R&D MANAGEMENT

The strategic dilemmas of innovative enterprises: proposals for high-technology sectors

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High levels of research and development (R&D) expenditure, pressure for innovation and the creation of new knowledge are features that distinguish high-technology (high-tech) enterprises from other, less technologically advanced, firms. Confronted with multiple contemporary approaches to strategy and turbulence in their environment, these enterprises make strategic choices continuously and dynamically. This paper proposes a model and matrix for the classification of high-tech enterprises' development strategies (with regard to their specific features), which are then verified. Qualitative research was conducted in 61 medium and large high-tech companies based in Poland that operate either in Poland or in the global marketplace. The results show that high-tech firms have the fundamental goal of developing R&D activity as a resource (and its redundancy) rather than product/market goals. The studied firms strive above all for leadership in innovation, creating new technologies based on their own R&D resources, while also using outside sources and mostly applying the personalisation approach in knowledge management. However, they choose different paths for product and market development, depending on the opportunities presented by the environment, and the firm's ability to identify and take advantage of these.

1. Introduction

Innovative enterprises are able to create and absorb innovations, are creative, and are characterised by an ability to adapt continuously to changes occurring in their environment (Tidd et al., 2005; Ettlie, 2006; von Stamm, 2008). Moreover, by conducting a wide range of research and development (R&D) work, they strive to develop new technologies and achieve technological leadership in an industry or sector (Deschamps, 2008). Similar features are ascribed to high-technology (high-tech) enterprises. However, apart from the high level of innovation and rapid diffusion of technological innovations, and R&D intensity – more than 8% of the value of sales [Organisation for Economic Co-operation and Development (OECD), 1995, 2009] – high-tech firms also have the following characteristics: a rapid process of obsolescence of products and technologies; a high level of employment of scientific and technical personnel; high capital expenditure and high rotation of technical equipment, which is replaced by more modern and innovative devices; high investment risk and fast devaluation of investments; and intense strategic domestic and international cooperation with other high-tech enterprises, and scientific and research centres (Davis, 2003; NewCronos, 2009).

Pressure for innovation and the creation of new knowledge, particularly technological, raise the question of how strategies should be approached in

high-tech enterprises, and which of the existing concepts and models of strategy are most appropriate to that sector, with regard to its specific features.

The aim of this paper is to propose a model and matrix for the classification of high-tech enterprises' development strategies, and to indicate which of the proposed strategic options seem to be best for firms of this type, with regard to their characteristic features.

The original contribution of this study to the existing literature can be summarised in the following points. First, in making a review of the literature and using the results of our own expert studies, we have created a growth strategy model for high-tech enterprises, whose foundation is the development of technologies, innovation and knowledge as a resource, and the ability to take advantage of opportunities. Second, using morphological analysis, and combining different strategic options as regards sources of technology acquisition, degree of originality of innovations and the method of knowledge management with defined product/market-based categories, we have created a multi-field matrix serving the classification of high-tech enterprises' strategies. At the same time, an identification is made of those strategic options that favour the building of lasting competitive advantage. Third, based on studies of 61 high-tech companies based in Poland that operate either in Poland or in the global marketplace, a verification of the adopted model has been carried out. Fourth, the work presents strategic dilemmas faced by high-tech firms, which may also be a valuable source of knowledge for other innovative and knowledge-based firms, as well as less technologically advanced ones.

The paper's structure is organised around the contributions it aims to make. First, the paper defines 'strategy' in high-tech enterprises, taking into account their specific features. Second, with regard to various dimensions of strategy, the paper presents a matrix for the classification of high-tech companies' development strategies. Third, the paper determines implications for R&D management.

