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Resilience and Capabilities of Firms for Sustainable Development: Coping with Climate Change

by

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Abstract

In the framework of socio-ecological systems, coping with climate change requires both knowledge of the interaction between systems and the interactions within them. In this sense, this work seeks to draw an outline of the interaction between the institutional framework that surrounds companies and these for the promotion of capabilities that allow them to face climate change and be resilient. There are hints that in the absence of a clear green policy, partnerships between companies and other allies can create an environment that favors the development of these capacities.

Resumen

En el marco de los sistemas socio-ecológicos, hacer frente al cambio climático requiere conocer tanto la interacción entre sistemas como las interacciones dentro de los mismos. En este sentido, este trabajo pretende dibujar un esquema sobre la interacción entre las empresas y el marco institucional que las rodea para así, promover capacidades que les permitan hacer frente al cambio climático y ser resilientes ante el mismo. Se insinúa que, en ausencia de una política verde clara, las asociaciones entre empresas y otros aliados pueden crear un entorno que favorezca el desarrollo de estas capacidades.

Resilience and Capabilities of Firms for Sustainable Development: Coping with Climate Change[1]

Paola Vera

Introduction

From the perspective of socio-ecological systems, the development of systems can be studied through three parameters: resilience, adaptive capacity and transformability capacity. Resilience, from this approach, is both the system's resilience while maintaining its functions, structure, identity and feedback (Walker *et al.*, 2004), as well as its ability to reconfigure -when it faces a disturbance- giving lead to new development paths (Folke, 2006). Among the attributes of resilience is the panarchy, which is the presence of nested relationships between the different subsystems, that is, the presence of crossed scales -processes and structures expressed in spatial, temporal and organizational dimensions or hierarchies- (Allen *et al.*, 2014).

Resilience is a characteristic shared by both ecological and social systems, on the other hand, the capacities for adaptation and transformation confer on the human environment because in human systems action is accompanied by foresight and intentionality, communication and technology (Holling, 2001). Adaptive capacity can be understood as the management and building of systems resilience; whereas, when a subsystem becomes unsustainable, it has the ability to create new and better conditions (Walker *et al*., 2004).

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From this approach, sustainable development is understood as the "*goal of fostering adaptive capabilities while simultaneously creating opportunities*" (Holling, 2001, p. 399). Where adaptive governance is the mechanism to agree on how to carry out adaptability and transformability actions, while adaptive administration is the set of strategies, plans and actions, which require flexibility; that is, that feedback is given –as a result of monitoring and evaluation- and that it reflects the changes in the rules that occur in governance (Walker *et al.*, 2004).

In this regard, cope with climate change is an example that shows the relevance of the concept of panarchy of socio-ecological systems; it is a problem that involves different scales of organization, as well as spatiotemporal dimensions, in which actions from the top down and from the bottom up affect the other subsystems. Of the various initiatives related to cope with climate change, current attention, and expectations, are the Paris Agreements and the Sustainable Development Goals (SDGs).

The brake that the Covid-19 pandemic has represented -with health, social and economic consequences, also manifesting itself in setbacks with respect to the advance of the SDGs, which in some cases were, of course, meager- (United Nations, 2020). Despite this adverse context, there have been signs that point to changes in the institutional framework of financial markets and that are reinforced with the purpose of the Biden administration for the United States to resume its leadership position in environmental matters (The White House, 2021).

In early 2020, BlackRock announced the launch of its first global environmental, social, and governance (ESG) total return bond fund as a sign of its commitment to making sustainability an investment standard (International Investment, 2020); also, it is singled out as one of the promoters in the convergence between sustainability reports (Financial Times, 2020).

In this logic, in a scenario in which pressure increases to address climate change and related aspects such as the energy transition, what is the institutional framework that surrounds the companies for the construction of capabilities that will be resilient? The objective of the work is to outline the interaction between the institutional framework and the performance of companies for capacity building and resilience, taking Mexico and Japan as cases.

