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# *Strategic actions for a sustained leadership of the Cuban biotechnology industry*

✍ Mayda Mauri[1], Idalia Romero[2]

[1] Dirección de Política Comercial, Negocios y Colaboración Internacional, BioCubaFarma
Ave. 17 A, No. 16418 entre 164 y 174, Playa, La Habana, Cuba
[2] Departamento de Ciencias Empresariales, Facultad de Economía, Universidad de La Habana
Calle L, No. 353 e/ L y M, La Habana, Cuba
✍ mayda.mauri@oc.biocubafarma.cu

***ABSTRACT***

This paper offers a vision of the Cuban biotechnology industry (CBI) derived from the conception of its future, as a frame of reference for the transformations and actions of today. Based on prospective analysis, we have defined the fundamental variables having the largest impact on the sector, thus facilitating the identification of key objectives for future actions and decision-making, which will build the future image of Cuban biotechnology. The shared vision of all actors involved in the CBI, who will work together in devising it, is of utmost importance. Together with the State's strategic priority to the industry and to strengthening the industrial policy for early actions consistent with this vision, this paper devotes a special significance to the updating of the Cuban economic model in agreement with the needs of the CBI. This would facilitate the necessary adjustments of strategic actions when dealing with the challenges in this sector.

*Keywords*: biotechnology industry, vision, strategic prospective, key variables, strategic actions

*Biotecnología Aplicada 2013;30:305-310*

***RESUMEN***

**Actuación estratégica para el sostenimiento del liderazgo de la industria biotecnológica de Cuba.** Se ofrece una visión de la industria biotecnológica de Cuba (IBC) derivada de la reflexión sobre el futuro, como referente de transformación y actuación en el presente. Respaldado en las herramientas de la prospectiva, este artículo aporta las variables que provocan los cambios en la IBC y facilita la identificación de las variables clave para la toma de decisiones y la actuación, que conducirían a la construcción de la imagen de futuro del sector. Se destaca la connotación de compartir la visión entre los actores que convergen en la IBC, con el fin de que se movilicen mancomunadamente en su construcción. Junto con la prioridad estratégica del Estado sobre la industria y el fortalecimiento de la política industrial para la actuación anticipada y coherente con la visión, el artículo otorga un significado especial a la actualización del modelo económico, en correspondencia con las necesidades de la IBC. Todo ello facilita el ajuste necesario de la actuación estratégica frente a los desafíos de este sector.

*Palabras clave*: industria biotecnológica, visión, prospectiva estratégica, variables clave, actitud estratégica

## *I*ntroduction

Biotechnology is becoming more and more the center of attraction of experts in Cuban economy, through the acknowledged progress of this activity in financial development. On envisioning the biotechnology sector as a process with an "interconnection between science and economy", it is thus "not spontaneous and requires strategy and leadership" [1]. This connection process marks a successful experience and creates a relevant platform to consolidate a line of thought of our own, which has led us to the current state of our industry [2]. The State's expectations on the enhancement of the Cuban biotechnology industry (CBI) and the speed of response are greater when faced with market changes and demands. How can we ensure the sustainability of leadership to meet the CBI's accountability to the State? This question requires deep reflection for a consistent performance leading to the progress and competitive consolidation of this industry, as a strategic sector of Cuban society and economy.

The design of a scientifically validated proposal for strategic action is supported by strategic prospective, enabling the anticipation and actions corresponding to the interests of the industry. The purpose of this paper is to specify the main elements of the strategic study in the CBI. It contains four parts: 1) Prospective as a methodological tool for the strategic action of the CBI; 2) Continuity and rupture; 3) Vision of the CBI; and 4) Building the desired stage and competitive sustainability through the action of stakeholders participating in the industry.

## *T*he prospective as a tool for the strategic action of the CBI

It is more difficult to sustain leadership than to achieve it; and it requires the renewal of energy to potentiate and motivate actions. More than just knowing how it is working or how a certain state has been reached, the basic problem of leadership is how to continue to find a new purpose. This is where the vision of the strategic process lies. In the modern world leadership in the market is not maintained without the systematic conception of the future. One must continuously understand the desired configuration of the biotechnology sector in the next 5 to 10 years, and define what should be done to ensure its most advantageous evolution.

