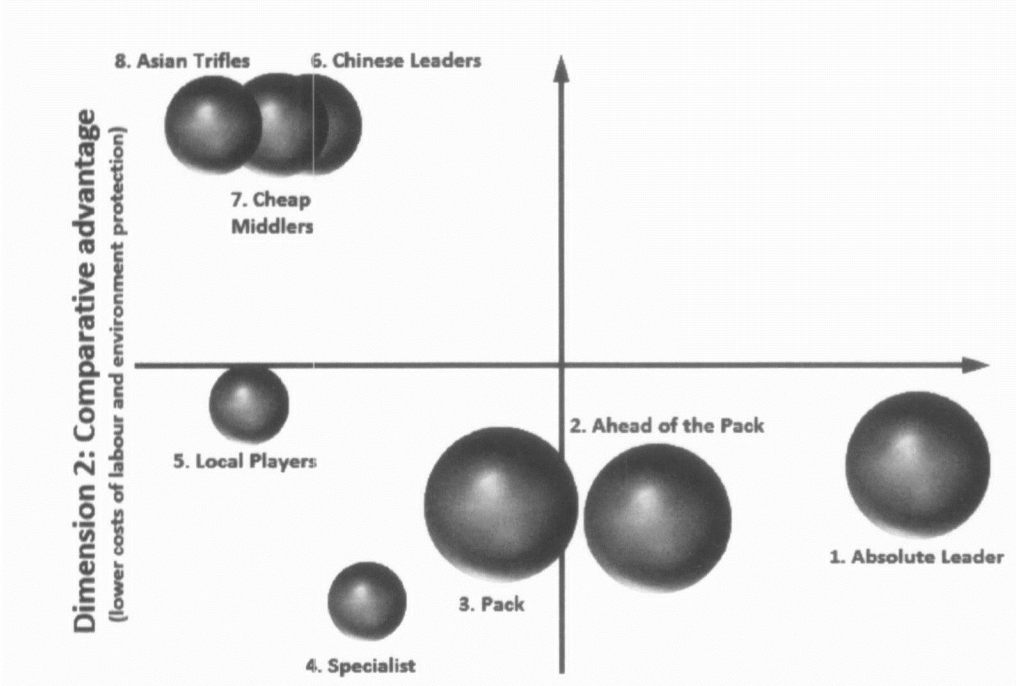

FIGURE 2. Strategic group map in titanium dioxide industry

comprising the group in the sector (measured by capacity).

Knowledge Gained from Strategic Group Map

The strategic group map, the creation of which has been described above, is a very practical useful tool. It allows the user to identify groups with different future prospects, including marginal groups (see Table 3). In order to extract groups with different future prognosis, the two dimensions of the strategic group map (advantage of scale and technology and comparative advantage) have been integrated into one synthesized variable "Collective Cost Advantage." This variable has been confronted with the "Quality/Price" variable. The TZMI consulting company proposes the division of the sector players into two categories regarding the product quality: *first tier market* (producers from the Triad countries) and *second*

TABLE 2. Basic Characteristics of Strategic Groups in Titanium Dioxide Industry

Strategic Group	Companies	Countries (where plants are located)	No. of plants	Capacity of the group (ktpa*)	Scale of average plant (ktpa)	Market share of the group (%)	Share of chloride technology in the group(%)
1. Absolute Leader	Du Pont	USA, Mexico, Taiwan	5	1,170	234	19.3	100
2. Ahead of the Pack	Cristal Global, TRONOX**	Brazil, Australia, France, USA, UK, Saudi Arabia, Netherlands, Australia	9	1,221	136	20.1	87
3. Pack	Huntsman, Kronos, ISK	France, Spain, South Africa, Italy, Malaysia, UK, Canada, Germany,Norway, Belgium, USA, Japan, Singapore	14	1,332	95	21.9	59
4. Specialist	Sachtleben***	Germany, Finland	3	342	114	5.6	0
5. Local Players	Cinkarna, Precheza, ZCh Police, Cosmo, Sakai Tayca, Titan Kogyo	Slovenia,Czech Rep., Poland, South Korea, Japan	7	351	50	5.8	0
6. Chinese Leaders	Henan Billions, Sichuan Lomon Shandong Dongija, Pangang Goup	China	5	565	113	9.3	6
7. Cheep Middlers	Kymski Titan, Sumykhimprom, Jiangsu Titanium, Wudi Seastar, CNNC Hua Yuan, Annada Titanium, Luohe Xingmao, Ningbo Xinfu, Nanjing Titanium, Kerala	Ukraine, China India	11	579	53	9.5	9
8. Asian Trifles	Many small plants	China, India	~40-45	516	~12	8.5	0

