BRAZILIAN RIDESA: R&D NETWORK
The Integration of Technology and Business Strategy

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Abstract

Once reflecting about green technology research and development (R&D) efforts along with its related events in real world dimensions as a critical question for sustainability of renewable energy resources, this paper introduces the case of RIDESA's System and its PMGCA R&D Network, a Brazilian federal governmental R&D program that has being implemented by ten public Federal Universities and operates in order to constantly create and improve sugarcane genetic breeding matrices. This Brazilian biotechnology sugarcane R&D segment has emerged in early seventies pushed by a huge nationwide ethanol's automobile fuel substitution program released by federal government during the military *regime* in response to the first oil crisis of 1973. Ridesa's history and milestone dates are emphasized in a way to characterize two different organizational phases in time: a prime survival period and a secondary, success phase. Theory of Network Organizational Form and Fit is applied for such characterization. The same way, elements in Theory of Strategy such as Knowledge-based view (KBV) contextual framework are also resorted inhere to formally translate Ridesa PMGCA circumstances. Furthermore, some recent results from PMGCA network are presented, supporting arguments about Ridesa *sui generis* organizational path: from failure to success.

Keywords: *Ridesa PMGCA Network; Sugarcane genetic breeding; Knowledge-based view (KBV); Organizational Fit*

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1. Justification/Motivation

Encompassing Green Energy and Environmental themes with business strategic combinations, the objective of this paper is to evidence the success and to present the case of Brazilian's RIDESA *Inter-University Network for the Development of Sugar-Alcohol Sector* and a special research program called PMGCA, Programa de Melhoramento Genético da Cana de Açucar (*Breeding Program of Sugarcane*), a nationwide program operating as an R&D network directed towards the genetic improvement of sugarcane species (cultivars).

Deriving from sugarcane raw-material resource, Brazilian Ethanol final product represents an effective sustainable option for fuel energy usages and an actual technological development when focusing on green economic solutions.

Taking into consideration the many interchangeable matches between business strategy and bio-fuels technology, the aim here is to characterize this R&D organizational scope as a network business strategy implemented by governmental research centers. It includes different public and private actors nowadays operating in Brazilian ethanol industry.

RIDESA/PMGCA Network produces R&D invisible assets and operates on the supply side of Brazilian Ethanol Industry supply chain, offering services on product and process' technological innovations like 'R&D in progress', 'Patents' and 'Trademarks' in the area of sugarcane genetic breeding knowledge, a Biotechnological market segment for R&D services.

2. Research Problem

Once reflecting about green technology research and development efforts along with its related events in real world dimensions as a critical question for sustainability of renewable energy resources, this paper introduces the case of RIDESA's System and its PMGCA R&D Network, a Brazilian federal governmental R&D program that has being implemented by ten public Federal Universities and operates in order to constantly create and improve sugarcane genetic breeding matrices. This Brazilian biotechnology sugarcane R&D segment

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3. The Institution

RIDESA network's structure corresponds to a sugarcane R&D System composed by ten nodes and seven research areas: genetic breeding, biotechnology and phytosanity; environmental management; soils, nutrition and fertilization; relationship soil, water and energy; cultural practices; administration, socio-economic and product diversification; industrial technology and quality control. One extensive and complementary new area is 'Dissemination and Technology Transfer'.

As said so, the focus of this work regards to the conventional genetic breeding research area, the PMGCA program Sub-system.

Wondering about RIDESA network history, this paper divides this two decades of existence into two historical phases: the first period, from 1990 to 1993, is here called the survival phase since all efforts were meant to structure and operate the organization simply in order to conduct a striving strategy by means of merely survival endings. The second historical phase, 1993-2010, can be characterized as the search for organizational success, up to the point that RIDESA's internal network boundaries were ruptured in order to include private firm partners - as mill companies - to its complementary value-creation shared space.

Dividing RIDESA's history into two phases make possible to highlight the two strategic decisions made by university think tankers and deans: a survival strategic decision in favor of a network organizational form and a second strategic choice *vis à vis* the intention of continuing organizational success.

These two strategic decisions denote RIDESA's dispositions and commitment to search for excellence patterns.

3.1 RIDESA's first phase, first choice, first solution.

The first of those two historic phases (1990-93) pictures an obvious Emergent Survival Strategy and can be framed by an organizational crisis context where the impact of governmental policy-decision made could have wasted dozen of years of R&D value-created when, in a sudden, has legally eliminated several productive centers and research groups that were prospering at that moment in studies for Brazilian ethanol energy-substitution program.