It is stated that "a large part of the future is invisible to all enterprises that will not like to escape from

✍ Corresponding author

1. Lage A. La economía del conocimiento y el socialismo: ¿Hay una oportunidad para el desarrollo? Cuba Socialista. 2006 [cited 2013 Sept 12];41:25-43. Available from: http://www.cubasocialista.cu/index.php?q=la-economia-del-conocimiento-y-el%20socialismo&page=0,0

2. Romero I, Mauri M, Martínez D, González B. Aportes de la biotecnología al pensamiento estratégico cubano. Economía y Desarrollo. 2012;147(1):107-23.

the shortsightedness of the market which they now serve and from the orthodoxy of current concepts of the bases of competitiveness today" [3].

"The prospective […] is an anticipation (pre-active and proactive) that will illuminate the current actions with the light of the possible and desirable future; preparing ourselves for the foreseen changes will not prevent our reactions to provoke the desired changes" [4].

Strategic prospective, as a way of acting within the contexts of uncertainty, is a tool in the theoretical repertoire, which is useful when dealing with the complexity and versatility of the conditions of the current scenario. It takes into account the diversity of the elements affecting the heterogeneity and turbulence of the scenario, where the responses need to be increasingly faster, and time for decision making is shortened.

The prospective helps open the way for action. Creating a vision is a strategic undertaking that goes beyond the imagery of an ideal. More than mentioning the type of industry we hope to have, it clarifies the answers in the deployment of essential competencies enabling the access to future spaces in the real context.

The vision is a paradigm or model that responds to the challenges of the industry and the changing trends of the setting. It involves aspects on how to maintain continuity and manage ruptures, combining them in an innovative form. It represents an image of the desired stage, in which the industry is conceptualized in a positive manner. And there is presumably a leadership that combines the ambitions of the shared strategic purposes assumed. Reaching a vision entails a sense of sacrifice, efforts and risks, which are only achieved with a committed leadership, knowing what to do, willing to take the risks, and prepared to make the necessary transformation to guarantee its materialization.

The vision is the what, the image of the future we pretend to create. "It offers a point of view of what the organization may be" [5]; and it is a bridge between the present and the future [6].

The origin of the vision is less important than the process through which it is finally shared. It is not a shared vision, unless it is connected to the personal visions of the people of the organization. "A shared vision, especially an intrinsic vision, raises the aspirations of the people. Work is transformed into a part of a major purpose embodied in the products or services of the organizations". "There is no intelligent organization without a shared vision" [5]. The shared vision encourages experimentation and the will to take risks.

The vision of an industry such as that of biotechnology should reflect the deepest yearnings and desires, not only of economic and social development but of its essence as an industry. It is a declaration of the future that will be reached through actions, decisions and work. It is dynamic and flexible, and it is modified with time; in other words, whenever goals are met, there will be others that will take their place progressively.

The design of the vision is a premise for the transformation of the sector. Devising it means there is a commitment between the main participants, foreseeing the action of competitors, the discontinuity to transform the frontiers of business and create new spaces for its development. Reaching this goal, built by the main actors, is a significant challenge; this undertaking starts by considering the elements that characterize the industry, from the perspective of its transition through stages of maturity until its current situation.

The empirical research process summarized the combination of several techniques, characteristic of the prospect, strategic management and statistics. The stages were:

1. Definition of the system that is the object of the study (CBI).
2. Determination of internal and external variables.
3. Identification of the key variables.
4. Devising the vision and the future desired state.
5. Definition of the model for strategic action.

The methodology used for this study covered:

- Expert's method: individual and collective rounds, interviews and surveys on strategic attitude.
- Strategic prospective: structural analysis by the MICMAC method (matrix multiplication program applied to the classification).
- Multivariate statistical analysis: Cronbach alpha, experts' agreements, main components and multidimensional scaling.

The participants in the study were selected rigorously from a competence matrix (Table 1). The experts included in the working session and consulting rounds met the established requirements. All data were processed with the Statistical Package for Social Science (SPSS).

