How the Management of The Trophic Cascade Determines Innovation?

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Abstract

Large corporations form transnational corporations that, despite working in different countries with specific legal and cultural requirements, have consolidated global management strategies, seeking to operate with maximum efficiency in different economic scenarios. In recent years, there has been a massive proliferation of international companies, most of them located in wealth and industrialized countries, which controll their foreign affiliates. In the current context of globalization, these companies have great influence on the economy, as they interfere with governments and local business relations. Comparing this situation with the multilevel biological trophic pyramid, these companies have a direct and /or indirect impact on other levels, and it equilibrium is directly dependent on the movements taken independently by the different levels. In the competitive marketplace, a large company at the top of the pyramid can change this competitive environment and influence or alter the survival of other trophic levels, due to its economic power and high predatory potential. A more aggressive predator (located at a higher trophic level), despite its low mobility and low innovation capacity, can dominate the environment and extinguish a lower trophic level, with less economic power or less commercial representativeness, which in many cases have excellent innovative capacity. In that case, the whole chain will become unbalanced. The objective of this work is to present a conceptual analysis model to try to scan the corporate chain through the trophic pyramid and its influence on the results, in order to identify improvements and new opportunities for innovation.

Keywords*:* trophic cascade, innovation, pharma sector, capillarization strategies

1. Introduction

One of the most important trends of the twentieth century, which impacted on how countries organize and negotiate among themselves, was the globalization of corporations, and the formation of transnational corporations, with the consequent creation of economic blocs (Macleod, 2015).

Globalization has brought advantages such as access to multiple products with competitive prices, stimulated competition, formation of competitive excellence areas and modernization of economic practices. However, there are disadvantages in this process, such as the formation of economic blocks, price control, predatory practices, unbalanced marketing in some regions (Woodward et al., 2001) and others. In an attempt to monitor and control these market changes, regulatory requirements must be constant and permanent, continuously and rapidly monitoring the required zonal adjustments to avoid market loss, profitability, lack of innovation and loss of reputation.

As a way of differentiating between markets, innovation is one of the most effective means of achieving profitability, increasing the possibility of gaining competitive advantages that add value. To leverage innovation, many studies indicate that entrepreneurship can be a powerful lever to induce institutional restructuring and drive change in the marketplace and generate innovation. (Saltman & Figueras 1997; Saltman et al., 1998). Skills required include specific technical skills, interpersonal and team management experience, continuous growth capacity, and ongoing training to manage process innovation (Siems & Ratner, 2006). The integration of these skills allows to achieve greater performance and, consequently, greater profitability. Mastering all of these skills allows companies to identify improvements and new opportunities in a timely and efficient manner, providing return on investment, which is essential for their perpetuation.

Thus, entrepreneurship is considered the center of economic activity and the agent of change, being a powerful lever for innovation as they dominate various corporate skills in a systemic format. Innovative ideas and entrepreneurship are at the heart of economic growth, but these ideas need the support of institutional policies and practices that create and support such growth, providing necessary, even regulatory protections, as well as a secure market for financing them (Siems & Ratner, 2006).

Another important factor as an agent of change would be the integration of public policies in a transnational way (for example, the area of health financing and the development of public policies) for the development of a research agenda (Yach & Bettcher, 1998) and effectiveness of actions. So knowing how to use these features to minimize operational complexities is becoming a crucial factor.

As an example, the pharmaceutical industry is an extremely regulated market, requiring continuous interactions between broadly different sectoral, strategic, tactical and operational levels. The ability of companies to interact with various agents in the chain, in a healthy and agile way, results in the ability to innovate.

A proposal to analyze the corporate environment and its interactions, would be how the agents interact in the cascading trophic aspect, that is, the relationships of power, force and predatorism determine the innovation of products in one sector and also impact the entire market.

The trophic cascades derive from the biological concept that explains the direct and indirect effect that a higher level exerts on other lower levels and on intermediate levels. The food chain in organizations is a sequence of businesses interconnected by commercial and technological relations, which include multiple actors in a system, composed of small, medium and large companies, transnational corporations and government. With all participating directly or indirectly in the competitive environment.

