INTEGRATED ASSESSMENT OF COMPETITIVE-STRATEGY SELECTION WITH AN ANALYTICAL NETWORK PROCESS

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Abstract. The present study explores efforts to identify the most appropriate competitive strategy relative to multinational biotech pharmaceutical enterprises' strategy selection. The research uses the analytic network process (ANP) technique combining both qualitative and quantitative information to construct a hierarchical model involving interactions among various criteria for competitive-strategy selection. The most important finding shows that the most suitable competitive strategy for multinational enterprises (MNEs) is differentiation strategy. The weighted calculations reveal important criteria: an external environment analysis reveals that the three most important criteria affecting FDI competitive strategy are population size, per capita income, and healthcare and medical insurance systems; a core competency analysis reveals that the three most important criteria affecting competitive-strategy selection of FDI to China are capability in collaborating with local partners, possession of high-quality research personnel with R&D capability, and possession of a strong brand.

Keywords: competitive-strategy selection, strategy formulation, analytic network process (ANP), integrated assessment, multinational biotech pharmaceutical enterprises.

1. Introduction

Since implementing an open-door policy in 1978, China has witnessed dramatic growth in the large amounts of inflow of foreign direct investment (FDI) into China. China has replaced the United States, becoming the largest recipient of FDI in 2003. China has successfully attracted FDI from multinational enterprises (MNEs), and MNEs of the biotech pharmaceutical industry are not excluded.

The biotech pharmaceutical industry has enormous opportunities to grow. Along with the technology development in the pharmaceutical field, nowadays the importance of biotech pharmaceutical products is greater than ever and increasing (Business Wire, 2009). In China, the biotech pharmaceutical industry has been growing rapidly. It has

been expanding at about 25% annually for the past few years and is poised for further expansion (Zhou 2007). According to research reports in *China Research and Intelligence* (2008), in 2008 the market size of China's biotech pharmaceutical industry was about 70 billion Yuan (about US$10 billion), a growth rate exceeding the whole market size of China's medicine market and also above three sub-sectors: chemical medicine materials, chemical medicine doses, and traditional Chinese prepared medicines. Under the current global economic recession, however, the development of China's biotech pharmaceutical industry has exhibited impressive momentum. The gradual expansion of China's biotech pharmaceutical industry is due to such favorable factors as China's rapid economic growth, people's growing incomes, increased understanding of and demand for biotech pharmaceutical medicine, improvements in China's healthcare system, and people's rising awareness of disease treatment. Fig. 1 shows the market scale of the biotech pharmaceutical industry in China during the period stretching from 2003 to 2007 (China Research and Intelligence 2008).

Facing uncertainties and ambiguities prevalent in the Chinese business environment, more and more MNEs are turning to a strategic approach as the way forward. How MNEs choose an appropriate market-entry strategy has become an important issue. An accurate competitive strategy has positive effects on business performance (Kirca *et al.* 2005; Matsuno, Mentzer 2000; Olson *et al.* 2005; Strandskov 2006; Vorhies, Morgan 2003). Studies about the relations between strategy and competitive advantage are discussed from two different perspectives. Competitive strategy is concerned with creating and maintaining a competitive advantage in each and every area of business (Thenmozhi 2011). Using a competitive strategy, an enterprise can position itself within an industry in such a way as to take best advantage of the competitive forces active in the industry. One approach of existing studies is to identify the key success factors (KSFs) of an industry on the basis of traditional theory, which emphasizes industrial organization. Other studies empirically identify the capabilities and the resources from the viewpoint of competence theory. Since KSFs change according to the industry in question, the possibilities of intervention depend on technology variables and on social-economic variables. Competitive advantage may not be sustainable in a changing or
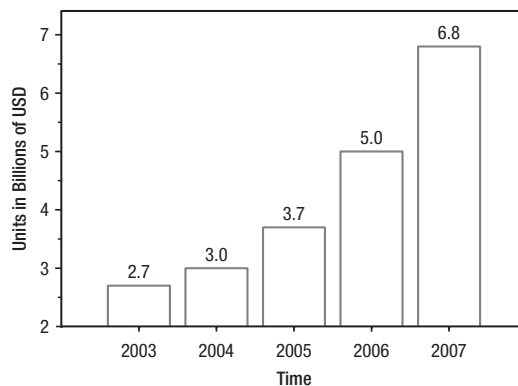

Fig. 1. Market Scale of Biotech Pharmaceutical Industry in China (2003–2007)

changed set of environmental conditions. Also, resources are not always linked to a core competence. Capabilities are termed 'core' when they result in a competitive advantage over other firms. This implies (1) that previous studies did not sufficiently address the factor of resources and (2) that capability, when transformed into core competency, can become competitive strength (De Saa-Perez, Garcia-Falcon 2002; Ginevičius *et al.* 2010; Korsakiene 2004).

Previous research targeting market-entry strategies, especially in the context of the biotech pharmaceutical industry, has focused on corporate-level strategy resulting in entities and events such as joint ventures, strategic alliances, mergers and acquisitions, and licensing agreements (Brouthers 2002; Chen, Lou 2004; Deeds, Hill 1996; Richards, DeCarolis 2003; Shan, Song 1997). To our knowledge, no study focuses on competitive (business)-level strategy, which is the foundation of successful business. For a firm trying to establish itself internationally, choosing a strategy for entry into a foreign market is of crucial importance. Therefore, to fill the gap in the literature, the current study elaborates on how multinational biotech pharmaceutical enterprises that are willing to invest in, or are currently investing in and want to expand, their business select an appropriate competitive strategy to compete in China. We use analytic network process (ANP) to construct a hierarchical model involving interactions among various factors for competitive-strategy selection: rests on integrated assessment including external factors and internal factors. The findings not only identify important factors of FDI for competitive strategy and rank them according to their importance, but also rank competitive strategies according to their level of competitiveness for decision makers.

The remainder of this paper is structured as follows. The second section presents a comprehensive review of the literature covering competitive (business) strategy, strategy formulation, and the ANP approach. The third section describes the current study's research process and research methodology as applied in this research. The empirical analysis and findings are discussed in Section 4. Section 5 concludes this paper and provides managerial implications.

2. Literature review

This section presents a review of related literature in three parts: competitive (business) strategy, strategy formulation, the ANP approach and summary.

2.1. Competitive (business) strategy

In the world of business, strategy is a way by which a firm fulfills its mission and attains its objectives. Brandenburger and Stuart (1996) mentioned that the essence of strategy lies in creating favorable asymmetries between a firm and its rivals. A good strategy neutralizes threats, exploits opportunities, capitalizes on strengths, and fixes weaknesses. The hierarchical view of strategy visualizes at least three levels of strategies. First, within large multi-business corporations, corporate strategy involves the selection of product markets or industries and the allocation of resources among them. Corporate-strategy decisions include investment in diversification, vertical integration, acquisitions, and new ventures. Second, business strategy is concerned with how the

firm competes within a particular industry or market. Porter referred to a business strategy as a competitive strategy. Pearce and Robinson (2003) indicated that competitive strategy strives to identify and secure the most prominent market segment within such a product-market arena. Thus, competitive strategies determine how the enterprise (business unit) must compete within such a segment in order to establish a competitive advantage. Each business unit within a multi-business firm could have its own specially tailored competitive strategy designed to strengthen the individual business units' use of distinctive competencies as competitive weapons. Third, functional strategies are the elaboration and implementation of business strategies through individual functions such as production, R&D, marketing, human resources, and finance. They are primarily the responsibility of the functional departments (Bernard 2010; Swamidass, Newell 1987).