Within this context Delphi is an effective method to integrate and achieve the consensus of the opinions of experts in a multi-disciplinary field such as biotechnology.

The results of the survey on the strategic action of the CBI validated the measuring tool used (Table 2). The agreement among experts was moderate.

## Continuity and rupture: premises for the competitive sustainability of the biotechnology industry

The competitive performance of the CBI is not only dependent on itself, but also on factors associated to its setting. The systemic approach of the industry implies its conceptualization as interrelations of exogenous forces affecting it, and its internal capability to deploy resources and capacities. Understanding the variables that mobilize the system under analysis

Table 1. Characteristics of the experts selected to design the strategic vision of the Cuban biotechnology industry

| Experts | PhD's (%) | Strategic decision making (%) | Closed cycle areas (%) | | | |
|---|---|---|---|---|---|---|
| | | | Research | Production | Marketing | High executives |
| 31 | 15 (48) | 23 (74) | 7 (22.58) | 5 (16.13) | 15 (48.39) | 4 (12.90) |

3. Hamel G, Prahalad CK. Compitiendo por el futuro. Estrategia crucial para crear los mercados del mañana. Barcelona: Ariel, Editorial S.A.; 1995.

4. Godet M, Durance P. Prospectiva Estratégica: problemas y métodos. 2da. Ed. San Sebastián: Prospektiker; 2007. Available from: http://www.prospektiker.es/prospectiva/caja-herramientas-2007.pdf

5. Senge PM. La quinta disciplina. El arte y la práctica de la organización abierta al aprendizaje. 3ra. Ed. Buenos Aires: Ediciones Granica S.A.; 1992.

6. Grant R. The knowledge based view of the firm. Oxford: Oxford University Press; 2002.

is essential to define the courses of actions and how to conduct them. Eighteen variables were defined, of which 9 were internal (Vi) and another 9 were external (Ve), and their interaction was analyzed using a direct relations matrix where the relationship between them were assessed using the following score:

0: variable *i* has no direct influence on variable *j*.
1: variable *i* has a weak direct influence on variable *j*.
2: variable *i* has a moderate direct influence on variable *j*.
3: variable *i* has a strong direct influence on variable *j*.
4: Potential relations between variables; *i.e.*, they are not important today, but they may exert influence within a different context.

The analyses with the MICMAC program reached an order where new indirect relations did not arise, denoting stability. The multiplication process stopped when the stability of driving and dependency of the variables were detected, obtaining the multidimensional distribution shown in figure 1.

Of the 18 variables analyzed, 12 are located in quadrant II (linkage variables, having high influence and dependency), 3 are in I (driving variables, having high influence and low dependency; all of which are external variables), 2 in III (results variables, low influence and high dependency; both are internal variables) and an external variable in IV. Internal variables were only found in quadrants II and III.

Using a structural analysis with the MICMAC program we identified the key variables, corresponding to those located in quadrants I and II: driving and linkage. Those classifying as driving variables explain or determine the rest of the system. The linkage variables are more relevant since any action upon them affects the rest, and also affect themselves. Table 3 groups the functions of key variables in the setting, as a space for systemic interaction.

The interpretation of the indirect relationship matrix facilitates the specification of key variables (driving and linkage), which explain the dynamics of the CBI (autonomous and results variables are excluded). The definition of the function of each variable offers consistency to the strategic performance of stakeholders participating in the system. It also enables the explanation of the driving forces that define the course and highlight the leverage induction policies, which act as regulation centers that compel the competitiveness of the industry.

## Vision of the CBI

The creation of an image of the future considers the stages of key variables. The vision becomes the compass for CBI progress; it not only shows the way, but also how far or how close we are to the desired state, and on what competencies will the transition to it depend.

The exercise of the vision generated many criteria regarding transformation that were validated by the group of experts (Figure 2) and are expressed below.

### We are recognized as a high social impact sector

The products generated have a high positive impact in health and the food supply of the Cuban population.