2. The multidimensional view of strategy: literature review and proposal for high-tech enterprises

2.1. Concepts of strategy and a model of growth strategies for high-tech enterprises

The term 'strategy' has many meanings, and many researchers have attempted to systematise the definitions of strategy and its evolution (e.g., Teece et al., 1997; Mathé, 2001; Farjoun, 2002; Mintzberg et al., 2009). Considering the contemporary views of strategy, such as (1) the resource-based view (Hamel and Prahalad, 1994; Barney, 2001; Lin et al., 2010); (2) the concepts of simple rules (Eisenhardt and Sull, 2001); (3) the dynamic capabilities (Teece et al., 1997; Arndt, 2011); (4) the red and blue ocean concept (Kim and Mauborgne, 2005); (5) strategic paradoxes (de Wit and Meyer, 2005; Raynor, 2007); (6) the FAST approach to strategy (Hagel and Brown, 2005); and (7) the results of expert research,[1] it must be concluded that the foundation for high-tech firms' strategy is the development of knowledge as a resource (its redundancy). Knowledge as a strategic resource is treated here in a broad sense, to include not only technology and patents, but also structural assets, outside relationships, products, methods and procedures of action, as well as resources contained within people (experience, know-how and interpersonal relations) (Evans, 2003). Knowledge may, thus, be found in documents of various types, but a significant part of it is contained in human minds. In high-tech firms, the development of knowledge as a resource concentrates primarily on the development of R&D activity, and on the creation of new technologies and innovations, understood as the transformation of an innovative idea into a high-tech product. The development of knowledge as a strategic resource of a high-tech firm supports its other resources (particularly financial). These in turn support the development of knowledge as a strategic resource. There, therefore, exists a bilateral relationship between them.

However, the same system of resources may be used in different ways (different markets, different products) as a result of firms' ability to quickly identify opportunities arising in a turbulent environment (Ansoff et al., 2004). Consequently, a firm's strategy defined in product/market categories, by way of (1) specialisation and diversification of the product and market, (2) the scope of vertical integration, and (3) internal and/or external growth path (Thompson and Strickland, 1993; Pearce and Robinson, 2007; Johnson et al., 2008), is emergent in nature. A model of strategy understood in this way is shown in Figure 1.

The proposed model relates to the corporate (grand) strategy level, omitting business strategies and functional strategies (Pearce and Robinson, 2007). A high-tech firm should adopt a resource-based approach to the creation of strategy, where the most important strategic resource is knowledge (particularly technological knowledge, which makes it possible to create innovative products). In building a strategic advantage based on knowledge, high-tech