Firms, capabilities and resilience

In the case of firms, as said by Linnenluecke and Griffiths (2010), it is not only about how they impact other subsystems —for example, through the greenhouse gas emissions (GHG) they make—, but how they are, and potentially they can be, affected by the effects of climate change —changes in regulation, environmental disasters, etc.—; which refers to the concept of resilience.

In the social sphere, resilience is an aspect that is studied from different perspectives, for this work we will consider those presented in Table 1. In the definitions of Holling (1973) and Folke (2006), the transit and understanding that resilience not only concerns ecological systems, but also social ones, is observed and that implies both resisting disturbances and adapting and transforming in the face of them. The other definitions focus on the study of resilience in firms.

Table 1. Resilience and firm

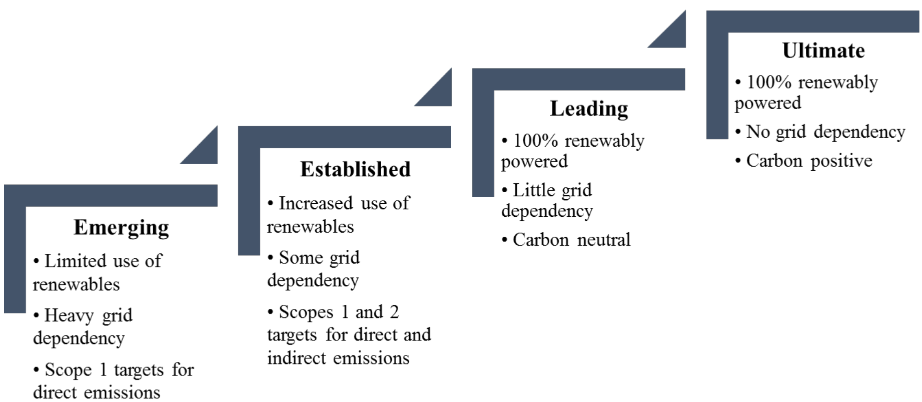
Author	Concept / approach	
Holling (1973, p. 14)	Resilience	… is a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables.
Hamel & Välikangas (2003, p. 2)	Strategic resilience	… It's about having the capacity to change before the case for change becomes desperately obvious.
Sheffi & Rice (2005, p. 41)	Resilience	… the ability to bounce back from a disruption.
Folke (2006, p. 260)	Resilience	… the resilience approach is concerned with how to persist through continuous development in the face of change and how to innovate and transform into new more desirable configurations
Linnenluecke & Griffiths (2010, p. 477)	By developing resilience	… organizations can develop resources and capabilities to avoid or minimize organizational collapse and to reorganize in light of discontinuities associated with climate change and weather extremes

Source: Authors above cited.

In the firm, aligned to the approach of Folke (2006), resilience is basically a capability or ability. In Sheffi and Rice (2005) the resilience approach towards the aspect of resistance is observed, as in the first approaches to the subject by Holling (1973). However, in the proposal by Linnenluecke and Griffiths (2010), even when it is bound to climate change, there is convergence with the conceptualization of Hamel and Välikangas (2003) because both refer to the ability of company leaders to identify the changes that need to be made in organizations before the need for adaptation is pressing. That is, both approaches point towards building resilience or adaptation and transforming or creating new growth paths for companies.

In this sense, meeting the demands of adaptation and mitigation to cope with climate change implies, on the part of the companies, attending to the aspects related to the mitigation of emissions —substitution of inputs, technological improvements, etc.— as well as the issues related to energy sources, that is, to the energy transition —from fossil sources to clean and renewable energies—. Figure 1 shows the relationship of these two aspects for the case of the company, framed in a circular economy system.

Figure 1. Energy and emissions: some characteristics of increasing company maturity in circular economy



Source: Adapted from Lacy et. al. (2020, p. 218).

Figure 1 illustrates the key points and the path that a company takes from an initial stage in which its renewable energy supply options are limited and the company focuses on its own emission reduction objectives. The company then develops energy production capabilities and emission reduction targets are expanded into its supply chain, until it reaches independence in the generation of renewable energy and even reverts its position from producer to capturing of emissions —for example, companies that manage forest areas—.