*kilo tons per annum; ** with Tiwest; ***with Kemira and Crenox

Source: own research based on *TiO2 Pigment Annual Review*, 2011, pp. 113, 116, 119, 125, 128, 181-229

tier market (CEE countries, China, etc.). The first tier players offer higher quality pigment and get higher prices for their titanium white. The difference between the *first tier market* and the *second tier market*, according to TZMI, varies between $350 and $380 per titanium dioxide ton, depending on the year [49]. According to the authors of this article, this classification should be extended by an additional (medium) category:

- I—the highest level represented by such producers as Du Point, Cristal, Huntsman, Kronos, TRONOX, Sachtleben, ISK, and other Japanese producers, who achieve the highest market prices;
- II—the medium level consists of producers from the CEE countries that belong to the EU (Slovenia, Czech Republic, Poland), whose prices are lower than those of the leading producers by about €110-250/t (the average medium price difference is €175/t, or $230/t), leading producers from China (prices lower by ~$250-300 that those of the leading producers, but about $200 higher than the Chinese average), and producers from South Korea;
- III—the lowest level is represented by small and medium Asian producers, mainly from China (prices lower by about $450-500/t) and firms from Ukraine (prices lower by about €480/t, which is ~$630/t).

With the awareness of the strategic differences depending on the cost and quality advantage (Table 3), one can more easily predict the changes in the sector as a result of shifts of firms and whole groups and sector entrances and exits.

TABLE 3. Categorization of Strategic Groups in Titanium Industry

Quality/Price	Collective Cost Advantage (Advantage of Scale & Technology and Comparative Advantage)			
	Very Low	**Low**	**Medium**	**High**
I (first tier market)	Specialist	Pack	Ahead of the Pack	Absolute Leader
II (second tier market)	Local Players	-	Chinese Leaders	-
III (third tier market)	-	Asian Trifles	Cheap Middlers -	

Source: own elaboration based on Figure 1 and TiO2 Pigment Annual Review, 2011, pp. 181-229

Du Pont, the Absolute Leader, has a very strong, highly competitive position in the sector (Table 3). In its case, further movement up and right can be predicted. In 2005, Du Point announced plans of constructing a titanium white plant with a capacity of 200 ktpa in Dongying, Shandong Province, China [49]. For now, these plans are on hold, but Du Point has declared its readiness to involve itself again in this project [11, 49]. In 2011, the firm revealed plans to expand its capacity by 350 ktpa by the end of 2014 [11]. Additionally, the decision to realize the core of the investment in Mexico [11] means that the completion of this plan will lead to a movement right (increase of the scale) and up (Mexico is a country with the comparative advantage) - Figure 3, Arrow 1. Alternatively, the return to the former plan of Dongying investment would more likely lead to moving up (Figure 3, Arrow 2).