Several strategic typologies have been proposed in the strategic-management literature over the years (Barczak 1995; Chrisman *et al.* 1988; Miles, Snow 1978; Porter 1980). Barczak (1995) suggested three strategic types based on the timing of entry, the first-to-market scenario, the fast-follower scenario, and the delayed-entrant scenario. Miles and Snow (1978) postulated four strategic types: defenders, prospectors, analyzers, and reactors. Porter (1980) described a typology consisting of three general types of strategies (cost leadership, differentiation, and focus) that businesses commonly use to achieve and maintain competitive advantage. These strategies are applied at the business-unit level, and they are not firm or industry dependent. Product differentiation fulfills a unique customer need by tailoring the product or service, allowing organizations to charge a premium price to capture market share. The differentiation strategy is implemented effectively when the business provides unique or superior value to the customer through product quality, features, or after-sale support. Firms following a differentiation strategy can charge a higher price for their products on the basis of product characteristics, delivery system, quality of service, or distribution channels. Spanos and Lioukas (2001) argued that there are at least two types of differentiation strategies. One is based on innovation differentiation, whose function is to make possible the most advanced and attractive products regarding the novelty of their quality, efficiency, design, or style. The other is based on marketing differentiation, whose function is to create a unique image for a product through marketing practices. Lower costs and cost advantages result from process innovations, learning-curve benefits, economies of scale, reductions, product designs that reduce manufacturing time and costs, and reengineering activities. Low-cost leadership strategy requires a vigorous pursuit of cost reductions deriving from experience, tight cost and overhead controls, avoidance of managerial customer accounts, and cost minimization in all activities, such R&D, advertising, process innovation, and product development. This strategy is implemented effectively when the firm designs, produces, and markets a product more efficiently than competitors. The focus is also known as a "niche" strategy, wherein the firm concentrates on a narrow competitive scope within the industry. Firms that succeed in a "focus strategy" are able to tailor a broad range of product-development strengths to a relatively narrow market segment that they know very well. Focus strategies grow market share by operating in a niche market or markets not attractive to, or overlooked by, larger competitors. A

successful focus strategy needs an industry segment large enough to have good growth potential but not of key importance to major competitors. Firms may use a focus strategy in conjunction with either the cost or differentiation strategies in a specific market niche (Allen *et al.* 1999).

2.2. Strategy formulation

Strategy formulation is the process of deciding the best course of action for accomplishing organizational objectives (Management Study Guide 2011; Karnitis, Kucinskis 2009). To formulate effective strategies, managers in an organization need to be aware of realities in a given business environment. Strategy formulation thus begins with a scanning of the external as well as internal environment. Analysis of an external environment helps to identify the possible threats and opportunities while analysis of an internal environment helps to identify strengths, weaknesses, and the key people within the organization being analyzed. An organization requires an analysis of what is happening outside the organization and an evaluation of current resources and an assessment of opportunities and threats present in the environment. Environment could be classified as external and internal (Thenmozhi 2011). Internal variables (in the firm) and external variables (in the industry) largely determine what type of competitive strategy a firm will choose to follow. O'Regan and Ghobadian (2004) pointed out that external and internal characteristics are the key factors considered in developing strategy. Toni and Tonchia (2003) considered strategy a long-term plan and noted that business is not conducted within a fixed environment. These strategic internal variables and external variables, which drive competitive strategy, change continuously. Competitive strategy may therefore adapt to changing circumstances in order to better position the enterprise seeking to benefit from the strategy. The above researchers argued that it is essential to integrate a twofold viewpoint: external and internal views.

The external environment consists of variables that are outside the organization and not typically within the short-run control of top management. The general factors, called the overall societal environment, comprises socio-cultural, economic, technological, political, and legal forces; and specific factors, called the task environment, include suppliers, employers, competitors, trade associations, communities, creditors, customers, special-interest groups, government, and shareholders. In order to have a better understanding of an industry's external environment, one must analyze the industry itself in detail. Usually competition analysis proceeds along with industry analysis. Ginter *et al.* (1992) proposed that macro environmental analysis is strategic thinking in strategic planning. Macro environments can be seen from five different perspectives: demographic, technological, political-legal, economic, and socio-cultural perspectives. The five different perspectives of macro environmental analysis are also mentioned by Hitt *et al.* (2007). The method widely used is Porter's Five-forces Model: barriers to entry, bargaining power of suppliers, bargaining power of buyers, rivalry among existing players, and threat of substitute products (Thenmozhi 2011). Pan (1999) proposed a simplified framework that encompassed two main elements for pharmaceutical companies' strategic launch decisions relevant to a new product: an external analysis (targeting customers, competitors,

the market, and the environment in which the new product would compete), and an internal/self analysis of the company (the company's overall performance and strategic options) (Trim, Pan 2005).

The resource-based perspective rests on an internal analysis of firms and suggests that firms are a collection of heterogeneous resources (tangible and intangible) that are semi-permanently tied to a company (Wernerfelt 1984). The study of the core-competency concept for strategy formulation has generated enormous interest since it is an element of successful strategy for MNEs (Grant 1991; Hoskisson *et al.* 2004; Kak 2004; O'Tegan, Ghobadian 2004; Prahalad, Hamel 1990; Toni, Tonchia 2003). Core competency is a concept well known to academics, business practitioners, and consultants in strategic management. Scholars have acknowledged the importance of core competency in formulating strategy (Grant 1991; Lahti 1999; Toni, Tonchia 2003; O'Tegan, Ghobadian, 2004). Bogner *et al.* (1996) analyzed the 41 largest pharmaceutical firms in the United States and Western Europe in terms of their core competencies and looked at how the relative competitive postures of these firms changed in the US market between 1969 and 1988. Kak (2004) explored a case study of two pharmaceutical organizations to investigate the issues related to core-competency development and strategy formulation with core competency. The findings revealed that the core competencies in Eli Lilly & Company, a worldwide leader in pharmaceuticals, were R&D and marketing, whereas the core competencies of another global pharmaceutical company, Pharmacia & Upjohn, were R&D and dedicated manpower. Another study narrowed its focus on biotech pharmaceuticals and emphasized the future importance of R&D leadership for this industry (Feltz 2007). Powell *et al.* (1992) suggested that firms in a wide range of industries were executing nearly every step in the production process through some form of external collaboration. These researchers argued that biotechnology firms were opting to sustain – by means of vertical integration – their competitive ability to learn through interdependence rather than through independence. With the growing complexity of process development, R&D firms like Pfizer have come to realize that they need to collaborate with other organizations that have expertise (Mehta, Peters 2007). Liu and Cheng (2000) pointed out that the entry strategies in China for pharmaceuticals may involve more complicated considerations: government policies (including legislation, healthcare insurance, medical insurance, regulatory affairs, and distribution), brand position, corporate strategies (consisting of target segments, marketing, spending, market channels, and prices), product life cycle, order of entry, and product category.

2.3. Analytic network process (ANP)

The analytic hierarchy process (AHP) is a powerful tool for dealing with complex multi-criteria decision-making problems, and can help to establish decision models that account for both qualitative and quantitative components. The AHP helps analysts to organize the critical aspects of a problem into a hierarchy rather into a family tree (Bevilacqua *et al.* 2004). By reducing complex decisions to a series of simple comparisons and rankings, and by then synthesizing the results, the AHP not only helps the analysts

to arrive at the best decision, but also provides a clear rationale for the choices made (Chin *et al.* 1999). Since the AHP was first proposed by Saaty (1980), it has been applied in a variety of fields. The AHP represents a framework with unidirectional relationships among elements of the system, which implies that lower levels do not affect upper levels. A hierarchical model therefore is not appropriate for a complex system involving interaction among various factors. The development of the analytic network process (ANP) emerged to fill this gap.

The ANP – also introduced by Saaty (1996) – is the generic form of the AHP. The ANP does not require hierarchical structure, because it replaces the hierarchy in the AHP with a network incorporating feedback and interdependent relationships among elements. Not only does the importance of the criteria determine the importance of the alternatives as in a hierarchy, but also the importance of the alternatives may affect the importance of the criteria (Saaty 1996, 2006). The ANP provides a general framework for dealing with decisions without generating assumptions about the independence between levels of a hierarchy (Saaty 2005).