Hart (1995) had already proposed that, to face the environmental challenge, companies needed to develop three types of strategic capacities: pollution prevention, product stewardship, and the so-called sustainable development capacity. The first of these refers to the internal processes of the company that are related to the reduction of flows and effluents; that is, the reduction of emissions, better use of resources and inputs, etc.; this capability to prevent pollution refers, in general, to eco-efficiency. While, the second capability involves the supply chain, and other stakeholders, it is about addressing the impacts throughout the life cycle of the product. The third capacity has a broad systemic approach, Hart (1995) associates it with the development of a shared vision (of sustainable development) in which the (transnational) company extends what the stakeholders consider to include the governments of other countries (mainly in development) in the construction of alliances. However, the circular economy could be considered as a system that illustrates the type of strategy that Hart (1995) referred to when proposing the capability for sustainable development.

The situation of the Figure 1 refers to considering the panarchy property existing by the socio-ecological systems. Although the company requires resources and capacity building, the possibility it has to develop self-sufficiency capacities for clean and renewable energy will be driven or limited by its environment. For example, in companies grouped in industrial associations -whether they pursue commercial purposes or related to sustainable development, to cite-, this association is potentially a mechanism for diffusing practices; in the present case, practices oriented towards eco-efficiency, the development of own sources of clean energy supply, etc. In this regard, Jennings and Zandbergen (1995) point to mimicry as the ideal mechanism for the dissemination of sustainable development practices; in other words, when companies imitate or copy strategies related to sustainable development, the dissemination of this type of actions is more viable since they are considered as an element of the strategy of leading companies or as the best practices of the industry. In addition, Axelrod (1997) points out the affiliation to groups with common ends as a mechanism that promotes the adoption of norms -socially accepted behaviors-, the achievement of the proposed goals, ultimately as a promoter of cooperation. Therefore, at this level of organization (industrial), companies would have incentives to develop clean energy self-sufficiency capacities, either due to general pressure on the industry -by stakeholders- or due to competition between companies.

However, companies operate at a local level, so national –and local- environmental policies also play a relevant role in promoting or limiting this type of capacity. Vera (in press) points out that the design of green policy requires the alignment of strategies between the different levels of organization -from the supranational to the national to environmental policies at the industrial and company level- as well as the definition of clear regulation, or rules, and mechanisms that promote cooperation among those involved. But, as Berkes and Ross (2016) point out, there is little discussion about the concept of panarchy when developing policies.

The institutional framework and firms: between supports and obstacles

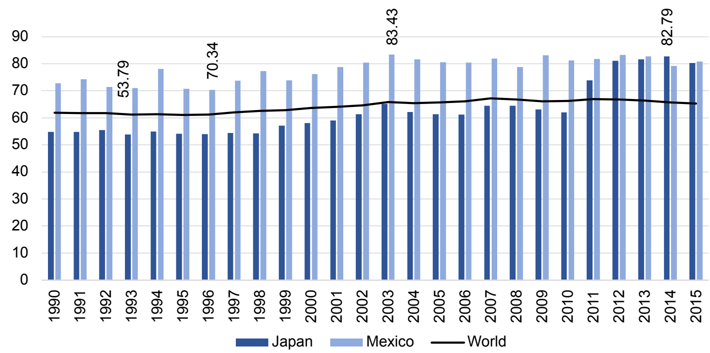
To delineate the institutional framework that involves Japanese and Mexican companies in building capacities to face climate change, it will be assumed that GHG emissions and the type of source used to generate electricity allow us to observe the result of environmental policy on this matter.

Concerning total GHG emissions, in the case of Mexico these emissions have increased from 417.45 Mt CO2e in 1990 to 695.26 Mt CO2e in 2018, that is, throughout that period they increased by 66.5%. Even so, it remains below the emissions of Japan, which increased by 3.6%%, going from 1.11 Gt CO2e in 1990 to 1.15 Gt CO2e in 2018. About the participation in the total of these countries, the percentage of emissions in Mexico has remained close to 1.3%, while Japan decreased its participation from 3.4% in 1990 to 2.3% in 2018 (calculations with data from Climate Watch, 2021).