Furthermore, not only physical assets would be lost but, as a matter of fact, new researchs and green technological innovations were, then, severely jeopardized.

Relative to the solution adopted in this prime phase of RIDESA R&D system and within observed strategic movements, two relevant theoretical frameworks are to be emphasized.

One corresponds to the fact that remaining researchers of discontinued centers in 1990 have had a comprehensive understanding over the kind of Resource related to their quest. They perceived that 'Knowledge' was their only and one core resource and product.

Second, taking into account that knowledge was the main resource and asset, think tankers have deliberated in favor for a more systemic form of organizational arrangements, emulating an efficient fit for Green R&D operating structure. Thereby, Network configuration posed as an ideal solution since it conjugates low cost, flexibility, freer flows and effectiveness.

So, the elements of this first organizational phase highlight two theoretical views: knowledge as an asset - a source for value creation, and network form implemented as a strategic arrangement solution.

3.2 KBV theory of strategy: knowledge as a competitive advantage.

Therefore, in order to build up a better understanding about the process of "Information Transfer" it is necessary to clarify the meaning of three different forms of objects transferred during the process of knowledge construction, sketching a three stage hierarchical model of knowledge construction: the data, any kind of information and the knowledge, itself.

At a secondary level of this knowing aggregation process, 'information' means "interpreted data", implying that the new object is a raw data gifted with relevance and purpose.

Yet, the last and highest level in this scale is reserved to the most value-aggregated form of apprehending cognition: 'Knowledge'. This way, the processes and packages of information transfers can include any of these three concepts, being that knowledge shall encompass all the other two.

So, in terms of business and strategic actions by organizations, this knowledge and 'knowing process' *phenomena* can be viewed as a valuable resource and, even more, like a source for organizations to obtain competitive advantage and carry on their dynamic capabilities on the long run; just as advocated by Resource-based Theory (RBT) and its extensions.

Taking into consideration the empirical evidences that knowledge and the knowing processes could be a source for sustainable Competitive Advantage, and even based on the crescent importance of invisible assets over the last decades, the 'Knowledge-based View' trend, "KBV Theory of Competitive Strategy", is a finely suitable tool for explaining the kind of core resource that, then, was at hand for think tank's decision-makers at public research areas involved in Brazilian governmental R&D ethanol programs at 1990. In fact, this trend of KBV theory asserts that "knowledge is the most important strategic resource for organizations".

Indeed, knowledge, 'knowing' construction processes, knowledge-based assets and business reality are tight linked in present global markets. The capture, storage and use of any of those three forms of cognition devices may produce 'knowledge-based resource', an intangible and invisible asset, like information based-resource. We can say that while visible assets come to play into business operations, invisible resources and assets are necessary for obtaining competitive success. "R&D in progress"', "Patents" and 'Trademarks" are, in fact, crucial for organizational success and are presumed to be even more critical than it had been in the past.

Observing this Brazilian real world green energy market solution model under the lens of value-creation approach, is of special interest highlight the fact that the origins of efficiency models for explaining differences among firms and the achievement or maintenance of long

term competitive advantage can be tracked in the scope of traditional Ricardo economic rents' mention and in rent seeking behavior economics.

This way, conceptual definition of "economic rent" refers to the "difference between current earnings of a resource and what that resource could earn in the next best alternative use" (Nemmers, 1979). On the other hand, 'seeking-behavior patterns' correspond to predictable organizational actions when in search for more effective uses of owned or controlled resources or assets. Since the best alternative use of resources can be translated into marginal opportunity gains, value is created.

Naturally, under this context, R&D services can also be thought of as a business opportunity for rent-seeking economic counterparts, indifferent for participants being either a public or private actor.

In fact, for economic organizations, rent-seeking behavior denotes an attempt to maximize the usage of some scarce or fixed resource, what could be done through optimizing costs and/or differential gains. In this sense, this paper recognizes RIDESA PMGCA network as a rent-seeking organization, struggling for survival and in search for long term success and excellence goals.

Finally, back in 1990, that initial perception about 'knowledge' being the core business of those discontinued research operations in a multi-organization level, has hugely contributed with the fundamentals of the first strategic choice made by think tank leaders: the network form of organization.