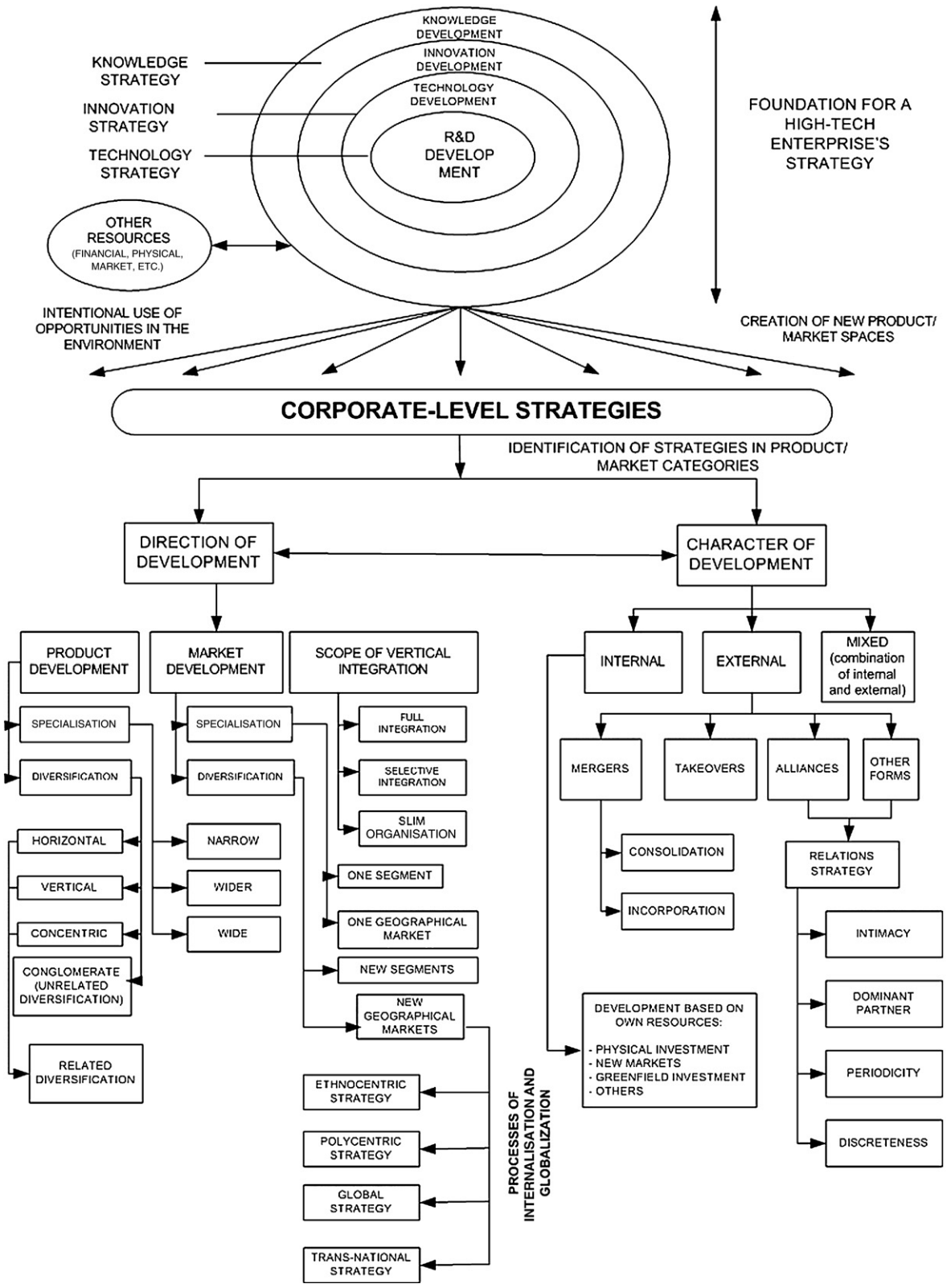

Figure 1. Model of the corporate strategy of a high-tech company. R&D, research and development.

enterprises must produce an excess (redundancy) of knowledge in order to be able to identify and take advantage of the opportunities that arise (Eisenhardt and Sull, 2001), and to create new product/market spaces (Kim and Mauborgne, 2005). The opportunities taken, however, define the corporate strategy of a high-tech enterprise in traditional product and market categories (specialisation or diversification of product and market, vertical integration, nature of development, including internal development based on the firm's own investments building up its potential based on existing resources, external development involving cooperation and fusion with other firms, or mixed development, as a combination of the internal and external varieties).

High-tech enterprises must make strategic choices in conditions of uncertainty (limitations, pressure and opportunities) in order to create innovative values (Hansen and Birkinshaw, 2007) and to maintain the firm's development potential in the long term.

2.2. *Strategic dilemmas relating to the development of technology, innovation and approach to knowledge management*

High-tech firms ought to feature technological development (Tao et al., 2010) and a large majority of the phases of the innovation process (Tidd et al., 2005). Only then will the indicator of R&D intensity be greater than when a firm limits itself only to development and implementation work. The scope of R&D work carried out determines the technological strategy (Burgelman et al., 2008; Dodgson et al., 2008; Dasgupta et al., 2009), which constitutes a set of investment programmes created in order to give a firm the capacity for research, development and applications. An especially important element here is the route by which new technology is acquired. This can be done from internal sources (the enterprise's own R&D), from outside sources (purchase of licences and know-how, joint ventures with a supplier of technology, purchase of a firm together with its technology, transfer of technology, strategic R&D partnership, etc.) or from mixed sources (Burgelman et al., 2008; Grudzewski and Hejduk, 2008; White and Bruton, 2011). The choice of option depends on the resources and capabilities that a firm possesses. Innovation strategy includes R&D strategy and technological strategy, but also goes beyond these (Mitchell, 1985; Dodgson et al., 2008; White and Bruton, 2011). Most generally, innovation strategies can be divided into two categories: innovation leadership and innovation followership (Tidd et al., 2005).

The development of both technology and innovation conditions and influences the development of knowledge. Of great importance here is the adopted strategy for knowledge management, which may tend in the direction of either codification or personalisation (Hansen et al., 1999; Jashapara, 2004).

Based on a combined view of the sources of technology acquisition, innovation strategy and approach to knowledge management, the three-dimensional model of strategic options shown in Figure 2 was drawn up. These three dimensions are not mutually exclusive; the choices made within their framework reflect jointly the development of knowledge as a strategic resource of a high-tech firm, which constitutes a foundation for its strategy (Figure 1) and which can be achieved in different ways.