In general, the decision framework described by a network in ANP can be drawn graphically. In the ANP approach, the interdependence occurring among attributes and attribute levels is represented by two-way arrows (or arcs). Interdependency relationships that occur within the same level of analysis are represented by looped arcs. The directions of the arcs signify dependence, arcs emanate from an attribute to other attributes that may influence it (Meade, Sarkis 1999).

The process of ANP proceeds according to the following four steps (Chung *et al.* 2005; Lin *et al.* 2009):

(1) Model construction and problem structuring

The problem should be stated clearly and decomposed into a rational system like a network. Decision-makers can identify or develop a structure by brainstorming or by undertaking other appropriate methods (Yüksel, Dagdeviren 2007).

(2) Pairwise comparison matrices and priority vectors

In ANP, like AHP, decision elements at each cluster are compared pairwise with respect to their importance for their control criterion, and the clusters themselves are also compared pairwise with respect to their contribution to a goal. Interdependencies among elements of a cluster must also be examined pairwise; the influence of each element on other elements can be represented by an eigenvector (Yüksel, Dagdeviren 2007). The relative importance values are determined with Saaty's (1980) nine-point scale. A score of 1 represents equal importance between the two elements and a score of 9 indicates the extreme importance of one element (row cluster in the matrix) compared to another one (a column of clusters in the matrix) (Meade, Sarkis 1999). A reciprocal value is assigned to the inverse comparison; that is, $a_{ij} = 1/a_{ji}$, where a_{ij} (a_{ji}) denotes the importance of the ith (jth) element in the matrix of pariwise comparison A. Like AHP, pairwise comparison in ANP is made in the framework of a matrix, and a local priority vector can be derived as an estimate of

relative importance associated with the elements (or clusters) being compared. The derivation can be solved on the basis of the following equation

$$A \times w = \lambda_{max} \times w, \tag{1}$$

where A is the matrix of pairwise comparison, w is the eigenvector with respect to λ_{max}, and λ_{max} is the largest eigenvalue of A (Yüksel, Dagdeviren 2007). Saaty (1980) proposes several algorithms to approximate w. In this paper, we use the computer software Expert Choice to compute the eigenvectors from the pairwise comparison matrices and to determine the consistency ratios.

(3) Supermatrix formation

The supermatrix concept is similar to the Markov chain process (Saaty 1996). To obtain global priorities in a system with interdependent influences, the local priority vectors are entered in the appropriate columns of a matrix. As a result, a supermatrix is actually a partitioned matrix, where each matrix segment represents a relationship between two nodes (components or clusters) in a system (Meade, Sarkis 1999). Let the components of a decision system be C_k, $k = 1, 2, …, n$. Each C_k contains mk elements denoted as $e_{k1} \cdots e_{k\,mk}$. The local priority vectors obtained in Step 2 are grouped and located in appropriate positions in a supermatrix according to the flow of influence from a component to another component, or from a component to itself as in the loop. A standard form of supermatrix is shown in expression (2) (Saaty 1996).

$$
W = \begin{array}{c} \\ C_1 \\ \\ \\ C_k \\ \\ \\ C_n \\ \end{array}
\begin{array}{c}
\begin{array}{ccc} C_1 & C_k & C_n \\ e_{11}\cdots e_{1\,m1} & e_{k1}\cdots e_{k\,mk} & e_{n1}\cdots e_{n\,mn} \end{array} \\
\begin{bmatrix}
w_{11} & \cdots & w_{1k} & \cdots & w_{1n} \\
\vdots & \vdots & \vdots & \vdots & \vdots \\
w_{k1} & \cdots & w_{kk} & \cdots & w_{kn} \\
\vdots & \vdots & \vdots & \vdots & \vdots \\
w_{n1} & \cdots & w_{nk} & \cdots & w_{nn}
\end{bmatrix}.
\end{array}
\tag{2}
$$

As an example, the supermatrix W representation of a hierarchy with three levels as shown in Fig. 2(A) is as follows (Saaty 1996)

$$
W_h = \begin{bmatrix}
0 & 0 & 0 \\
w_{21} & 0 & 0 \\
0 & W_{32} & I
\end{bmatrix}.
\tag{3}
$$

In this matrix, w_{21} is a vector that represents the impact of the goal on the criteria, W_{32} is a matrix that represents the impact of criteria on each of the alternatives, I is the identity matrix, and entries of zeros correspond to elements that have no influence.

For the above example, if the criteria are interrelated among themselves, the hierarchy is replaced by a network as shown in Fig. 2(B). The (2, 2) entry of W_n given by W_{22} would indicate the interdependence, and the supermatrix would be as follows (Saaty 1996):

$$W_n = \begin{bmatrix} 0 & 0 & 0 \\ w_{21} & W_{22} & 0 \\ 0 & W_{32} & I \end{bmatrix}. \tag{4}$$

Note that any zero in the supermatrix can be replaced by a matrix if there is an interrelationship of the elements in a component or between two components. Since there usually is interdependence among clusters in a network, the columns of a supermatrix usually yield a sum of more than one. The supermatrix must be transformed first to make it stochastic, that is, each column of the matrix sums to unity. A recommended approach by Saaty (1996) is to determine the relative importance of the clusters in the supermatrix, with the column cluster (block) as the controlling component (Meade, Sarkis 1999). That is, the row components with non-zero entries for their blocks in that column block are compared according to their impact on the component of that column block (Saaty 1996). To obtain an eigenvector, one can conduct a pair-wise comparison matrix of the row components with respect to the column component. This process gives rise to an eigenvector for each column block. For each column block, the first entry of the respective eigenvector is multiplied by all the elements in the first block of that column, the second by all the elements in the second block of that column, and so on. In this way, the block in each column of the supermatrix is weighted, and the result is known as the weighted supermatrix, which is stochastic.

Raising a matrix to powers gives the long-term relative influences of the elements on each other. To achieve a convergence on the importance weights, the weighted supermatrix is raised to the power of $2k + 1$, where k is an arbitrarily large number,
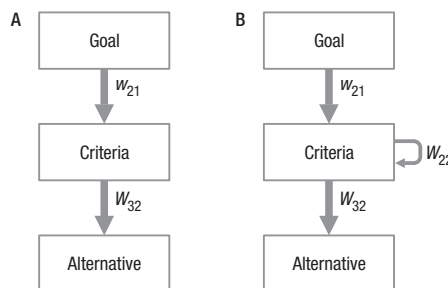

Fig. 2. Hierarchy and network: (A) hierarchy; (B) network

and this new matrix is called the limit supermatrix (Saaty 1996). The limit supermatrix has the same form as the weighted supermatrix, but all the columns of the limit supermatrix are the same. By normalizing each block of this supermatrix, the final priorities of all the elements in the matrix can be obtained.

(4) Selection of the best alternatives

The selection of the best alternative depends on the normalized supermatrix. which overall priority weights of the alternatives are shown in it. On the other hand, if a supermatrix comprises only components that are interrelated, additional calculations are necessary to obtain the overall priorities of the alternatives. The alternative with the largest overall priority should be the one selected.