The "aspiring" strategic groups can be the ones of the Ahead of the Pack, Pack, and Chinese Leaders groups (Table 3). The predictions regarding the Ahead of the Pack group would include "treading on the heels" of the Absolute Leader. TRONOX increased its cost competitiveness by $300-400/t thanks to vertical integration [32, 51], which is equal to a large movement right on the map (Figure 3, Arrow 3). Cristal upgraded its plant in Yanbu (Saudi Arabia) [5], which equals movement up and right (Figure 3, Arrow 4). Despite all this, the Leader is protected by mobility barriers—large scale, long-term experience, and unique technology of direct transformation of ilmenite into chloride white—barriers very difficult to break. In the case of the Pack, there will probably be a slight movement right and up (expanding the capacity, especially in more attractive localizations) - Figure 3, Arrow 5. The situation could be altered by a consolidation within the group (Figure 3, Arrow 6), but the probability of such a scenario is not very high. The Chinese Leaders can expect an effort of radical movement right—not only thanks to the scale increase, but also by introducing the chloride technology (Figure 3, Arrow 7). Given the entry into the Chinese government five-year plan and their determination to date, there is a big chance that the Chinese will get the chloride technology within a decade.

The endangered group includes the Specialist and Cheap Middlers. The Specialist, meaning Sachtleben, achieves attractive prices with specialist products, but this does not exempt it from regarding the costs. Sachtleben has three plants, two of which have low profitability, and one brings quite a large profit [49]. What is to be expected in this firm is the portfolio restructuring (Figure 3, Arrow 8). Cheap Middlers will try to catch up with Chinese Leaders (Figure 3, Arrow 9). Those who fail to succeed will have to make a living from meeting the need of lower segments of the market.

Marginal groups consist of Local Players and Asian Trifles. Local Players should try to move significantly right or up (Figure 3, Arrows 10-11). Making such an attempt will, however, be met with mobility barriers—the availability of proper resources, especially no access to the chloride technology. The chance to break at least some of these barriers could lay in the consolidation of the firms in the group (Figure 3, Arrow 12), if not as a merger, then at least as a strategic alliance, joint venture, etc. Some exits can be expected in this group (Figure 3, Arrow 13). In the case of Asian Trifles, not many will probably make it to the Cheap Middlers group (Figure 3, Arrow 14), but it seems that within a decade most of these producers will exit the market (Figure 3, Arrow 15), also thanks to the tightening of the Chinese government's regulations regarding the environment.

Aside from the aforementioned shifts, entries in the Chinese Leaders group (Figure 3, Arrow 16), or eventually into other Asian countries, can be expected. Vietnam and Indonesia seem to be a promising investment direction (Figure 3, Arrow 17) [49].

CONCLUSIONS

Knowledge is the fundamental basis of contemporary competition. Competing successfully on knowledge requires aligning strategy to what the organization knows and also developing the knowledge and capabilities needed to support a desired strategy [56]. In this first process, it is indispensable to create appropriate strategic knowledge. The key is to tie the information collection to the building of sustained competitive advantage. Before we answer the questions like "What strategy should we choose?" and "What actions should we take?," we should answer logically the prior question "What information should we acquire to accurately understand our environment, particularly our competitive position in the industry we operate?" Gaining such knowledge is the key to making a profit maximizing strategic choices and taking correct actions.

The strategic group map offers the ability to take a snapshot of where the firm is today and where their competitors are. However, industry structure is not static. The strategic group map is a tool that is also helpful in predictions of future industry shape. In such