The goal is to use a biological concept known as the "food chain" to characterize corporate environmental factors (macroenvironment, microenvironment, direct and indirect competitors, similar, intermediates, customers and partners) and how their market interactions result in a balanced or unbalanced trophic chain. The result of this interaction affects the entire market, while one organization of predators (upper trophic level) can affect another smaller company (trophic basal levels), causing a change in the current balance in the national and transnational sector environment. This is because the predatory organization monopolizes the entire market and creates barriers to entry for new actors, thereby altering a country's competitive structure, including altering its capacity for innovation (an indirect consequence of the food chain). This

model contemplates both the bottom-up trophic cascade, the one that is at a basal level of the trophic cascade affecting a higher level directly or indirectly, and the descending top-down mechanism, in which a predator affects a basal level by direct consumption of an intermediate trophic level.

2. METHOD

This article is basically conceptual, proposing a new model of analysis, considering the trophic relationships among the members of the productive chain. A balanced relationship between the various actors in the market generates positive influences for the formation of economic blocks and fostering innovation. This model proposes to identify imbalances, understand relationships and propose improvements and consequently generate new opportunities as well as promote a new approach to analysis and management.

2.2 Competitive environment under the view of the trophic cascade

Using the concept of trophic cascade, a trophic level exerts, directly or indirectly, influence on the other levels, and can cause imbalance in the chain. Extrapolating to the organizational market, a company, because of its strength, economic power and high predatory potential, can alter the competitive environment and influence survival on other trophic levels.

This same phenomenon also happens to nature, when a predator, struggling for food, destroys its prey and, consequently, indirectly affects the lower levels of the chain, possibly causing the extinction of a species.

From the analysis of the trophic chains, it is possible to notice that some predatory companies practice aggressive competitive policies, creating high economic barriers and consequently dominate the entire market (Jardon, 2016), thus generating forces antagonism (prey/ predator) (Berlow et al. 2004) and unbalanced the market. Comparing this example with the relationships between small and medium-sized national and transnational companies, the trophic relationship becomes even more evident because predators are generally at the top of the pyramid and dominate the market, and typically small and medium-sized enterprises are at levels lower.

It is essential to consider that small and medium-sized enterprises are very important for innovation in a local market because they are more flexible and dynamic; but at the same time they are not prepared for aggressive competition and to address the regulatory issues imposed by relations with larger companies.

The predator-prey relationship can be divided into: (1) lethal and (2) non-lethal. Note that the presence of the predator brings structural changes in the market and in the environment.