Six different variants of technological innovation leadership strategies, as well as six variants of technological innovation followership strategies, are distinguished here. Innovation leadership strategies include the following:[2]

(1) The ILIC strategy (innovation leadership is based on new technologies developed through a firm's own R&D resources, with the use of extensive databases for codification and storage of knowledge; a strategy characteristic of firms that have extensive R&D resources, a high level of intellectual capital and very extensive IT systems; defined concepts and ideas are codified and used multiple times by personnel having access to the database; in this strategy use is made primarily of acquired experience, and hence it is used chiefly by mature firms);
(2) The ILIP strategy (innovation leadership is based on new technologies developed using a firm's own R&D resources, with the sharing of knowledge between employees being dominant, this being supported by information technology enabling the elimination of communication barriers; this strategy makes a great deal of use of employees' creativity and uses hidden, undocumented knowledge; the primary focus is on the creation of technological innovations; characteristic of both very creative small firms and larger more mature enterprises);
(3) The ILEC strategy (innovation leadership is based on new technologies acquired from outside by way of, for example, transfer and implementation of technology from a science and technology park; the acquired technology is codified within an extensive existing knowledge base, and particular solutions are used in the further functioning of the firm; used by firms that

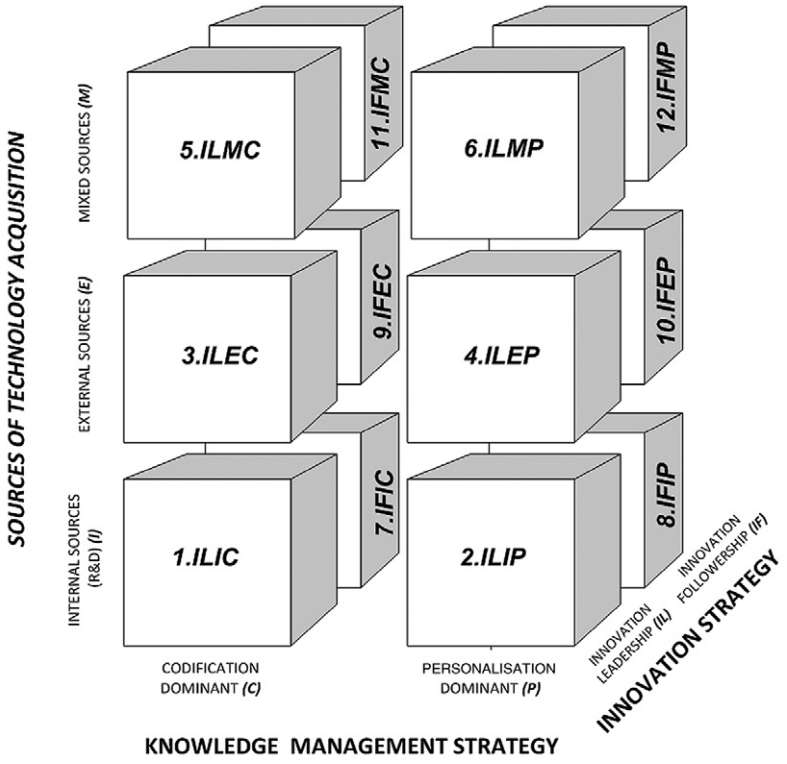

Figure 2. Three-dimensional strategic space of an enterprise with respect to technology, innovation and knowledge.

do not have sufficient R&D resources to create innovative products by themselves);

(4) The ILEP strategy (innovation leadership is based on new technologies acquired from outside, with a dominant role played by the exchange of information and knowledge among personnel, as well as the acquisition and extension of knowledge through learning from others; particularly characteristic of firms undertaking strategic partnership, broadly construed, in the field of R&D);

(5) The ILMC strategy (innovation leadership is based on new technologies acquired based on both internal and external sources, with a dominant role played by codification in the strategic management of knowledge; this strategy often includes the contracting of R&D with institutions operating independently, such as within universities, which makes it possible to obtain unique products, or the purchase of know-how which can be improved through a firm's own R&D resources based on past experience);

(6) The ILMP strategy (innovation leadership is based on new technologies developed based on the firm's own R&D resources and through cooperation, broadly construed, in the field of technology based on creativity and the sharing of knowledge, helping to speed up the launching of new products; this strategy is characteristic of very mature, high-tech firms).