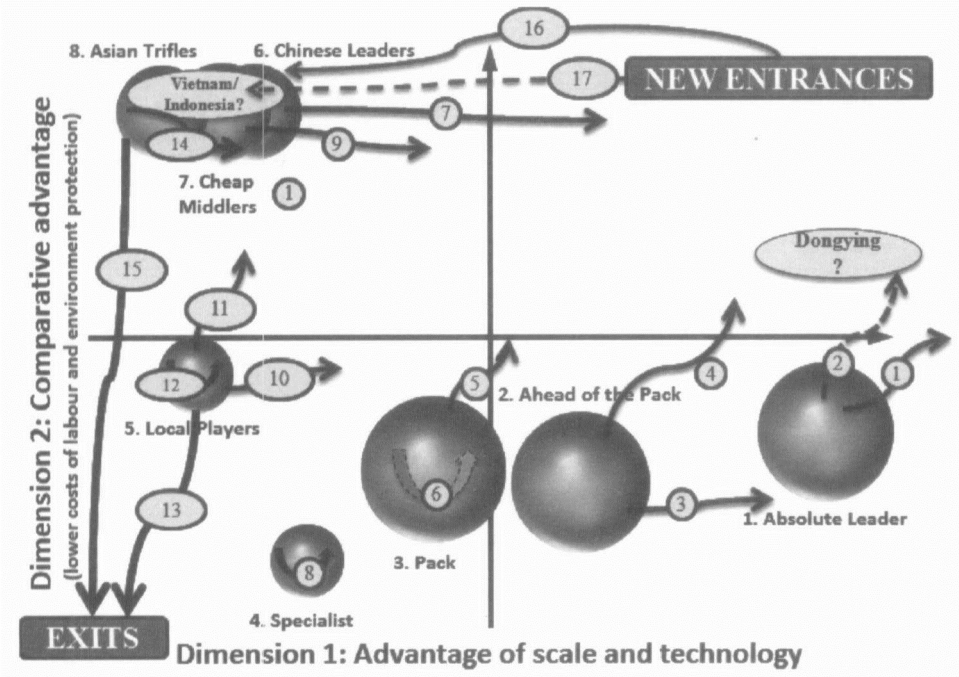

FIGURE 3. Map of strategic groups as knowledge source—expected strategic moves in the titanium dioxide industry
Source: Own research

way, it could be a source of dynamic knowledge of the competitive environment. Having mapped the present and predicted firm's competitive position against its rivals, an organization can plan future action. Moreover, having performed a strategic evaluation of its position, an organization can determine what knowledge should be developed or acquired.

From our study, some implications could be drawn. In the paper, we show a case study, which confirms that the strategic knowledge management tool allows processing of the sector information to knowledge of the expected strategic changes in the industry. Based on it, one of the players from the portrayed industry developed business strategy for one of its units. This strategy was based firmly on the knowledge gained through developing a strategic group map. This tool was also helpful for this firm in choosing what additional strategic and marketing knowledge should be acquired to develop and effectively execute the competitive strategy of the aforementioned business unit (compare figure 1). The strategic group map allows one to identify the specific competitive factors that are relevant in a given business activity. By creating a cognitive scheme, this map helps in selecting systematically the necessary further information, which should be collected for evaluating these factors. Such information will be indispensable for creating core strategic knowledge, which could become a fundamental building block of the organization's intellectual capital. Moreover, the strategic group map, by labeling the clusters of competitors, introduces a common language for managers when dealing with business unit strategy.

It should be stressed that we follow in our study the advice of McGee and Thomas [31], and we try to build our own deep industry expertise. Based on it, we were able to specify the sources of dissimilarities between firms and identify relevant strategic dimensions of the strategic group map. Such an in-depth study of the titanium dioxide industry allowed us to show problems related to strategic choices in a way inaccessible to researchers using statistical tools. This research has made a contribution to knowledge management literature. It has identified the strategic group map as an effective tool of gaining important knowledge in organizations. Additionally, we have made a contribution to the practice. Understanding how to create deep-knowledge based strategic group maps will increase the ability to successfully compete in the marketplace, according to proper choices made by business decision makers. This will lead to increased organizational performance, the primary goal of knowledge management.

Of course, such an approach creates some limitations in our study. The case study method concentrates on a qualitative description and does not allow us to acquire precise quantitative information or construct a model. Furthermore, our research only focuses on one industry.

By pointing to further research directions, we postulate studying the strategic group maps with a case study method as a research direction parallel to the more formalized, but less in-depth statistical approach. Acquiring more case studies will ensure the properly broad, and at the same time, in-depth view on the strategic group's existence in different industries and mapping them as a strategic knowledge management tool. Cross-sectional case studies would be especially desirable. It would also be good to show the connection between the clustering of firms based on strategic group mapping and their economic performance. From the more broad point of view we suggest to continue to explore links between strategy and knowledge management area.

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