Table 2. Validation of the survey to measure strategic action in the Cuban biotechnology industry (CBI)

| Experts | Experts | Index | Results |
|---|---|---|---|
| Reliability of the questionnaire | Cronbach's Alpha | 0.943 | High reliability and internal coherence |
| Agreement of experts | Kendall's W | 0.460 | Moderate agreement |

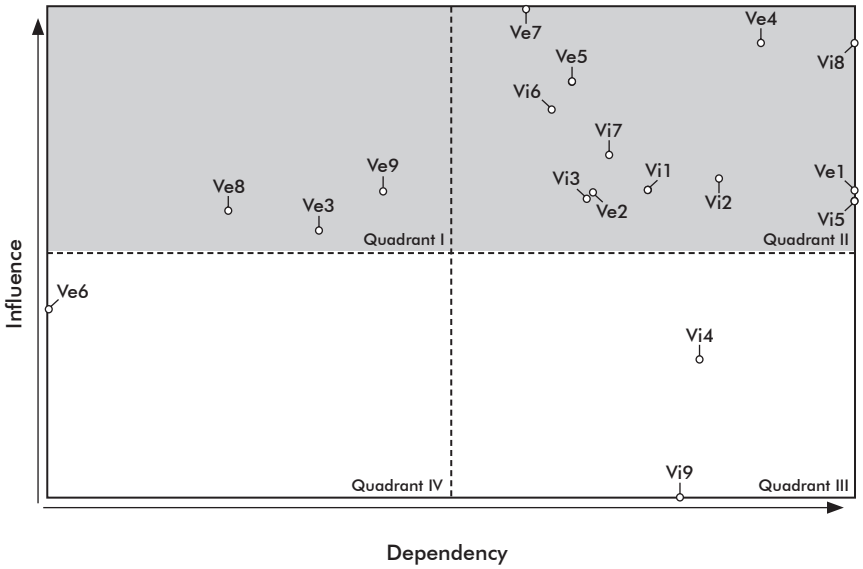


Figure 1. Matrix of direct influence in relation to the dependency of variables of the CBI. Internal variables: Vi1: Knowledge; Vi2: Closed cycle; Vi3: National integration; Vi4: Motivation and commitment of workers; Vi5: Investments in productive, research and development capacities with the compliance of good practices; Vi6: Capacity for innovation and generation of intangible assets; Vi7: Leadership of the Cuban biotechnology sector; Vi8: Distribution and sales networks; Vi9: Dependence on supplies and equipment coming from the United States. External variables: Ve1: Potentiating and regulating effect of the State; Ve2: Regulatory barriers; Ve3: Innovation and financial capacities of competitors; Ve4: Industrial standards; Ve5: US blockade; Ve6: World economy cycle; Ve7: South-South integration and cooperation processes; Ve8: Greater participation of the governments in the national health systems; Ve9: Increase in the demand for drugs to treat chronic diseases. Quadrants I (driving variables) and II (linkage variables), which are essential in strategic actions, are highlighted in gray.

Table 3. Systemic approach for the interpretation of the actions of key variables in the Cuban biotechnology industry (CBI)

| Key variables | Quadrant | Space for interaction | Function in CBI dynamics |
|---|---|---|---|
| Ve5: US blockade<br>Ve7: South-South integration and cooperation processes | II | Global setting | Determining the course |
| Ve3: Innovation and financial capacities of competitors<br>Ve8: Greater participation of the governments in the national health systems<br>Ve9: Increase in the demand for drugs to treat chronic diseases | I | Global setting | Regulators of performance |
| Vi8: Distribution and sales networks<br>Ve4: Industrial standards<br>Vi3: National integration<br>Vi7: Leadership of the Cuban biotechnology sector<br>Vi1: Knowledge<br>Ve2: Regulatory barriers<br>Vi2: Closed cycle<br>Vi6: Capacity for innovation and generation of intangible assets | II | Context of the country and Global setting | Centers of strategic actions |
| Ve1: Potentiating and regulating effect of the State<br>Vi5: Investments in productive, research and development capacities with the compliance to good practices | II | Context of the country | Leverage induction policies |

The first priority of the CBI is to meet the people's needs.

### We are recognized as a strategic industry

The State offers a maximum priority to the development of the CBI, which has a center for the sector's policy. The CBI is the first line of exportable goods in Cuba; an expression of the strong connection between science and economy. Because this industry is highly attractive for foreign capital, the strategic options for partnerships are intensified; this has a growing impact in the technological development of other domestic industries.