3.3.Theory of organization: network form of systemic solution

Once, the importance of knowledge-based core resource over green Ethanol sugarcane derivative fuel was broad understood by think tank chapter leaders in sugarcane's R&D areas of Public Federal Universities in Brazil, another strategic step should be the decision among different choices about the most effective organizational form to be assumed in terms of survival endings.

Actually, at that very first moment of disruption in early 90's, the one utmost crucial decision to be made by those remaining universities research centers on sugarcane-ethanol activities was: what kind of organizational form should be adopted ? So, struggle against

governmental discretionary ordinance imposing bankruptcy and failure of former research institutes has led to the choice among different courses of action and among several entity forms of organizational design. That one was meant to be an ultimate and definite solution.

Then, the perception that survival chances would be more easily improved by adopting an organizational form being, at the same time, cost reducing and an excellence facilitator, one that would permit flexible arrangements and unlocked relation flows, disseminating a broader systemic vision and more organic features.

According to Ferreira, Reis and Pereira (2002), Systemic Organizational theoretical adhocracy point of view has implications and commitments over more flexible operating structures, *ad hoc* decentralized decisions, horizontal communication flows and a non hierarchical, networking way for solutions.

Indeed, in terms of Burns and Stalker classification among mechanistic and organic structures of organization, RIDESA Network model should be considered like a more organic system of exchangeable flow of information, with internal and external transfers.

In grounds of Miles and Snow's framework (1984) of organizational strategy, structure and processes, Fit and Form of Organizations - including the search for excellence - also has much to say about this RIDESA case. According to the authors, organizational survival and success when related to the appropriated design form do have many trade-offs in-between. Excellent organization fitness enables high levels of economic gains and a whole set of configuration devices at hand for survival and success ends.

Revisiting literature in this network conceptual field, Grandori and Soda (2006) see organization forms as "particular combinations of coordination mechanisms and rights allocations". The same authors (1995), when treating about network characteristics cite it as "modes of organizing economic activities through inter-firm coordination and cooperation" and "nexuses of integration mechanisms".

RIDESA's case can be also recognized in Ekbia and Kling (2005) analyzing the approach of Castells' information society and the three fundamental features of the 'new economy'. The first, informational feature, corresponds to the hypothesis that "capacity of generating knowledge and processing/managing information determine the productivity

competitiveness of firms". Global and networked features highlight, respectively, the global scale capacity of strategic activities like R&D, and "based on a new form of economic organization, the network enterprise".

From these four knowledge processes, the first RIDESA's phase has here emphasized the vigor and importance of internal transfers of data, information and knowledge between internal network nodes, an endogenous relationship between federal university chapters and researchers.

Concluding, the 1990-1993 period of RIDESA, deciding for a network organizational design provided means for immediate survival goals and permitted an opened door for the second phase strategic choice rationale.

3.4 Market solution: funding R&D in progress via industry network

The second phase started when scholar intelligence thinkers, wondering about new ways to expand and diversify operations, realized that RIDESA network was also a node inside the whole sugarcane Industry Network. Ebers and Jarillo (1998) define industry network as "a set of organizations (e.g., firms, unions, state agencies, associations) that have developed recurring ties (e.g., buyer-supplier relationships, joint activities, information ties) when serving a particular market". Thus it represents clusters of organizations with more related ties with each other acting inside the industry.

This perception of RIDESA as a node in sugarcane industry conducted the terms that led for the second strategic choice: breaking through RIDESA's initial public boundaries, information transfers that had been flowing only through internal nodes until then (ten universities chapters), in 1993, this dimension was extended across boundary lines to overlap into a complementary shared space with other actors participating of sugarcane industry network.

As shown in the shaded area of Figure 1 below, PMGCA subsystem of RIDESA network is itself a double entry network with internal and external transfers of knowledge and products.