2.4. ANP literature

ANP can act as a valuable method for solving many multi-purpose, complicated decision-making problems. Over the years, there have been many ANP methods applied by various authors. Chung *et al.* (2005) developed a model for the selection of product mix with an ANP application. In Lee and Kim's (2000, 2001) studies, they used ANP for interdependent information-system project selection to find project priorities. In two studies by Meade and Sarkis (1998, 1999), ANP served to identify appropriate logistic strategies and to improve production speed. Momoh and Zhu (2003) used ANP to illustrate optimal production schedules. Partovi (2006) presented a strategic solution to the facility-location problem, and the solution uses ANP to incorporate both external and internal criteria in the decision-making process. Sarkis (2002) presented a framework that, based on ANP, effectively treats tangible, intangible, strategic, and operational factors in the strategic evaluation of suppliers. Tesfamariam and Lindberg (2005) proposed an application of ANP in selecting the best among competing system configurations. Ulutas (2005) specified an appropriate energy policy for Turkey. Wua and Lee (2007) selected knowledge-management strategies using the ANP method. Yurdakul (2003) constructed a model by using the ANP technique to evaluate long-term performances of production systems.

2.5. Summary

Strategy research examines mainly why firms differ in overall performance and achieve sustainable competitive advantage over other firms. Briefly, the research seeks to establish why some firms are more successful than others. The prior literature addressed this important question by suggesting the need to achieve a fit or balance between the firm's internal environment and its external-operating environment (Volberda 1996). A proper scanning of internal and external environments helps to identify strategic alternatives that harness strengths and overcome weaknesses in the light of opportunities and threats operating in the environment (Ghazinoory *et al.* 2011; Thenmozhi 2011). In this research, we focus on (1) macro-level environmental analysis and industry analysis as the external environmental analysis and (2) core-competencies analysis as the internal environmental analysis. We held a focus-group discussion (FGD) with eight experts (see Appendix 1) to determine-following the aforementioned literature and the characteristics of the biotech pharmaceutical industry-preliminary macro-level environmental fac-

tors, industry factors, and core competencies that influence China-based multinational biotech pharmaceutical enterprises' strategy selection relative to FDI. The preliminary comprehensive factors involve international-strategy decisions. But not all determinants are relevant for each enterprise; there may be only a few important factors, and they would dominate the decision-making processes in each business (Stevenson 1996). The current study also accounts for Porter's (1980) approach to generating preliminary business strategies because his typology is similar to others' and has received more empirical support from previous research than other typologies. In addition, the object herein is to select the best competitive strategy from alternatives for biotech pharmaceutical firms. The problem becomes complex owing to numerous criteria that have interactions between each other and within themselves. It is not easy to analyze most criteria and their various levels correctly. Therefore, it is necessary to harness a technique combining both qualitative and quantitative information. It seems appropriate to use ANP as an analytic tool for strategy selection because of its suitability in providing solutions in such a complex multi-criteria decision environment.

3. Research process and proposed model implementation

The research process of this study is divided into five steps, as presented in Fig. 3, and these steps are described in the following section. The model for competitive-strategy selection is proposed in Fig. 4. This framework is divided into five levels. The first level is the framework goal. Dimensions for assessing an environment are listed in the second level; each dimension has several detailed groups that are listed in the third level. And each group includes more criteria that are on the fourth level. The fifth level consists of three alternatives. Appendix 2 presents the corresponding detailed definitions. The hierarchical model depicts a situation where there is no interaction among the dimensions and groups, while the loop diagram indicates a situation where there is interaction between criteria. Fig. 5 shows the network with representative symbols.

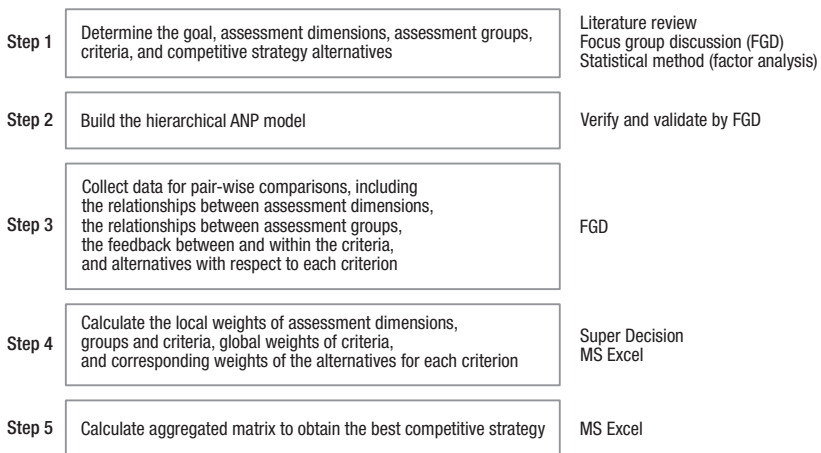|		
Step 1	Determine the goal, assessment dimensions, assessment groups, criteria, and competitive strategy alternatives	Literature review Focus group discussion (FGD) Statistical method (factor analysis)
Step 2	Build the hierarchical ANP model	Verify and validate by FGD
Step 3	Collect data for pair-wise comparisons, including the relationships between assessment dimensions, the relationships between assessment groups, the feedback between and within the criteria, and alternatives with respect to each criterion	FGD
Step 4	Calculate the local weights of assessment dimensions, groups and criteria, global weights of criteria, and corresponding weights of the alternatives for each criterion	Super Decision MS Excel
Step 5	Calculate aggregated matrix to obtain the best competitive strategy	MS Excel

Fig. 3. The proposed research process for selecting the best competitive strategy alternative
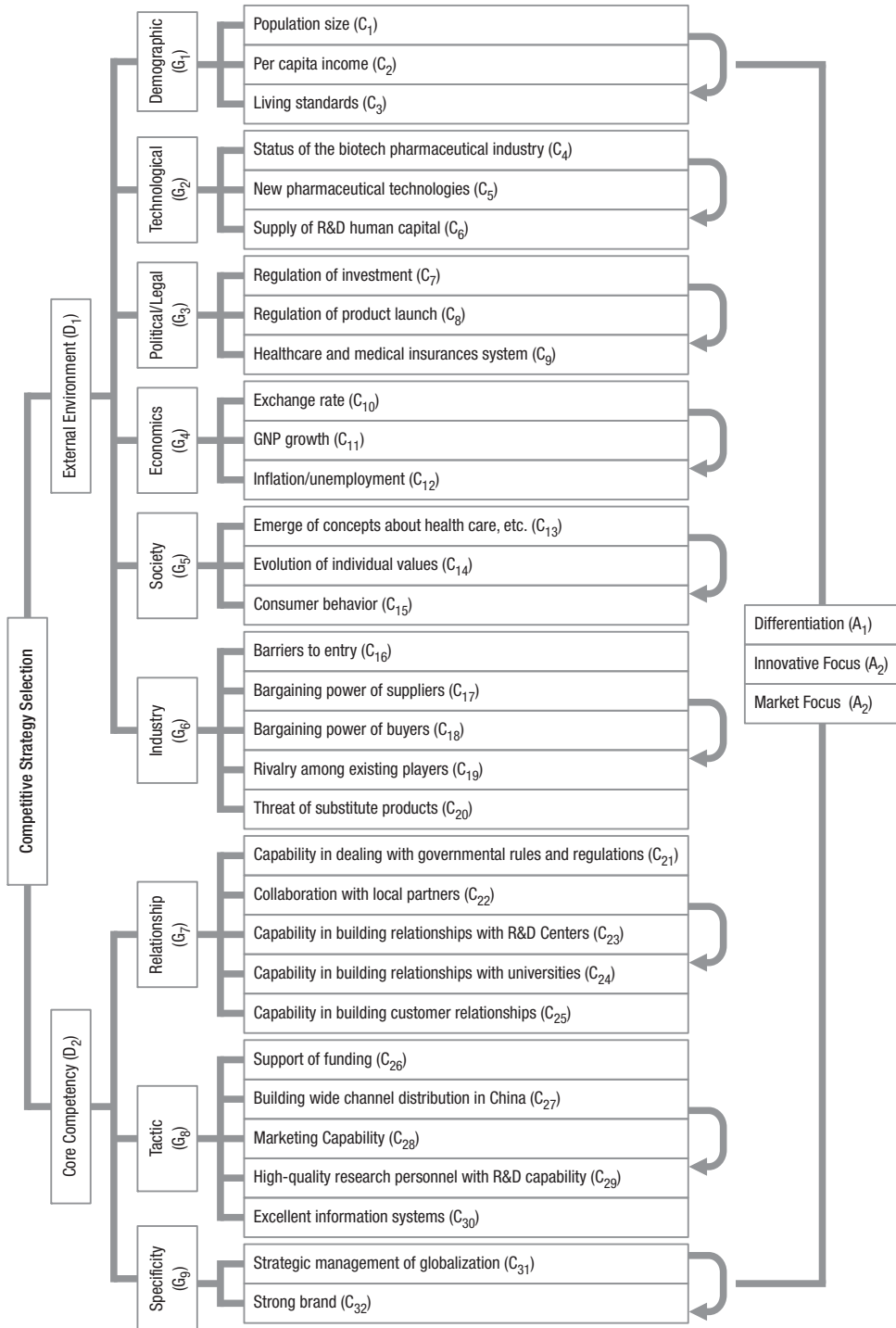
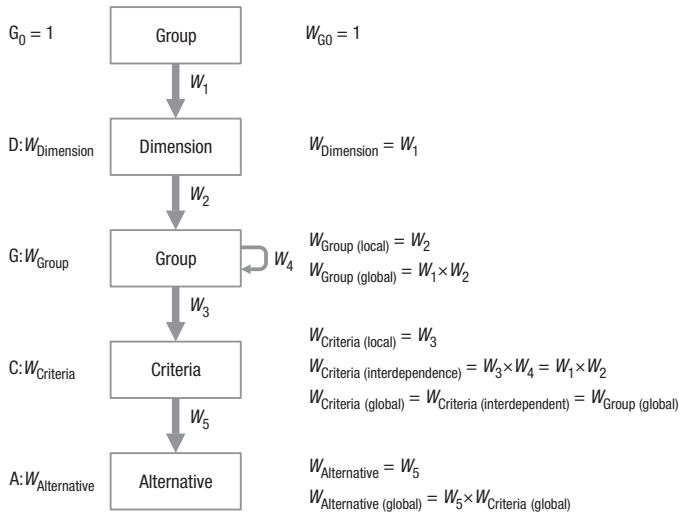**Fig. 4.** The ANP model for competitive-strategy selection