### We have chains of integrated activities

The high specialization of the actors of the industry in the fields of their own activity prevents internal competition and produces a synergy between the main activities and participants in the chain of values, from the idea to the product. This leads to a concentration in the key processes of the industry. The fusion of the CBI with the domestic pharmaceutical industry generates new opportunities.

### We are a high technology industry that meets international regulatory standards

The sector has a balanced research-development portfolio that enables the diversification of novel products. The self-sustainability of the industry makes it possible to maintain the required levels of investment in key processes of research, development, production and marketing, as a way of increasing its international competitiveness. Its image is consolidated as "the developing world's most established biotechnology industry" [7].

### We have a solid international position

The integrated and efficient output of marketing processes. The CBI increases its leadership in Third World countries. Through its novel products and high standards, it is present in First World markets and has strategic partnerships with partners from industrialized countries and emerging economies, as those belonging to the BRICS group (Brazil, Russia, India, China and South Africa).

### Our human resources are highly competitive

The highly specialized, committed and motivated human resources have social acknowledgement for their scientific work and impact in society. They find large possibilities for professional development and promotion, through an academic training system according to individual needs and those of the industry. Their income is directly related to their results.

### We have our own economic model

The biotechnology and pharmaceutical industry is a "Higher Organization of Business Management" (OSDE, according to its Spanish acronym), working under the self-financing principle. It is formed by enterprises having a high autonomy and responsibility. The economic model of the OSDE makes it possible to join several management forms (state, joint ventures between Cuba and other countries, enterprises with 100 % Cuban capital abroad, and agreements with third countries in Cuba and abroad) to achieve its strategic objectives.

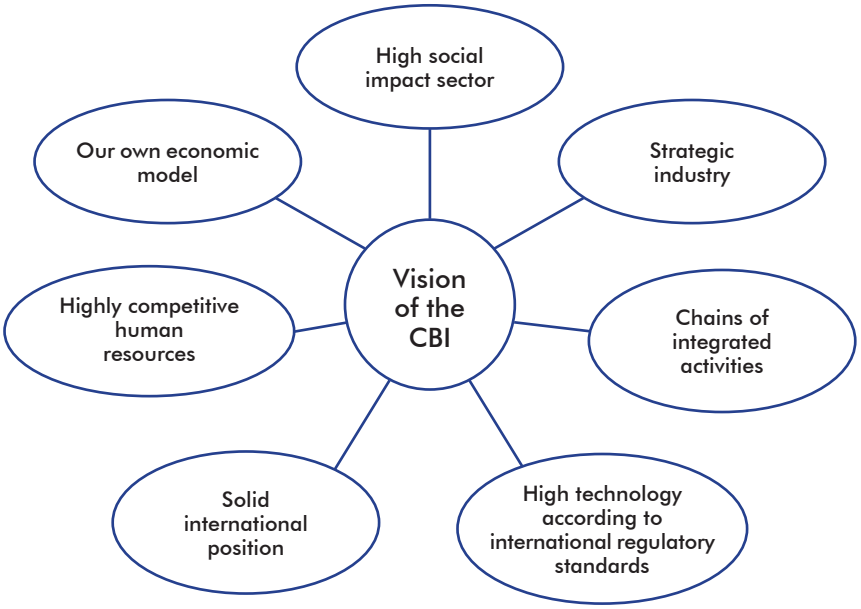


Figure 2. Vision of the Cuban biotechnology industry (CBI). The elements forming it were identified by the expert's method through the interaction with a group of 31 experts of the CBI.

The evaluation of the changes imposed by the vision built by the experts showed that aspirations represent 59 % of the continuity of the success achieved; the rest is discontinuous. According to the nature of the changes, 52 % is associated to modifications of the economic model. The harmony and cohesion between the center of the sectoral policy, the stakeholders of the industry and the State are necessary for the sustainability of the sector. The importance of the changes is shown in the leverage of the organizing resources found in 100 % of the transformations.