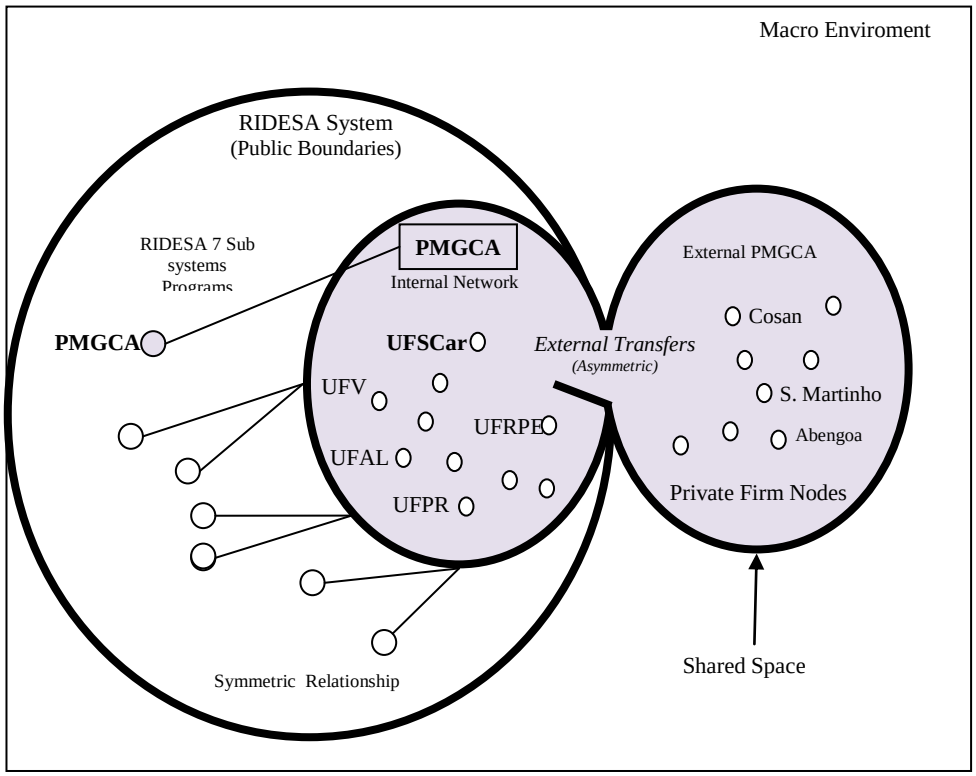

Figure 1: RIDESA's PMGCA Sub system Network.

According to Dyer, Kale and Singh (2001), in order to achieve sustainable competitive advantage, one possible choice is to establish strategic alliances, "a fast and flexible way to access complementary resources and skills that reside in other companies". Reflecting about "interfirm alliance formation patterns", Gulati (1995), quoting Harrigan, defines interfirm strategic alliances as "voluntary arrangements involving durable exchange, sharing or codevelopment of new products and technologies", emphasizing the fact that, with the proliferation of strategic alliances, many organizations are now nodes within a "network of interorganizational relationships that are crucial to the success and survival".

Introducing this open boundary mentality, RIDESA has contracted since then many public-private partnerships involving data, information and knowledge flows on one side and, on the other hand, commercial ties which guaranteed, since 1993, a diversification of funding sources to RIDESA's R&D activities on sugarcane knowledge.

Should be noticed that as presented in Figure 8 above and taking PMGCA UFSCar as an example, R&D network has basically two different operating modes: one, regarding

endogenous relationship among ten internal nodes, and another, into a shared space that, in 2010, has involved around 126 public-private partnership agreements, including the biggest players in sugarcane and ethanol Brazilian market.

These two dimensions between RIDESA PMGCA internal network and extensive off-boundary ties can be seen in Figure 2 below:

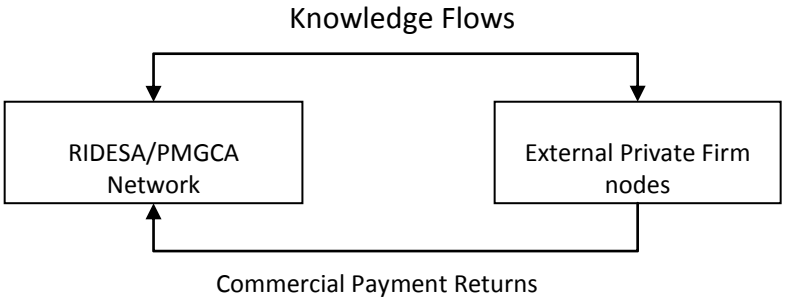

Figure 2: RIDESA's PMGCA Private Partnerships

When addressing knowledge transfer across organizational boundaries through alliances it is possible to acquire "new knowledge in the form of new skills and capabilities", which can be a "source of sustainable competitive advantage" (Eisenhardt and Santos).

RIDESA's transcendence across public boundaries is here considered as a determinant factor for organizational success and financing needs. Nowadays, almost half percent of R&D activities spending are supported by private side customers.