In the innovation followership strategy category, the following variants are distinguished:[3]

(7) The IFIC strategy [an imitator that attempts to work out a given technology (usually that of a competitor) using its own research resources, taking advantage of past experience and tested patterns];

(8) The IFIP strategy (an imitator that has acquired a technology through a creative approach to imitation strategy, using the technology of a pioneer, and the knowledge, experience and analytical abilities of personnel);

(9) The IFEC strategy (an imitator that has acquired a technology through the purchase of a licence, for example, enabling it to launch new products quite rapidly but without exclusivity; the acquired know-how is codified, which reduces the number of errors made by personnel);

(10) The IFEP strategy (an imitator that has acquired a technology by way of technology transfer from a pioneer, or sometimes in an unethical manner, such as bribery, business intelligence, buying up

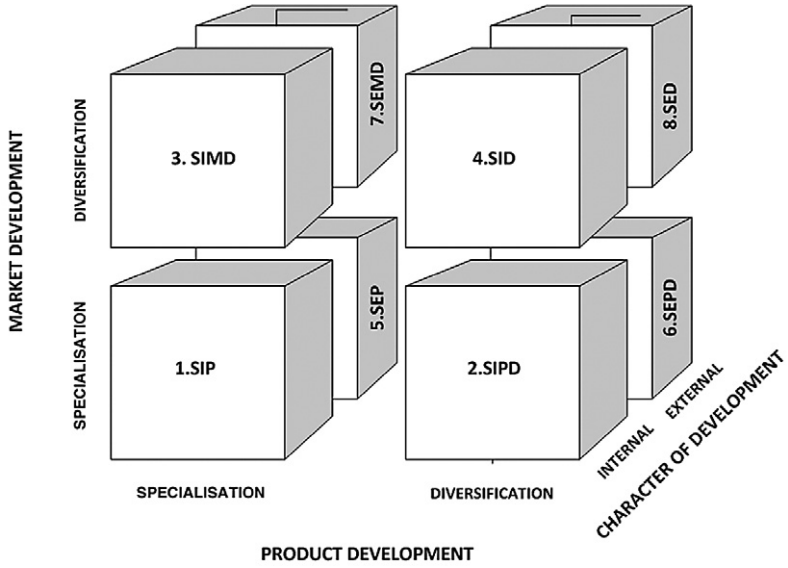

Figure 3. Three-dimensional strategic space of an enterprise with respect to product development, market development and character of development (internal/external growth path).

of key employees, using personalisation, interpersonal contacts and their direct communication of knowledge);

(11) The IFMC strategy (an imitator that has acquired a technology using both its own R&D resources and outside sources, making use of a wide information base and experience, as well as open knowledge and the experience of others);

(12) The IFMP strategy (an imitator that has acquired a technology from both internal and external sources, based primarily on hidden knowledge and interpersonal contacts serving the sharing of knowledge).

2.3. *Strategic dilemmas relating to products and markets*

Redundancy of key resources (technology, innovation or more broadly knowledge) and the opportunities arising in the environment enable high-tech firms to expand and change their fields and countries of activity. These enterprises are consequently confronted by further strategic choices (Figure 3).

These choices relate to product/market categories, and are a result of the opportunities taken by a high-tech firm, given the resources it has.

Considering the type of product and market development (to specialise or diversify), and the character of development (internally through own investment, or externally[4] through own investment and cooperation and merger with other entities), the following eight possible growth strategies for a firm are distinguished:[5]

(1) The strategy of internal penetration (SIP) – characterised by product and market specialisation, and an internal growth method; based on its own investments and unique technological competences, a firm offers existing products, often altered and modernised, on one geographical market or one market segment, satisfying the specialised needs of customers;

(2) The strategy of internal product development (SIPD) – characterised by product diversification and market specialisation, and an internal growth method; the firm operates in one market segment or within one geographical market, and uses its own resources to offer new, innovative products;

(3) The strategy of internal market development (SIMD) – using product specialisation and market diversification, and an internal growth method; independently, based on its own investments, the firm begins to offer its specialised, innovative products in new market segments or on new markets in the geographical sense;

(4) The strategy of internal diversification (SID) – characterised by product and market diversification, and an internal growth method; the firm differentiates its products and extends the area of its activity using only its own resources;

(5) The strategy of external penetration (SEP) – based on product and market specialisation, and internal and external growth methods; the firm offers the same products as before, modifying and modernising them, on one geographical market or one market segment. In doing this, it