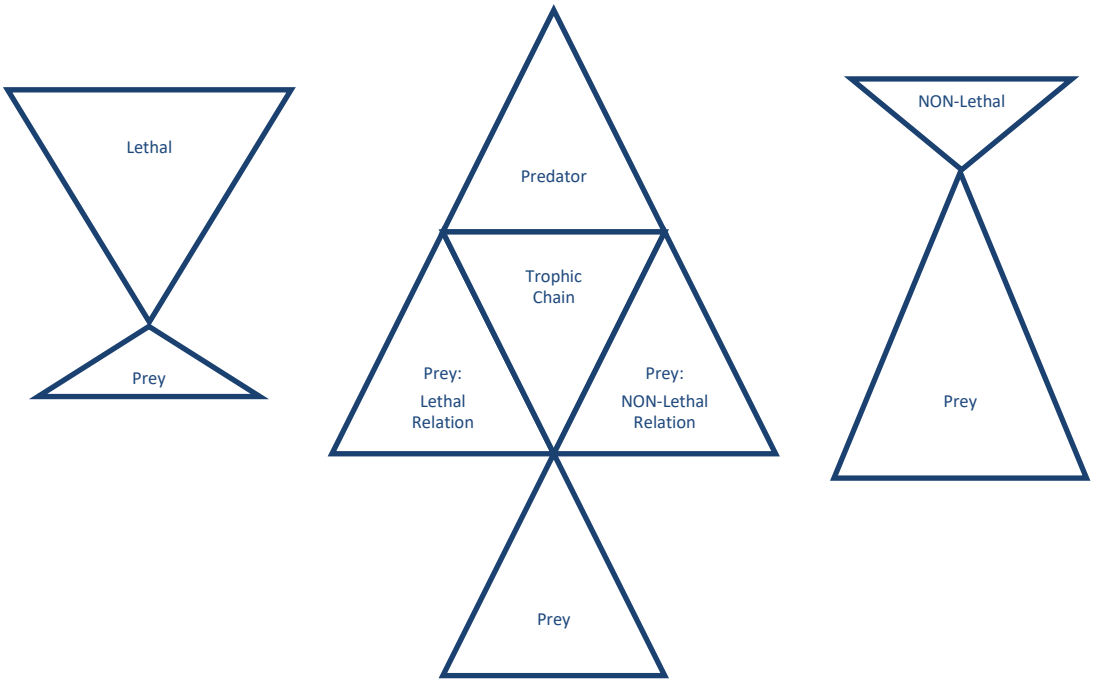

Figure 1: Predator-prey relation at several organizational trophic levels.

The above figure shows the predator-prey relationship as (1) lethal and (2) non-lethal. Lethal predator-prey relation: The predator hunts prey and this can be extinguished, that is, the organization "dies" being extinguished from the market. It is possible to make an analogy with natural events: when innovative small- and medium-sized enterprises are "persecuted and killed" by those who are well structured, stronger and more resourceful (predators). Companies that are "trapped" because they are "less structured" still need time to adapt to the market and do not have enough resources to protect themselves economically, and are therefore more easily attacked by higher trophic levels and more vulnerable to extinction. causes an imbalance in the trophic chain as a whole.

Non-lethal predator-prey relationship: there is an equilibrium in the chain, where the predator does not extinguish a lower trophic level and a healthy adaptation occurs in the market. In this environment the presence of the predator, forces behavior changes in the prey, as a way to protect the enemy, the environment is more competitive and flexible, so that prey and predator are balanced. The food chain is strengthened and the market is more innovative and propelling change. By analogy with the biological concept: predators have become healthy, not destroying lower and more integrated trophic levels, exchange of information and knowledge between them. The predator collaborates for the process of commercialization, development and equilibrium in the market.

2.2 Description of trophic levels and their interactions

The trophic levels are differentiated between first, second (intermediate) or third trophic level. Predators and prey are situated at different levels according to their interaction capacity and their influence on the environment.

Thus, the trophic chain is the integrated sequence of business through commercial and technological relations among many actors in a system. Composed by small, medium and large companies, transnational companies and government, they participate directly or indirectly in the macro and micro competitive environment, in direct and indirect competitors, similar companies, intermediaries, clients, public policies, regulations and partners. For example, the pharmaceutical industry trophic chain has as regulatory area the decisive factor for all stages that impacts the trophic interaction between the actors (figure below).