Fig. 5. The network with symbols

3.1. Calculating the weights of assessment dimensions with respect to the goal

In this step, two assessment dimensions are compared to each other with respect to goal. The pair-wise comparisons rest on FGD and on geometric mean rule; then pair-wise comparison matrices are formed with a 1–9 scale. The scale regarding relative importance to measure the relative weights can be seen in Table 1. With values, the eigenvector is obtained by using Expert Choice software as shown in Table 2 (calculate $W_{\text{Dimension}} = W_1$).

3.2. Calculating the weights of assessment groups with respect to the dimension

First, comparing the groups, for example Macro and Technological are compared using the question "How important is Macro when it is compared with Technological?" we get the following data (Table 3). Then the global weight matrix for each group is obtained by multiplying with each corresponding $W_{\text{Dimension}}$ as shown in Table 4 (calculate $W_{\text{Group(global)n}} = W_{\text{Dimension}} \times W_{\text{Group(local)}} = W_1 \times W_2$).

3.3. Calculating the global weights of each criteria

It is not possible to assume criteria to be independent. Therefore, we analyze the impact of each criterion on all other criteria by using pairwise comparisons. First, criteria's local weights in each assessment group are determined in the same way. Table 5 present the respective weights of the 32 criteria with respect to assessment groups. Next, the FGD serve to identify the inner loops among the criteria in each group. There are relations between the criteria in all groups except the socio political group. Eight pairwise comparison matrices were formed for 29 criteria. The resulting relative importance weights of these dependence matrixes were calculated listed in Table 6 to Table 13, separately for each criterion.

Table 1. Linguistic scales for the importance weight

Linguistic scales for importance degree	Linguistic terms	Explanation
1	Equal Importance	Two activities contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one activity over another
5	Strong importance	Experience and judgment strongly favor one activity over another
7	Very strong or demonstrated importance	An activity is favored very strongly over another; its dominance demonstrated in practice
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation
2, 4, 6, 8	For compromise between the above values	Sometimes one needs to interpolate a compromise judgment numerically because there is no good word to describe it
Reciprocals of above	If activity i has one of the above nonzero numbers assigned to it when compared with activity j, then j has the reciprocal value when compared with i	A comparison mandated by choosing the smaller element as the unit to estimate the larger one as a multiple of that unit

Table 2. Pair-wise comparison matrix and weights of assessment dimensions

Dimensions	D_1	D_2	$W_{Dimension}$
D_1	1	0.23	0.219
D_2	4.29	1	0.781

Table 3. Pair-wise comparison matrix and weights under each assessment group

D_1	G_1	G_2	G_3	G_4	G_5	G_6	$W_{Group(local)}$
G_1	1	0.910	0.435	1.248	0.726	1.732	0.231
G_2	1.099	1	1.154	1.232	2.069	1.732	0.201
G_3	2.298	0.866	1	1.277	2.568	2.236	0.193
G_4	0.801	0.812	0.783	1	1.383	1.732	0.161
G_5	1.378	0.483	0.389	0.723	1	1	0.119
G_6	0.577	0.577	0.447	0.577	0.577	1	0.104
D_2	G_7	G_8	G_9				$W_{Group(local)}$
G_7	1	0.616	2.282				0.343
G_8	1.623	1	2.404				0.483
G_9	0.438	0.416	1				0.174

Table 4. The global weight for each group

D_1	$W_{\text{Group(local)}}$	$W_{\text{Dimension}}$	$W_{\text{Group(global)}}$
G_1	0.231	0.219	0.051
G_2	0.201	0.219	0.044
G_3	0.193	0.219	0.042
G_4	0.161	0.219	0.035
G_5	0.119	0.219	0.026
G_6	0.104	0.219	0.023
D_2	$W_{\text{Group(local)}}$	$W_{\text{Dimension}}$	$W_{\text{Group(global)}}$
G_7	0.343	0.781	0.268
G_8	0.483	0.781	0.268
G_9	0.174	0.781	0.136

Table 5. Pair-wise comparison matrix and weights for each criterion

Demographic	C_1	C_2	C_3	$W_{\text{criteria(local)}}$
C_1	1	0.543	0.655	0.228
C_2	1.842	1	1.447	0.445
C_3	1.527	0.691	1	0.327
Technological	C_4	C_5	C_6	$W_{\text{criteria(local)}}$
C_4	1	0.923	0.944	0.316
C_5	1.084	1	0.653	0.295
C_6	1.059	1.532	1	0.389
Political	C_7	C_8	C_9	$W_{\text{criteria(local)}}$
C_7	1	0.417	0.514	0.189
C_8	2.400	1	0.687	0.370
C_9	1.944	1.456	1	0.442
Economic	C_{10}	C_{11}	C_{12}	$W_{\text{criteria(local)}}$
C_{10}	1	0.658	0.885	0.276
C_{11}	1.521	1	0.885	0.365
C_{12}	1.130	1.130	1	0.359
Socio cultural	C_{13}	C_{14}	C_{15}	$W_{\text{criteria(local)}}$
C_{13}	1	1.565	1.132	0.398
C_{14}	0.639	1	0.880	0.272
C_{15}	0.883	1.136	1	0.330