Table 1. Matrix for the classification of high-tech enterprises' strategies

Strategic decisions relating to development of technology, innovation and approach to knowledge management	Strategy in product and market categories							
	SIP	SIPD	SIMD	SID	SEP	SEPD	SEMD	SED
ILIC								
ILIP								
ILEC								
ILEP								
ILMC								
ILMP								
IFIC								
IFIP								
IFEC								
IFEP								
IFMC								
IFMP								

uses concentrative or cooperative forms of combined business activity;

(6) The strategy of external product development (SEPD) – characterised by product diversification and market specialisation, and the use of mixed growth methods; the firm offers new products using various forms of combined business activity, such as mergers, takeovers, strategic alliances, etc., without going beyond its existing market;

(7) The strategy of external market development (SEMD) – using product specialisation and market diversification, and mixed growth methods; through various forms of combined activity with other firms, the firm begins to operate on new markets, particularly international and global ones;

(8) The strategy of external diversification (SED) – characterised by product and market diversification, and the use of mixed growth methods; the firm differentiates its products and extends the area of its activity, undertaking cooperation with other firms in doing so.

2.4. A matrix for the classification of high-tech enterprises' development strategies

Combining the distinguished strategic options relating to development of technology, innovation or more broadly knowledge as a resource (Figure 2) with the specific product/market categories, which are a result of the opportunities taken by the firm (Figure 3), we have produced a multi-field matrix serving to classify the strategies of high-tech enterprises (Table 1). In this way, 96 different strategies were produced. Going on to use morphological analysis (Zwicky, 1969; Ritchey, 2006) in the context of the specific characteristic features of high-tech enterprises, an indication was made of those strategies which, in the author's opinion, are most appropriate for firms of that type. This is the author's own proposal, based on the proposed model for the strategy of a high-tech enterprise (Figure 1), and being a synthesis of the strategic choices previously described (Figures 2 and 3).

A black colour denotes the fields that, in the author's view, ought to be present most often in high-tech firms in view of their specific nature and desire to achieve innovation leadership, this being a source of technological advantage, while a grey colour denotes fields that are present less often but may also lead to success. The white fields are not fully suited to the specific features of high-tech firms.

It should be noted that, among the innovation followership strategies, those that involve a creative approach to imitation, including a firm's own concepts and ideas, have a chance of success. However, imitator strategies will never provide a firm with the same advantages as are obtained through the technological leadership to which high-tech firms ought to aspire.

In order to check the above strategic options in relation to high-tech enterprises, a survey was conducted of 61 selected companies in Poland from 1 September 2010 to 31 January 2011. The following section describes the methods of data collection.

3. Methods of research

The participants were selected on the basis of two criteria: (1) that the company belonged to the high-tech enterprise sector (according to the OECD classification – sectoral approach; OECD, 2009); and (2) that the company was classified as a medium or large enterprise (over 49 or over 249 employees, respectively) (the act on freedom of economic activity, Polish legislation, 2004). From 180 companies invited to take part in the survey, 61 companies eventually agreed to participate: 24 from the IT and telecommunications industries, 13 from the pharmaceutical industry, and 24 from other segments in the high-tech sector. Forty-seven of these companies were classified as medium enterprises and 14 as large enterprises. All 61 companies were based in Poland during the study period; 29 operate solely in Poland and 32 operate globally.

The monographic method was applied, with the standardised interview technique. This made it possible for the researcher and survey participants to come to a common understanding of various strategic options. The respondents represented chief executive officers (CEOs). The study concentrated on the identification and evaluation of strategic choices made by the firms in relation to sources of technology acquisition, degree of originality of innovation, approach to knowledge management and market/product development.

4. Results and discussion

A clear majority of respondents (55 persons) base their strategy on a resource-based approach (Barney, 2001) and key competences (Hamel and Prahalad, 1994). It was pointed out that what is important for a firm is not just having and making effective use of key resources, but also their development and renewal (dynamic capabilities; Teece et al., 1997). The following were identified as the most important resources for a firm's development: (1) personalised knowledge, that is the competences and talents of employees (72.1% of CEOs); (2) employee attitudes, that is creativity, desire to experiment (65.6%); (3) technological knowledge, that is know-how, patents, licences (54.1%); and (4) partnership relationships with outside entities (50.8%). The CEOs were also asked to evaluate particular capabilities of the firm (Table 2). This evaluation used a scale of 1–5, where 1 denotes very low capability and 5 denotes very high.