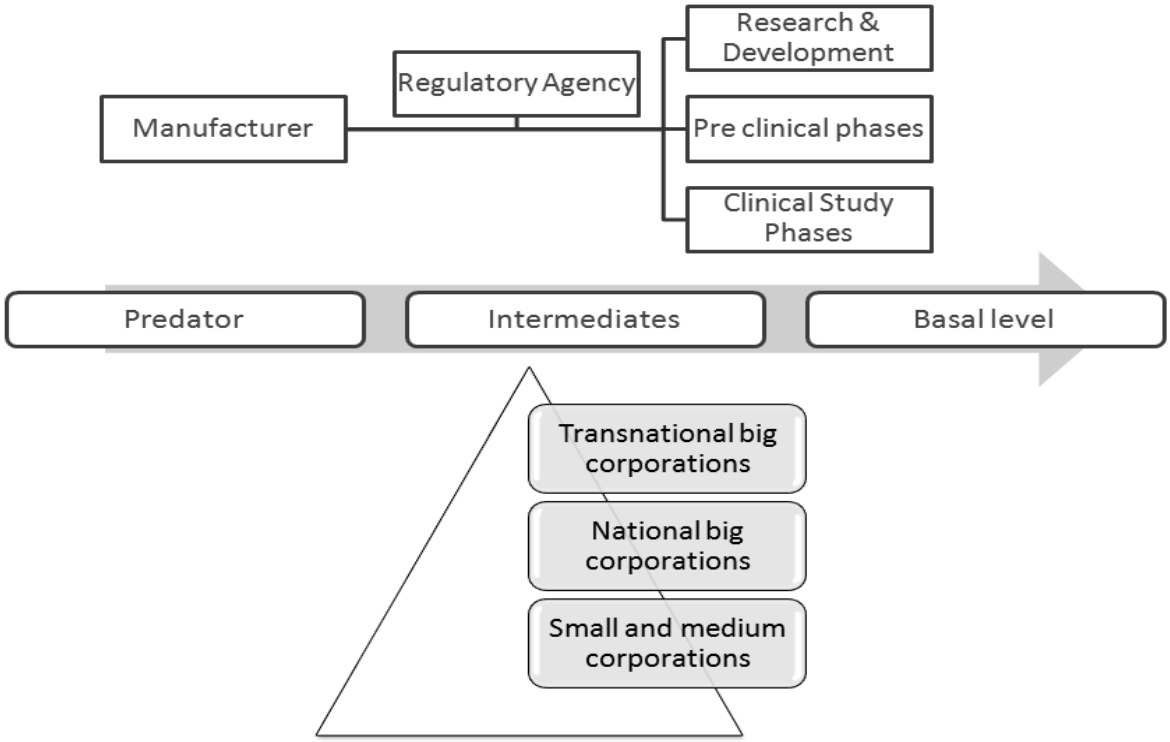

Figure 2: Pharmaceutical industry trophic chain

The first trophic level consists of autotrophic beings (companies capable of generating and producing technology and innovation, quickly and with small resources), also known as small and medium enterprises and startups. As a consequence of being the basis of organizational biodiversity, these companies are known as first-line producers, presenting an organic and flexible structure and very adaptable to the environment. Small businesses and startups revitalize the market, but they need an auspicious environment to develop and succeed because these companies usually have little ability to influence and direct the market. They are very attractive companies from the strategic point of view, but usually have limited resources: finance, space and systemic management, despite their great potential for profit.

Small and micro-enterprises are a very relevant sector of the emerging economies, including Brazil, where they account for 98% of the total enterprises, employing 67% of the workforce and accounting for 20% of GDP. These results (the number of companies versus the share of GDP) indicate that the productivity of these companies is relatively important (Zilber, 2012). The position they all occupy in the food chain is a hierarchical level that classifies them as producers, providers and developers of innovation and technology.

The upper level is composed of heterotrophic companies (which do not produce their own technology and innovation) but which have a great influence on the market. These companies are generally hierarchical, consisting of more mechanistic structures and well defined operational processes, which hampers the processes of innovation. Usually they take ownership of innovation and new processes through the creation of partnerships with startup or acquisition of other companies. Or they use the capillarization strategy to penetrate more inhospitable and difficult markets, forming partnerships with smaller, more agile and resilient companies to try the first marketing approach. This first approach requires agility, flexibility, endurance and technical mastery; to respond quickly to the demands of an inhospitable and unknown market, thereby capillarizing the market and penetrating the sector.

This capillarization strategy can be healthy for both, strengthening the basal chain and feeding the upper chain. But it can also be pernicious and annihilate one of the trophic levels, depending on the lack of a balanced trade agreement and disrespect to it. To be successful in this process, members of the trophic chain must clearly state their policies and protect themselves as a robust legal system in order to avoid imbalances in the chain.

During the capillarization strategy, there is a transfer of knowledge in the trophic chain, which can be spontaneous (obtained by experience and routine) or intentional (company initiative, through training, contracting, research, mergers, acquisitions and others). This knowledge transfer is the basis of innovation and the basis of profitability.