End of Table 5

Industry	C_{16}	C_{17}	C_{18}	C_{19}	C_{20}	$W_{criteria(local)}$
C_{16}	1	0.926	0.880	0.738	0.529	0.154
C_{17}	1.080	1	1.164	0.540	0.497	0.156
C_{18}	1.136	0.859	1	0.747	0.683	0.168
C_{19}	1.355	1.853	1.338	1	1.403	0.265
C_{20}	1.889	2.013	1.465	0.713	1	0.256
Relationship	C_{21}	C_{22}	C_{23}	C_{24}	C_{25}	$W_{criteria(local)}$
C_{21}	1	1.059	2.359	2.374	1.403	0.284
C_{22}	0.944	1	2.568	2.430	1.169	0.275
C_{23}	0.424	0.389	1	1.423	0.822	0.136
C_{24}	0.421	0.412	0.703	1	0.624	0.112
C_{25}	0.713	0.855	1.217	1.602	1	0.194
Tactic	C_{26}	C_{27}	C_{28}	C_{29}	C_{30}	$W_{criteria(local)}$
C_{26}	1.000	0.802	0.535	0.905	0.847	0.156
C_{27}	1.246	1.000	0.907	1.454	1.888	0.243
C_{28}	1.869	1.103	1.000	1.401	1.736	0.266
C_{29}	1.105	0.688	0.714	1.000	1.787	0.193
C_{30}	1.181	0.530	0.576	0.560	1.000	0.142
Specificity	C_{31}	C_{32}				$W_{criteria(local)}$
C_{31}	1	1.097				0.523
C_{32}	0.912	1				0.477

Table 6. The relative importance weights for criteria under the Demographic Group

Demographic	C_1	C_2	C_3
C_1	1	0.352	0.252
C_2	0.000	1	0.448
C_3	0.000	0.000	1

Table 7. The relative importance weights for criteria under the Technological Group

Technological	C_4	C_5	C_6
C_4	0.371	0.382	0.240
C_5	0.00	0.62	0.407
C_6	0.629	0.00	0.353

Table 8. The weight matrix of inner dependence for criteria the under Economic Group

Economic	C_{10}	C_{11}	C_{12}
C_{10}	1	0.22	0.00
C_{11}	0.00	0.401	0.446
C_{12}	0.00	0.38	0.55

Table 9. The relative importance weights for criteria under the Socio Cultural Group

Socio cultural	C_{13}	C_{14}	C_{15}
C_{13}	0.565	0.602	0.470
C_{14}	0.43	0.40	0.336
C_{15}	0.00	0.00	0.195

Table 10. The relative importance weights for criteria under the Industry Group

Industry	C_{16}	C_{17}	C_{18}	C_{19}	C_{20}
C_{16}	1.000	0.000	0.000	0.239	0.166
C_{17}	0.000	1.000	0.000	0.000	0.174
C_{18}	0.000	0.000	0.194	0.159	0.000
C_{19}	0.000	0.000	0.408	0.367	0.376
C_{20}	0.000	0.000	0.398	0.235	0.284

Table 11. The relative importance weights for criteria under the Relationship Group

Relationship	C_{21}	C_{22}	C_{23}	C_{24}	C_{25}
C_{21}	1.000	0.000	0.000	0.000	0.000
C_{22}	0.000	1.000	0.740	0.677	0.516
C_{23}	0.000	0.000	0.260	0.000	0.000
C_{24}	0.000	0.000	0.000	0.323	0.000
C_{25}	0.000	0.000	0.000	0.000	0.484

Table 12. The relative importance weights for criteria under the Tactic Group

Tactic	C_{26}	C_{27}	C_{28}	C_{29}	C_{30}
C_{26}	0.289	0.000	0.000	0.000	0.000
C_{27}	0.000	0.259	0.290	0.000	0.000
C_{28}	0.000	0.350	0.318	0.000	0.000
C_{29}	0.361	0.204	0.201	1.000	0.531
C_{30}	0.350	0.187	0.191	0.000	0.469

Table 13. The relative importance weights for criteria under the Specificity Group

Specificity	C_{31}	C_{32}
C_{31}	0.473	0.000
C_{32}	0.527	1.000

Then, criteria's interdependent weights in each assessment group are formed by multiplying dependence matrix of the criteria with the local weights of criteria.

Take the interdependent weights for C_1–C_3 under the demographic group as an example, the equation of which is as follows:

$$w_{C_1-C_3 \text{(interdependent)}} = \begin{bmatrix} 1.000 & 0.352 & 0.252 \\ 0.000 & 0.648 & 0.448 \\ 0.000 & 0.000 & 0.300 \end{bmatrix} \begin{bmatrix} 0.228 \\ 0.445 \\ 0.327 \end{bmatrix} = \begin{bmatrix} 0.467 \\ 0.435 \\ 0.099 \end{bmatrix}.$$

Finally, multiplying the interdependent weight of each criterion with the corresponding global weight of the assessment group as shown in Table 4, the last column in Table 13 yields the computed results for all criteria. There are three categories of data in external dimension concerning ranked importance: Population number (size) (C_1), Income (C_2) and Health care and medical insurance system (C_9). The three most important criteria in core competency dimension affecting competitive-strategy selection of FDI to China are Collaboration with local partners (C_{22}), possession of high-quality research personnel with R&D capability (C_{29}), and strong brand (C_{32}) ($W_{\text{Criteria(global)}} = W_{\text{Criteria(interdependence)}} \times W_{\text{Criteria(local)}} \times W_{\text{Group(global)}} = W_4 \times W_3 \times (W_1 \times W_2)$).

3.4. Determining the weights of competitive strategies with respect to each criterion

After obtaining the global weights for criteria, it is necessary to compare the competitive strategy alternatives with respect to each criterion. Table 14 presents the weights of the alternatives under each criterion (Calculate $W_{\text{Alternative}} = W_5$).

Table 14. The computed results for all criteria

Group	$W_{\text{Group(global)}}$	Criteria	$W_{\text{Criteria(interdependent)}}$	$W_{\text{Criteria(global)}}$
G_1	0.051	C_1	0.4666	0.0236
		C_2	0.4352	0.0220
		C_3	0.0982	0.0050
G_2	0.044	C_4	0.3232	0.0142
		C_5	0.3405	0.0150
		C_6	0.3362	0.0148
G_3	0.042	C_7	0.1886	0.0080
		C_8	0.3697	0.0156
		C_9	0.4416	0.0187
G_4	0.035	C_{10}	0.3554	0.0125
		C_{11}	0.3061	0.0108
		C_{12}	0.3385	0.0119
G_5	0.026	C_{13}	0.5437	0.0142
		C_{14}	0.3921	0.0102
		C_{15}	0.0642	0.0017
G_6	0.023	C_{16}	0.2600	0.0059
		C_{17}	0.2009	0.0046
		C_{18}	0.0748	0.0017
		C_{19}	0.2622	0.0060
		C_{20}	0.2021	0.0046

End of Table 14

Group	$W_{\text{Group(global)}}$	Criteria	$W_{\text{Criteria(interdependent)}}$	$W_{\text{Criteria(global)}}$
G_7	0.268	C_{21}	0.2839	0.0762
		C_{22}	0.5509	0.1478
		C_{23}	0.0352	0.0094
		C_{24}	0.0361	0.0097
		C_{25}	0.0939	0.0252
G_8	0.268	C_{26}	0.0451	0.0170
		C_{27}	0.1401	0.0528
		C_{28}	0.1696	0.0640
		C_{29}	0.4277	0.1612
		C_{30}	0.2174	0.0820
G_9	0.136	C_{31}	0.2474	0.0336
		C_{32}	0.7526	0.1022

3.5. Determining the overall priorities of the alternative strategies and obtaining the best "competitive strategy" alternative

In this step, the final weights of "competitive strategy" alternatives are calculated. By multiplying the global weight of each criterion with the values in Table 15, we obtain the priorities for the competitive strategies (Table 16). Differentiation strategy is the best competitive strategy with a 0.3724 value. Market-focus strategy is the second best, and the remaining ranking of the alternatives is innovative-focus strategy. Take $W_{\text{C1-C3}}$ under the demographic group as an example (calculate $W_{\text{Alternative(global)}} = W_5 \times W_{\text{Criteria(global)}}$).

$$W_{\text{C}_1-\text{C}_3} = \begin{bmatrix} 0.2740 & 0.3944 & 0.2998 \\ 0.4032 & 0.3010 & 0.3015 \\ 0.3229 & 0.3010 & 0.3986 \end{bmatrix} \begin{bmatrix} 0.3026 \\ 0.0220 \\ 0.0050 \end{bmatrix} = \begin{bmatrix} 0.0166 \\ 0.0176 \\ 0.0162 \end{bmatrix}.$$

4. Discussion

This study presents an effort to select the most suitable competitive strategy for multinational biotech pharmaceutical enterprises. The obtained results reveal that differentiation strategy comes in at the top of the rankings.