Table 2. Assessment of selected capabilities at the studied companies

Ability to:	Total (All companies)			
	N	$\bar{\mathbf{X}}$	M	Q
experiment, generate ideas and innovate	61	3.57	4	1
make redundant (create an excess of) key resources	61	3.34	3	1
identify opportunities	61	3.81	4	1
use opportunities	61	3.72	4	2

$\bar{\mathbf{X}}$ = average; M = median; Q = quantities deviation.

Most highly rated was the ability to identify and use opportunities, which indicates that the investigated firms are able to put their innovation strategies into effect in a rapidly changing environment.

In all of the companies, there was an R&D department (internal sources of technology acquisition). However, new technologies were created not only based on the results of that department's work, but also through the use of outside sources. Most often indicated were contacts with other centres engaged in R&D (56 firms), purchases of licences and know-how (41 firms), and transfer of technology (40 firms). R&D contracting and strategic partnership were more rarely used (nine firms), and only in seven firms had a decision been made to purchase a firm together with its technology (seven firms), and in nine firms to set up a joint venture with a supplier of technology. This means that all of the studied firms used mixed sources of technology acquisition.

Most of the CEOs (70.5%) described their innovation strategy as striving to be a technological leader by developing new technologies and bringing new products onto the market. The remainder (29.5%) declare imitation as their innovation strategy, although the option most often indicated was creative imitation (Enkel and Gassmann, 2010), involving the use of the experience of an innovator and its new product to launch the firm's own improved or substitute products.

As regards the approach to knowledge management, in 73.8% of the investigated firms, personalisation is dominant, reflected in the sharing of knowledge, particularly hidden knowledge, through direct interpersonal contacts. However, in 26.2% of the firms, the dominant approach was codification, where emphasis is placed on open knowledge and information technology.

Table 3. Growth strategies of the investigated high-tech firms

Strategic decisions relating to development of technology, innovation knowledge management	Strategy in product and market categories					
	SIP	SEP	SEPD	SEMD	SED	Total
ILMC	1	3	–	3	2	9
ILMP	2	7	3	15	7	34
IFMC	1	2	2	–	2	7
IFMP	3	4	1	2	1	11
Total	7	16	6	20	12	61

When asked to identify their strategies in product/market-related categories, 70.5% of CEOs declared product specialisation, and out of these, 37.7% also declared market specialisation (the area of Poland) and 32.8% market diversification in the geographical sense (the global market). However, in 18 firms (29.5% of the sample), there occurred product diversification (mainly concentric and horizontal), together with market specialisation (6 firms) or geographical diversification (12 firms).

Only seven firms developed exclusively based on their own investment, building the potential of the enterprise on the basis of existing assets; the others also used external growth methods, mainly mergers and takeovers (19 firms), and strategic alliances (37 firms).

In assigning the identified strategies of the investigated firms to the fields of the proposed matrix for classification of high-tech enterprises' strategies (Table 3), it is noted that most of them (41 firms) lie within those strategic fields which were recommended for firms of this type on the grounds of their specific features (the black fields in the matrix).

They strive for innovation leadership, use internal and external sources of acquisition of technology and a personalisation approach to knowledge management, more rarely adopting codification as the dominant knowledge management approach. In this, they use different product and market development paths, depending on the opportunities presented to them by the environment.

Some of the firms pursue strategies that also have a chance of success (the grey fields in the matrix) but do not guarantee a position of innovation leader. These are mainly firms that apply imitation in innovation (15 firms), usually together with a market penetration strategy. This strategy carries a high level of risk due to the ever shorter product life cycle in the high-tech sector. Two firms in this group strive for innovation leadership concentrating on open knowledge, while pursuing strategies of product and market diversification. This strategic option provides less chance of success in obtaining the position of innovation leader, in view of the excessive differentiation within the firm and the need to divide limited resources between different types of activity.

The strategies of three of the investigated firms are not fully suited to the specific nature of the high-tech sector. These firms apply innovation followership strategies, operating on different markets and offering differentiated products. In view of the large dispersion of activity and reliance on the experience of a pioneer, it is hard for such firms to be innovative – and it is the development of new technologies and creation of innovative products that are the basic features that distinguish high-tech firms from other types of businesses.