2.3 Analysis of the pharmaceutical industry and the existing trophic relationship

The pharmaceutical sector has great social relevance and requires large investments in innovation and technology. The global drug market moves around USD 1.3 tr in 2018 (IMS Health Market, 2017), which means a 30% increase over the year 2013. This means a steady growth of around 4-7% year, mainly due to the development of new therapeutic treatments and specialized medicine, as well as increased access to new technologies, diagnostic methods and patents expired in developing countries.

According to IMS Health 2017, next year advancements in areas of therapy such as oncology, immunotherapeutics, hepatitis C and chronic diseases such as diabetes and hypertension, will be of great importance to the areas of knowledge. Only the area of oncology contributes annually with 100 bi in research and development. The effect of population aging, with the expectation that people over 65 years of age will become 30% of the total population over the next decade worldwide, will increase treatments for the elderly, diagnostic methods and medicine for chronic diseases.

According to the Ministry of Health (2010), South Africa, China, India, Russia and Brazil together account for 273 million people aged 60 and over, totaling about 40.6% of the world's oldest population in 2005. Brazil also follows the world trend of growth, aging in its population and in 2008, the population was formed by 21 million elderly people (11.1% of the total population), surpassing in absolute numbers the oldest population of countries like France , England and Italy (between 14 and 16 million people), according to the UN (2010).

From 1997 to 2007, there was an overall population growth of 21.6%. Therefore, at the same time, the share of 60 years or more increased by 47.8% and that of people over 80 years old increased by 86.1%

(Silva & Nascimento Filho, 2007). This great potential for growth has some interesting characteristics: huge investments, large development periods, highly regulated sectors and high technical demand. All these factors provide a scenario of market concentration, development lethargy and regulatory and market barriers, thus requiring a greater capacity to work with integrated databases and focus on innovation.

The demands for change are no longer localized, sectoral or linear; they are globalized and intersectoral. It requires interaction between the actors, generating innovation and research of new drugs. Countries or companies that have technologies for the production of medicines control the health system economically and influence the chain of innovation, being able to stimulate or even block it.

In Brazil, in the area of biotechnology, the Ministry of Health will invest R $ 443 million a year in technology transfer and in the acquisition of five new biological medicines. The new partnerships for productive development (PDP) seek to reduce the cost of medicines and encourage domestic production, as there is an annual deficit of R $ 2 billion in the trade balance of the Brazilian pharmaceutical sector. These values show the importance of the sector and how its interactions can influence the entire production chain.

The innovative capacity of the pharmaceutical industry presupposes that companies can launch new medicines, covering all phases of development: pre-clinical, clinical, manufacturing, registration, delivery and post-marketing.

An analysis of the trophic relationships between the actors of the sector would collaborate to identify the predators and prey, as well as the existence of a balance between levels or instability of the sector. For example: large transnational pharmaceutical companies have several subsidiaries worldwide and end up verticalizing their operations, such as intermediary manufacturers, raw materials and finished products. It can be an advantage to speed the process of development and purchase of products but on the other hand, it has the disadvantage of market manipulation and imposition of commercial barriers to new entrants.

2.4 Fragility in the trophic relationship and the impact on innovation

In comparison with a biological system, transnational corporations are usually located at the third trophic level. They operate in several countries through their global subsidiaries. They allow for an expansion in the country's development through technology transfer and job creation. However, the fact that profit is transferred to the parent company raises many questions about the advantage of this model.

To achieve greater profits they need to generate innovation, and often use small and medium-sized companies, because they are faster and more flexible in their decision-making processes. This "capillarization strategy", which smaller and national companies achieve greater penetration by being more agile, and respond better and faster to market demands, allow large companies to increase performance in access to local markets.

Large companies often have more rigid and hierarchical structures. Consequently, innovation strategies are more difficult to implement. The capillarization strategy confers flexibility of mobility and innovation capacity to large companies. For smaller companies, capillarization allows them to achieve greater financial gains and structured growth, as well as the transfer of knowledge and gain through direct and indirect technology. But, as in biological nature, if this relationship is not balanced, the lowest trophic level becomes

prey, disappearing after playing its role. In addition, large companies can also inhibit the growth of national companies.