Nothing is spontaneous in relation to uncertainty; and it is necessary, but not sufficient, to establish the image with the purposes. The link between the future and the present time demands the formulation of the main events defining the consistent strategic performance [8]. The construction of the vision of the future as the desired state is only possible when you have a draft of the architecture you desire, in which the mutations or migration routes that will make the intentions possible, are well designed.

## The action to build the desired state and the competitive sustainability of the CBI

A vision without action is a dream. Only actions in the right direction for transforming purposes can lead to the strategic management of the system. The strategic action of the CBI, according to the perception of experts, reflects the high potential for the consolidation of vital aspects that guarantee success for the future (Figure 3).

To achieve strategic action for the CBI it is indispensable to have workers and management involved and with a sense of ownership of the most challenging aspiration. They must have a clear sense of the heritage

7. Cuba's biotech boom [editorial]. Nature. 2009;457:130.

8. Mintzberg H, Quinn J, Voyer J. El proceso estratégico. Conceptos, contextos y casos. México, D.F.: Prentice Hall; 1997.

they are leaving to their successors, as the sense of understanding the challenges for the anticipation and management of the essential competencies, which will allow them to reach the desired state (Table 4).

The construction of the vision is not spontaneous. The conceptualization of the transformation process from the present situation is necessary using a series of interrelated actions. This makes it possible to drive the CBI towards the fulfillment of strategic aspirations, which are specified in the action model.

The first component of the model must be highlighted: *Inductors of the deployment of the strategic capacity.* This insists in the need of creating the action driven by the workers forming part of the industry. Sharing the organizational vision is a challenge for the strategic management of the CBI. The workers share the strategic purposes; their personal and collective interests are correctly represented; a dependency is created with the realization of the interests of the working group that increases when performance is improved.

We are dealing with the design and management of a way to minimize the space between today and tomorrow, so as to maximize the proportion of prospective benefits for the future. For this, it is indispensible to have the strategic sustainability of the priority of the State, the strengthening of industrial policy and updating the appropriate economic model that corresponds to the needs of the CBI.

Prahalad and Hamel recognized that the vision is a shared aspiration that enables the company to broaden beyond the limits of the present resources, something providing a sense of direction, of a common purpose, a sense of destiny, a unique and inspiring challenge that demands respect and loyalty from each person of the organization [9].

The vision built and the components of the model correspond to the main transformation projected for the adjustment of the Cuban economic model expressed in the Guidelines of the Economic and Social Policy of the Party and the Revolution [10]. These guidelines were approved during the VI Congress of the Cuban Communist Party in order to update the Cuban economic model and they strengthen the autonomy of enterprises and create the necessary bases for their operation. The initiatives proposed for their implementation in the business sector of the CBI include:

1. Enterprises under the self-financing principle with the authority to import and export.

2. Enterprises with the possibility of investing 10 % of their gross sales or net profits in research and development, as an essential form of ensuring the sustainability of the industry.

3. Pay the workers according to the economic results of the entity and create stimulation funds that are awarded after complying with the State commitments and meeting the established requirements.

4. Create a fund through profits (after paying taxes) that will be used in minor investments related to re-equipping, modernizing and improving quality standards.

5. Create a salary fund through a percentage of the gross added value (GAV), which is distributed according to a regulation designed and approved by each entity.