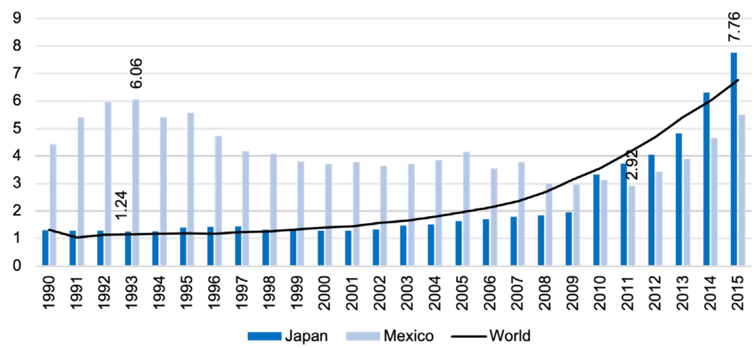
Another aspect of this general framework that involves companies in these countries concerns the sources of energy supply. Figure 2 shows the energy production series for the fossil and renewable type. Part (a) of the figure shows the percentage that represents the generation of electricity from fossil sources, a first aspect to highlight is that a flat behavior of the series is observed worldwide, the average for the period is located at 64.26%, with 67.29% and 61.02% as maximum and minimum points, respectively. Then, in the case of Mexico, the percentage of energy generated by this source is above the world level, this type of source represents on average 78% of the energy generated in the period from 1990 to 2015, having at minimum 70.34% in 1996, and a historical maximum of 83.43% in 2003. As for Japan, the average participation of these sources was 62.68% in the period, with a minimum of 53.79% in 1993 and a maximum of 82.79% in 2014 (calculations with data from The World Bank, 2021a).

In this country, the increase in the use of this source is explained by the fact that after the Fukushima accident (Taghizadeh-Hesary et al., 2017), which occurred in 2011, the government decided to abandon the production of energy from nuclear sources (Kim *et al.*, 2013).

Figure 2. Electricity production (% of total) - Japan, Mexico, World



(a) Electricity production from oil, gas and coal sources* (% of total)



(b) Electricity production from renewable sources, excluding hydroelectric (% of total)**

Source: The World Bank (2021a, 2021b).

(*) Sources of electricity refer to the inputs used to generate electricity. Oil refers to crude oil and petroleum products. Gas refers to natural gas but excludes natural gas liquids. Coal refers to all coal and brown coal, both primary (including hard coal and lignite-brown coal) and derived fuels (including patent fuel, coke oven coke, gas coke, coke oven gas, and blast furnace gas). Peat is also included in this category.
(**) Electricity production from renewable sources, excluding hydroelectric, includes geothermal, solar, tides, wind, biomass, and biofuels.

Part (b) of Figure 2 presents the share of renewable sources in electricity production. In this case, at the world level there is a growing trend in the use of these sources with an average annual growth rate of 7.1%. For Mexico, the highest percentage of these sources in energy production was 6.06% in 1993, and the lowest was 2.92% in 2011, although a recovery in the percentage of participation is observed in the last years of the period. In Mexico, the average percentage of electricity generated by renewable sources has been 4.20%, while for Japan this source has represented on average 2.27% of electricity production. However, the Japan series presents an interesting change in its trend when the share of this type of energy went from 1.95% to 3.32%, which represented a growth of 70.4% between 2009 and 2010. The share of these sources has gone increasing, reaching 7.76% in 2015; so that the average growth was 8.3%, a rate higher than the world one. In contrast, for Mexico the series does not reflect a clear policy regarding the use of these sources; the average annual growth rate was barely 1.5%, in the period from 1990 to 2015 (calculations with data from The World Bank, 2021b).

After this brief overview, the next section will consider some ESG criteria to identify signs of capacity building to face climate change by Mexican and Japanese companies.