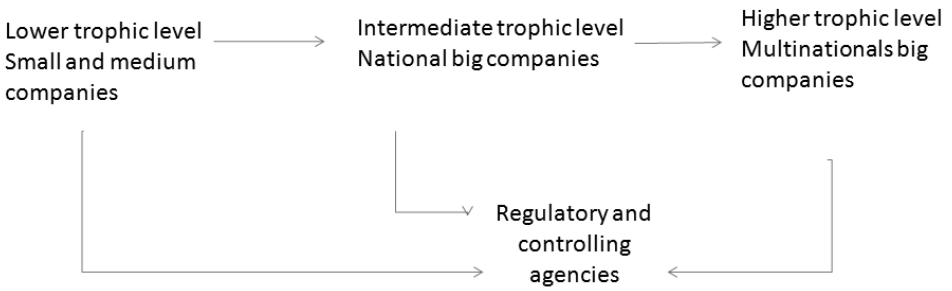

Figure 3: Tropic level relations

The figure above shows the trophic levels relations. Regulation agencies play a very important role in the preservation of the trophic chain, organizing the environment and providing a scenario that does not allow for exaggerated predatory behavior between the levels, assuring legal warranty to market development and innovation.

Markets that do not regulate the relations between large companies (predators) and medium and small companies (basal level), tend to create a high risk scenario, causing extinction in lower trophic levels and imbalance of the chain, since the capillarization strategy can constrain in the long run, the expansion of innovation, contaminating a healthy environment.

The determination of biodiversity in the organizational community and its patterns of spatial and temporal variation is very relevant for sustainable governments to assess organizational environmental quality, since companies occupy multiple levels in the trophic pyramid and can impact innovation capacity and technology of a country.

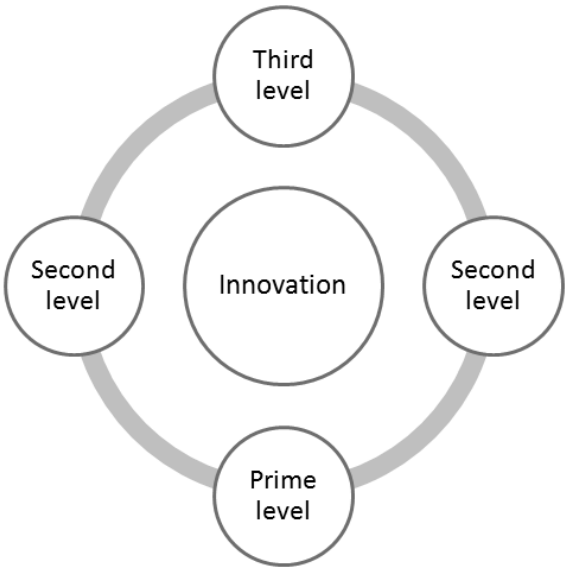

Figure 4: Trophic level relations

In the figure above, diverse levels collaborate for sustainable innovation, when competition is civilizing, but when only the slaughter of competition occurs, it would contribute to the economic imbalance.

3. RESULTS AND DISCUSSION

There is a relationship between the levels of the food chain and the existence of innovation in the market. The more this chain is predatory and aggressive, the more there will be imbalance between the parties, because when a basal level is extinguished, being small and with few financial resources to defend itself, the strongest predators prevail.

These direct and indirect effects on a trophic cascade, as well as analysis of its dynamics and interaction are important to describe the organizational biodiversity and how innovation is triggered from this interaction.

A balanced food chain advocates partnership between transnational corporations, startups and knowledge generators to capture innovative projects. Research should be based on the balance between knowledge creators (new ideas, new technologies, new patents), universities (articles, scientific domain) and companies that make up the different trophic levels, controlled by regulatory frameworks that guarantee balance and interaction fairly.

Rich and healthy biodiversity is essential to maintain economic balance and foster innovative projects. For there is a need to create an environment conducive to creative activities supported by both the public and private sectors.

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