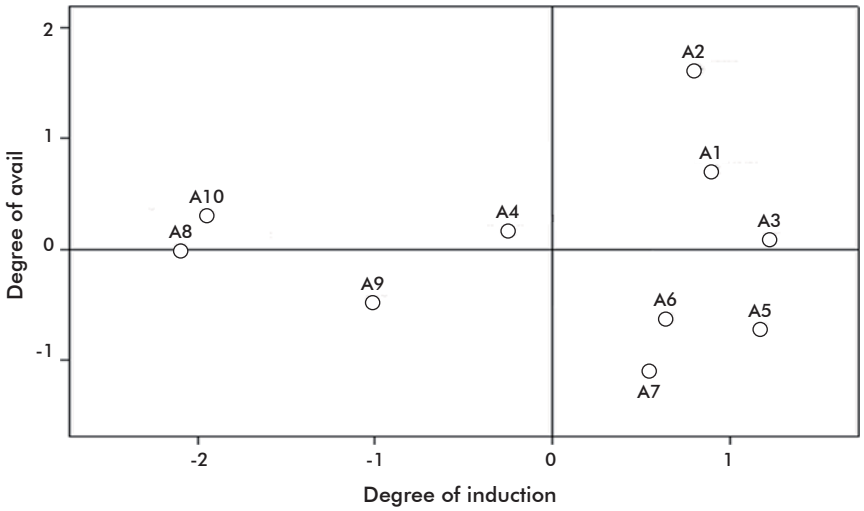


Figure 3. Perceptional map for strategic action of the Cuban biotechnology industry (IBC), on the basis of the degree of avail in relation to the degree of induction in strategic action. The map was generated by multi-dimensional scaling using the Statistical Package for Social Sciences (SPSS). Variables: A1: Clear idea of the future of the industry; A2: Transformations are daring; A3: Influence in the national context; A4: Workers sharing the aspirations and sense of inheritance for the future; A5: Challenging aspiration; A6: Clearly defined challenges for the industry; A7: Horizon of opportunities far from the existing markets, products and services; A8: Management of essential competencies; A9: The industry is capable of anticipation; A10: Leverage of resources.

Updating the Cuban economic model is an important leverage that catalyzes the change of the industry towards the sustainability of its leadership, by consolidating human capital as the source of competitive advantage that is able to generate scientific results and high incomes. It is a pivot for Cuban economic and social development, leading to the implementation of the vision stated in this paper.

## Conclusions

The importance of devising the strategic actions and particularly considering the strengthening of leverage induction policies for competitiveness makes it possible for the vision of the CBI, as an innovative aspiration, to modulate the behavior of the interacting actors, and they are shared as personal and collective aspirations that are fundamental for the compliance of the State's mandate.

9. Prahalad CK, Hamel G. Competing for the Future. Boston, Massachusetts: Harvard Business School Press; 1994.

10. Partido Comunista de Cuba. Lineamientos de la política económica y social del Partido y la Revolución. 2011 [cited 2013 Sep 12]. Available from: http://granma.co.cu/secciones/6to-congreso-pcc/Folleto%20Lineamientos%20VI%20Cong.pdf

Table 4. Model of the factorial analysis for strategic action of the Cuban biotechnology industry (IBC)*

| Characteristics of strategic action | Contribution | Components of the model |
|---|---|---|
| A4- Workers sharing aspirations and sense of inheritance for the future | 0.941 | 1. Inductors of the deployment of strategic capacity |
| A5- Challenging aspiration | 0.910 | |
| A6- Clearly defined challenges for the industry | 0.845 | |
| A3- Influence in the national context | 0.551 | |
| A10- Leverage of resources | 0.879 | 2. Understanding the challenges |
| A2- Transformations are daring | - 0.818 | |
| A9- The industry is capable of anticipation | 0.810 | 3. Anticipation |
| A7- Horizon of opportunities far from the existing markets, products and services | 0.778 | |
| A8- Management of essential competencies | - 0.850 | 4. Developing competencies |
| A1- Clear idea of the future of the industry | 0.742 | |

*The model was made using the main components techniques. This enabled the reduction of the dimensions of the original variables of the research without losing the maximum explanatory capacity. It is based on exploring the clustering structures by building new artificial or synthetic variables called components that contain an internal structure reflecting the linear combination of the original variables with the corresponding values of their correlations, loads or weights.

The vision serves as a compass for strategic actions that will enable the creation, starting today, of the essential competencies that will place the industry in its space for the future. This is the only assurance for the construction of the desired state in the advancement and sustainability of the positions reached, and it clarifies the main strategic decisions that will facilitate its intentional and conscientious construction.

The prospective analysis presented here was able to identify the vitalizing variables of the CBI as a system and define the key aspects for strategic action. Updating the Cuban economic model, strengthening the strategic priority of the State and consolidating the center of the sectoral policy and leadership, are strategic pillars in the reduction of risks and negative impacts for the future of the CBI.

*Received in June, 2013.*
*Accepted in September, 2013.*