3.5. Sugarcane-Ethanol R&D Network Results

From 1990 to 2010, 61 varieties of RB (symbol of the varieties developed by RIDESA) were released by RIDESA, being that, in 1993, sugarcane average productivity was around 65 tons per hectare while nowadays it rose to 85 tons/hectare, with some cultures climbing to productivity levels of 100-120.

On the other hand, during the first phase of RIDESA the relation between sugarcane transformation in ethanol was of 70 liters of ethanol per one sugarcane ton, whilst in 2010 the same quantity of sugarcane produces 90 liters of green fuel.

PMGCA UFSCar coverage area includes the states of São Paulo (SP) and Mato Grosso do Sul (MS) and is responsible for 65% of Brazilian sugarcane production. According to UNICA, a sugarcane industry association, taking into consideration 2008-2009 crop as reported by

official data from Brazilian Ministry of Agriculture, São Paulo ethanol production has corresponded to a share of 16,722,479 thousand liters, with a sugarcane production totalizing 346,293,389 thousand liters, of which Mato Grosso do Sul State counts for 1,076,161 thousands. Brazilian overall ethanol production was about 27,512,972 thousand liters in 2009, corresponding to a roughly 20% increase over 2007-2008 crop.

In terms of sugarcane production levels, the same report tells that São Paulo numbers went up to 546,293,389 tons of production in 2009.

According to 2010 Sugarcane Varietal Census realized by PMGCA UFSCar, in both States within its coverage area, RB variety responds to almost 60% of total planting, harvest and crop areas, and São Paulo state is the greatest ethanol producer in Brazilian Federation and responds for roughly 60% of national ethanol production. Considering 2010 Sugarcane Varietal Census, in SP state, RB variety also responds to almost 60% of total planting, harvest and crop areas:

4. Conclusions and Recommendations

Introduced by Portuguese colonial *regime* during the first half of century XVI, Brazilian sugarcane business culture has prospered ever since. Brazil's accumulated knowledge over this originally eastern plant with energetic power comes today to roughly 500 years.

This fact, along with some impressive Brazilian economic indicator figures like the huge national volumes of production, internal sales and export, *vis à vis* the high economic scales gains and low opportunity costs, can highlight the potential for country´s comparative advantage in sugarcane based products.

In fact, as an ecological product, sugarcane-based ethanol besides being a secure and cheap form of renewable green fuel contributes twofold to the maintenance of green national resource assets inventories, adding value to the national sustainable development and prosperity.

Thus, the matter of this manuscript told about business strategy aspects involving modes of Public-Private Partnership agreements in which recurring ties of R&D´s complementary interchangeable knowledge flows and commercial relationships has led an organization from failure to success. That is the capital point and the main conclusion of this paper.

As recommendation for future works, a look over Brazilian RIDESA R&D System and it continuing search for excellence is indicated since, presently, is already possible for speculate about a third upcoming phase.

Into the future, this third phase would correspond to an even broader diversifying strategic move towards the internationalization of RIDESA R&D activities and partners. Since 2007, RIDESA has staked interests along with others countries in Latin America as Paraguai, Bolivia, Peru, Suriname and Mexico.

Also, *Serra do Ouro* germplasm bank has been exchanging sugarcane genetic breeding knowledge with institutes inside USA like 'Canal Point Station', a site located in Miami, Florida and reputed, - alongside with Indian bank - the utmost complete worldwide collection of sugarcane germplasm species.

In this future tense, with the expected expansion of ethanol usage and the exigency from planet regarding energy-substitution needs, also is likely that sugarcane-based ethanol ecological product can achieve so high critical volume levels of commercial negotiations that it would be standardized by means of turn into a commodity asset in global markets.

Finally, Brazilian federal sugarcane research centers and their private counterparts have, over the years, gathered productivity gains and value creation from RIDESA Network activities.

That initial group of think tankers and their follower fellows do have preserved more than just a business opportunity. They have retained a precious national knowledge legacy for future generations. And, indeed, it is an empirical phenomenon that they do have conquered a significant presence and share within sugarcane genetic breeding R&D services market.

So, the privileged RIDESA's industry positioning and market power that has being settled down along 20 years of organizational history, are factors that come to testify about the appropriateness of organizational fit and the excellence of overall strategic actions, processed all through organic deliberations about two choices, two decisions and two solutions implemented.

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