There are three types of medicinal drugs in China. One is brand-name drugs, which rely on their trade-based reputation and which hold patents on the drugs (the drugs can be produced and sold only by the company holding the patent). The second is off-patent drugs, which are produced by a brand-name company after the patents' expiration. The third is generic drugs, which are former brand-name drugs that, owing to the expiration of their patent and to government approval, appear on the market as generic drugs sold by non-"brand name" companies.

Table 15. The weights of the alternatives under each criterion

Criteria	Alternatives		
	A_1	A_2	A_3
C_1	0.274	0.403	0.323
C_2	0.394	0.301	0.301
C_3	0.300	0.302	0.399
C_4	0.246	0.347	0.407
C_5	0.213	0.500	0.287
C_6	0.210	0.495	0.296
C_7	0.252	0.395	0.354
C_8	0.285	0.469	0.246
C_9	0.329	0.341	0.330
C_{10}	0.290	0.391	0.319
C_{11}	0.348	0.349	0.303
C_{12}	0.411	0.281	0.308
C_{13}	0.428	0.245	0.326
C_{14}	0.347	0.277	0.376
C_{15}	0.431	0.264	0.304
C_{16}	0.225	0.496	0.279
C_{17}	0.316	0.379	0.305
C_{18}	0.375	0.364	0.261
C_{19}	0.305	0.399	0.296
C_{20}	0.346	0.475	0.179
C_{21}	0.319	0.453	0.228
C_{22}	0.379	0.248	0.373
C_{23}	0.349	0.350	0.301
C_{24}	0.423	0.334	0.243
C_{25}	0.476	0.240	0.283
C_{26}	0.196	0.414	0.390
C_{27}	0.452	0.178	0.370
C_{28}	0.479	0.229	0.292
C_{29}	0.357	0.300	0.342
C_{30}	0.385	0.291	0.324
C_{31}	0.412	0.358	0.230
C_{32}	0.425	0.315	0.260

Table 16. Results of competitive strategy alternatives

Group	Alternatives		
	A_1	A_2	A_3
G_1	0.0166	0.0176	0.0162
G_2	0.0097	0.0191	0.0152
G_3	0.0126	0.0168	0.0128
G_4	0.0123	0.0120	0.0109
G_5	0.0103	0.0067	0.0090
G_6	0.0068	0.0099	0.0061
G_7	0.0997	0.0838	0.0847
G_8	0.1470	0.1034	0.1266
G_9	0.0572	0.0442	0.0343
Sum	0.3724	0.3136	0.3159

Because most China-based biotech pharmaceutical firms are small and medium-size enterprises (SMEs), it is difficult to invest significant sums of money in new-drug innovation, particularly given the risk of disappointing results stemming from long-term drug-development research. Both foreign and joint-venture pharmaceutical firms in China have a monopoly in the brand-name drugs market and the off-patent drugs market. Multinational biotech pharmaceutical enterprises should adopt differentiation strategy rather than a simple strategy of new-product development in order (1) to avoid harmful competition with other MNEs in the brand-name drug market, (2) to shorten time-consuming and complex approval processes for new drugs from the State Food and Drug Administration (SFDA), (3) to reduce the risk of incurring fruitless and unnecessarily expensive research and development costs, and (4) to avoid avoidable declines in profit due to insufficient protection under intellectual property rights law.

For example, first, multinational biotech pharmaceutical enterprises could focus on the development of new formulations, new delivery systems, new indications, or new combinations of new drugs, not just the development of new entities. Moreover, multinational biotech pharmaceutical enterprises could enter the market by focusing on the specific diseases or ailments to which people in China are vulnerable (e.g., hepatitis B, oral cancer, diabetes mellitus, asthma, and nasopharyngeal cancer). Third, multinational biotech pharmaceutical enterprises could input more resources in the generic-drug market to increase profits since the market size is projected to reach more than US$88.5 from 2010 to 2014.

Segment size and potential growth are requirements for effective international segmentation. Since the EU and US economies have slowed, the pharmaceutical and biotech industries have demonstrated tremendous growth potential in emerging markets. Among all emerging economies, the focus is more on China than on any other territory owing

to rising demand in China's massive population and particularly in its rapidly growing middle class. China's pharmaceutical market will continue to grow more at approximately 20% annually, and will account for approximately 21% of overall global growth through 2013. And by 2020, the value of China's total pharmaceutical market is projected to be US$120 billion; indeed, China is predicted to overtake the United States in becoming the world's largest, and China's biotech market is expected to grow strongly as well. Biotech revenue growth in China alone is projected to exceed 25 percent within the next five years. Pharmaceutical sales are growing at a fast rate in China owing to the growth of Chinese per capita income that gives people more disposable income to spend on medicine. Furthermore, the continuous reorientation of healthcare and medical insurance systems toward business and market issues has caused China's biotech pharmaceutical industry to acquire a huge space in which to develop. Hence, from an external environment analysis, the current study's weighted calculations strongly suggest that the three most important criteria affecting competitive-strategy selection of FDI to China are population size (C_1), per capita income (C_2), and healthcare and medical insurance systems (C_9).

Drug development is extremely time-consuming and costly. No single organization has all the expertise necessary to produce the medical innovations that customers want. Therefore, MNCs that collaborate with useful entities on the domestic front (i.e., that form strategic alliances with complementing resources in the host country) will gain access to new research capabilities, accelerate products' introduction time (thereby granting first-mover advantage to the MNCs), and reduce the risk of incurring fruitless and unnecessarily expensive research and development costs. To progress beyond incremental improvements, biotech pharmaceutical firms should not only continuously cultivate internal expertise but also collaborate with partners whose capabilities augment its own. Such collaborations enable a biotech pharmaceutical firm to strengthen its entire R&D value chain (Kak 2004). Furthermore, MNCs' cooperation with local partners can accelerate the MNCs' entrance into the Chinese market, thereby enabling the MNCs to overcome obstacles related to cultural, language, geographical, and political barriers. The biotech pharmaceutical industry is a knowledge-intensive industry so that the availability of high-quality research personnel proficient in R&D activities has became an important factor. Drug innovation is also a necessity for multinational biotech pharmaceutical enterprises' successful international competition. Biotech pharmaceutical enterprises seeking to undertake research and product-development activities should adopt strategies that result in the realization of optimum innovation levels and optimum returns on investment in pursuit of these goals. People with R&D capability are central to non-Chinese multinational biotech pharmaceutical companies seeking to enter China in ways that enable the companies to market innovative products, to improve operational performance, and to gain competitive advantage over rivals. A review of the Chinese pharmaceutical market reveals that the domestic pharmaceutical market is highly fragmented and inefficient. Biotech pharmaceutical enterprises have understood that they operate in a low-trust environment and have hoped that a strong brand image can strategically increase their own share of the market. Creating a strong brand

image and building brand awareness is especially critical to China's pharmaceutical enterprises as they look to win consumers' trust in the quality, safety, and effectiveness of their products. Once enterprises develop a good brand image, they can use it as a tool to open further opportunities, to expand their targeted market, and to acquire a larger share of the expanded market. The goals of the Phi conference in 2011 are to enhance brand awareness, to develop business relationships, and to launch new products; hence, the current study's weighted calculations strongly suggest that, from a core competency analysis, the three most important criteria affecting competitive-strategy selection of FDI to China are capability in collaborating with local partners (C_{22}), possession of high-quality research personnel with R&D capability (C_{29}), and strong brand (C_{32}).