5. Conclusions and implications for R&D management

The foundation for the strategies of innovative enterprises, a category into which high-tech firms undoubtedly fall, is the development of technology, innovation and knowledge as a resource (Barney, 2001; Grant, 2010). A redundancy of these resources enables firms to take advantage of the opportunities that arise in a turbulent and uncertain environment, where the use of such opportunities is a deliberate action, a rule according to which the firm operates (Eisenhardt and Sull, 2001). At the same time, high-tech firms ought, through their creative actions, to create new product and market spaces (Kim and Mauborgne, 2005), and strive towards radical innovations (Morone, 1993; Christensen, 2003; Masson et al., 2010). These activities in combination shape, in an emergent fashion, the firm's strategy in the classical product/market categories. The proposed model for high-tech firms' strategies based on these assumptions, which take account of modern approaches to strategy and the specific features of the high-tech sector, enriches the

theoretical description of this subject area. Meanwhile, the matrix for the classification of high-tech firms' strategies supplies practical guidance relating to the strategic choices faced by CEOs.

The qualitative research carried out here confirms that the strategy of high-tech firms is expressed in the language of resources and opportunities, and that the majority of these firms strive for innovation leadership based primarily on the development of their own R&D activity, the creation of new technologies and personalisation as the dominant approach to knowledge management.

The resulting basic implications for R&D management can be summed up in the following points: (1) R&D is at the core of high-tech firms' strategies, defining their technological and innovation strategies or more broadly their knowledge strategies, and consequently they should pursue the fundamental goal of developing R&D activity as a resource (and its redundancy) rather than product/market-related goals; (2) in order to enable the development of the R&D resource, the processes and structures in the area of innovation exploration must be as flexible as possible (Galbraith et al., 2002; Masson et al., 2010), supported by a pro-innovation organisational culture (openness and excellent communication, trust, knowledge sharing and learning together, a sense of common responsibility (Arad et al., 1997; Martins and Terblanche, 2003); (3) CEOs should constantly improve the firm's ability to identify transient opportunities in the environment, which should be quickly exploited through the development of R&D activity as a resource, which may lead to the achievement of innovation leadership in the sector.

Innovativeness is now a key focus of strategic thinking, and therefore the strategic choices of innovative high-tech firms may be the source of new dynamic approaches to strategy, something that the future will undoubtedly bring.

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Notes

1. In order to better understand the essence and features of the strategies of high-tech companies, an expert survey was carried out in Poland in 2009 by A. Zakrzewska-Bielawska (Zakrzewska-Bielawska, 2011). A panel of 15 experts was selected, including 11 well-known academics from Polish universities working in the field of economics and specialists in strategic management, two representatives of consulting companies providing business consulting services for the high-tech sector, and two managers managing high-tech companies. The experts were asked to express their views (as comprehensively as was practicable) on their attitude towards strategy, and its characteristic features in high-tech sector companies. The survey included five open-ended questions about the specificity of strategy in high-tech enterprises. All the experts were of the opinion that the most appropriate approach to strategy for high-tech firms is the resource-based view (Hamel and Prahalad, 1994; Barney, 2001) and learning school of strategy (Mintzberg et al., 2009). Also often indicated were the simple rules school, and the ability to identify and take advantage of opportunities (Eisenhardt and Sull, 2001).
2. The abbreviation IL indicates that the firm strives for innovation leadership, the next letter denotes the source of technology acquisition (I – internal, E – external, M – mixed), and the last letter denotes the dominant approach to knowledge management (C – codification, P – personalisation).
3. The abbreviation IF indicates that the firm bases its operations on innovation followership, the next letter

denotes the source of technology acquisition (I – internal, E – external, M – mixed), and the last letter denotes the dominant approach to knowledge management (C – codification, P – personalisation).

4. It was decided to use the term 'external development' here rather than 'mixed development', since the word 'mixed' might be misunderstood. Assuming that high-tech firms always develop using their own resources, the term 'external development' places stronger emphasis on the use of outside resources and cooperation with other partners.
5. The strategies are denoted by letter codes. The letter S stands for 'strategy', the following letter I or E denotes the manner of development (I – internal, E – external), and the remaining letters indicate the category of the strategy based on Ansoff's matrix (Ansoff, 1965), where P denotes penetration, PD denotes product development, MD denotes market development and D denotes diversification.

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