5. Conclusions

In this study, we have sought to identify the most appropriate competitive strategy for multinational biotech pharmaceutical enterprises that plan to invest, or have already invested, in China. By harnessing an ANP technique that combines both qualitative and quantitative information, we proposed a hierarchical model for competitive-strategy selection. The model consists of 1 goal, 2 assessment dimensions, 9 groups, 32 criteria, and 3 alternatives. With the help of interactions between criteria under each group, the data reflects the reality in a better way. This study's use of ANP has revealed that the most suitable competitive strategy for MNEs is differentiation strategy, followed by market-focus strategy and innovative focus (in the order of descending importance). The results of this study have also revealed two other significant points: external environment analysis has revealed that the three most important criteria affecting the competitive strategy selection of FDI to China are population size (C_1), per capita income (C_2), and healthcare and medical insurance systems (C_9); and core competency analysis has revealed that the three most important criteria affecting competitive-strategy selection of FDI to China are capability in collaborating with local partners (C_{22}), possession of high-quality research personnel with R&D capability (C_{29}), and strong brand (C_{32}).

Future studies can incorporate more important criteria and competitive strategies to expand and refine the model. In addition, future studies can use this model to research strategy selection as it applies to product categories' fitness for foreign investment.

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APPENDIX 1

Expert Backgrounds (FGD)

	Expert	Experience & Expertise
1	Experience	30 years of experience in a multi-national pharmaceutical company in China. Currently leads the China Pharmaceutical Enterprise Association (Association manager)
	Expertise	Business development; marketing and sales
2	Experience	30 years of experience in a multi-national pharmaceutical company in China. Currently leads a management consulting company in Taiwan
	Expertise	Business development; marketing and sales
3	Experience	25 years of experience in a multi-national pharmaceutical company in China. Currently owns a pharmaceutical trading company in China
	Expertise	Business development; marketing and sales
4	Experience	25 years of experience in a multi-national pharmaceutical company in China. Currently is on track to become a top manager in a China-based pharmaceutical MNE
	Expertise	Business Development; Marketing and Sales
5	Experience	20 years of experience in a multi-national pharmaceutical company in China. Currently leads a pharmaceutical trading company in Taiwan
	Expertise	Business development; marketing and sales
6	Experience	15 years of experience in a multi-national pharmaceutical company in China. Currently leads the China Pharmaceutical Enterprise Association (Association Director)
	Expertise	Marketing and sales
7	Experience	10 years of experience in a multi-national pharmaceutical company in China. Currently works in a management consulting company.
	Expertise	Marketing and sales
8	Experience	10 years of experience in a multi-national pharmaceutical company in China. Currently is on track to become a top manager in a local pharmaceutical company in China
	Expertise	Marketing and sales

APPENDIX 2

The definition of assessment criteria and alternatives

Criteria	Definition
Population numbers (Size) (C_1)	The total number of people inhabiting a specific area in China
Per capita income (C_2)	Income per person in a selected population in China
Living standards (C_3)	A level of material comfort as measured by the goods, services, and luxuries available to an individual, group, or nation
The current status of the biotech pharmaceutical industry (C_4)	The current status of China's biotech pharmaceutical industry
New pharmaceutical technologies (C_5)	The possibility of new pharmaceutical-technologies development
Supply of R&D human capital (C_6)	Sufficient research-personnel supply in China
Government regulation of investment (C_7)	Public-sector oversight of speculation in assets
Government regulation of product launches (C_8)	These include clinical-trial regulation and pricing management
Healthcare and medical insurance systems (C_9)	Healthcare and medical insurance systems in China
Exchange rate (C_{10})	Change in the exchange rate
GNP growth (C_{11})	Per capita gross national product
Inflation/unemployment(C_{12})	Unemployment rate
Emergence of concepts about healthcare, etc. (C_{13})	Health-related approaches, which are becoming more high-tech and which involve biotech drugs
Evolution of individual values (C_{14})	Heightened attention to personal standards regarding health
Consumer behavior (C_{15})	Changes in shoppers' practices (self-prescribed medicine, medicine purchases, on-line aspects of medicine, modern medicine)
Barriers to entry (C_{16})	The biotech pharmaceutical industry may obstruct entry through, for example, economies of scale, brand loyalty of customers, and constant investment
Bargaining power of suppliers (C_{17})	Companies' ability to keep down costs of sales
Bargaining power of buyers (C_{18})	Customers' ability to force down prices
Rivalry among existing players (C_{19})	Competitors may use tactics such as price competition, product introduction, and advertising campaigns

Criteria	Definition
Threat of substitute products (C_{20})	Substitute products exert pressure on enterprises within an industry. This is done by offering an alternative product to the customer
Capability in dealing with governmental rules and regulations (C_{21})	The biotech pharmaceutical firm can deal with the host country's state-mandated laws, standards, and guidelines governing such matters as investment-regulation regimes, patent acquisition, drug-pricing systems, public health insurance, import-export controls, work and resident visas, and trademark policies
Collaboration with local partners (C_{22})	The biotech pharmaceutical firm can work with local partners in ways that gain the firm quick access to local markets
Capability in building relationships with R&D centers (C_{23})	The biotech pharmaceutical firm can develop links with research institutions in the host country to accelerate products' introduction time and to reduce the risk of incurring unnecessary research-and-development expenses
Capability in building relationships with universities (C_{24})	The biotech pharmaceutical firm can develop links with academic institutions for knowledge-related sharing and collaboration
Capability in building customer relationships (C_{25})	The biotech pharmaceutical firm can develop customer relationships to clarify customer needs, to develop needed medicines, and to offer good sales service
Support of funding (C_{26})	The biotech pharmaceutical firm can obtain sufficient long-term financing from diverse channels, including initial public offerings, venture capital, or cash flow from product sales
Building wide channel distributions (C_{27})	The biotech pharmaceutical firm can develop diverse sites for channel distribution, including such sites as hospitals, clinics, pharmacies, and e-commerce establishments
Marketing capability (C_{28})	The biotech pharmaceutical firm can conduct promotional activities through advertising, public relations, and personal sales to market new products, to acquire high-potential pharmaceutical-product customers, and to help the firm shift its orientation outward to customers and their unmet medical needs
High-quality research personnel with R&D capability (C_{29})	The biotech pharmaceutical firm possesses skilled and talented workers who can effectively study and create novel innovative products
Excellent information systems (C_{30})	The biotech pharmaceutical firm possesses data-processing mechanisms that strengthen the firm's platform for developing a global, effective supply chain and for establishing industry networks

End of Appendix 2

Criteria	Definition
Strategic management of globalization (C_{31})	The biotech pharmaceutical firm can effectively handle international matters in pursuit of short- and long-term firm goals, and can specifically familiarize itself with relevant aspects of the host country (e.g., business behaviors there)
Strong brand (C_{32})	The biotech pharmaceutical firm possesses an invaluable trademark reputation that makes specific promises of value embedded in customers' awareness
Differentiation strategy (A_1)	Entering the market by focusing on specific diseases or ailments to which people in China are vulnerable (e.g., hepatitis B, oral cancer, diabetes mellitus, asthma, and nasopharyngeal cancer)
Market-focus strategy (A_2)	Focusing on the higher-end market, which is composed of wealthy consumers enthusiastic about health food and medical cosmetology in China
Innovative-focus strategy (A_3)	Entering the market with a new patented drug

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