The union is strength or the importance of being in a business association

The Mexican and Japanese companies that this work shows were selected from the report *The Sustainability Yearbook 2021* (S&P Global, 2021a), then the details of their ESG score were searched on the basis of S&P Global (2021b). For the report, the rating agency evaluated around 7000 companies, of which 631 presented a sufficient score to be considered in the yearbook.

Table 2 shows the classification for the top 10 countries with the highest number of companies listed, as can be seen in the United States is the country with the highest number, 97 companies representing 15.4% of the total; followed by Japan with 78 companies listed, 12.4% of the total. It should be noted that Chile is the only Latin American country that appears in the Top 10. As for Mexico, 6 companies are listed (Table 3), which cover 1% of the total; of these, the industry in which they are classified was considered to identify their Japanese counterparts for the purpose of some contrasts.

Table 2. Top 10 countries

Rank	Country	Number of companies listed
1	USA	97
2	Japan	78
3	Republic of Korea	40
4	UK	37
5	France	35
6	Taiwan	32
7	Thailand	29
8	Australia	28
9	Spain	24
10	Chile	21
10	India	21

Source: Data from S&P Global (2021a, pp. 98-99).

In the logic that economic activities present different impacts, the ESG considers different criteria between industries, for which a direct comparison is not possible. Of the dimensions covered by the ESG, the score for the environmental is presented, as well as those corresponding to the climate strategy and operational eco-efficiency, as these are the points that have been considered throughout this work.

Table 3 shows that for some industries the selected ESG criteria do not apply, as in the case of banks in terms of operational eco-efficiency, and in beverages the climate strategy does not apply either. In the environmental dimension score, it is observed that the six companies are behind the best in their industry and above the mean. For the cases that apply, this situation is repeated in the climate strategy and operational eco-efficiency, with the exception of Cemex in terms of the climate strategy in which it is at the best level; furthermore, the cement industry mean is the one with the highest score. The analysis of what happens in the cement industry will be expanded.

Table 3. Mexican companies listed

Company	**Banco Santander México**	**Cemex**	**Coca-Cola FEMSA**	**FIBRA Prologis**	**Fibra UNO**	**Orbia Advance Corporation**
Industry	Banks	Construction Materials	Beverages	Real Estate	Real Estate	Chemicals
ESG Score	68	76	75	66	64	61
Environmental dimension						
Company	70	88	90	70	71	72
Industry best	99	94	98	98	98	95
Industry mean	60	65	61	47	47	58
Rank in industry	70 of 142	7 of 23	6 of 26	32 of 132	31 of 132	21 of 68
Climate strategy						
Company	56	100	--	78	77	75
Industry best	100	100	--	100	100	100
Industry mean	53	76	--	46	46	62
Operational Eco-efficiency						
Company	--	91	--	45	76	82
Industry best	--	93	--	100	100	100
Industry mean	--	61	--	53	53	57

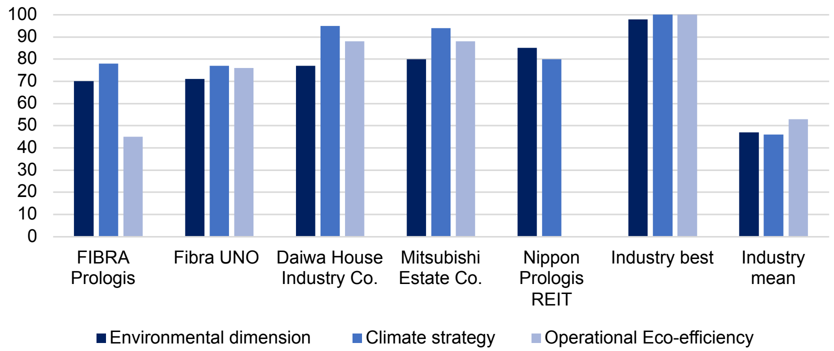
Source: Data from S&P Global (2021a, 2021b).

The cement industry has three critical points: the extraction of limestone, the high demand for fuels and the decarbonation process that occurs in the production of Clinker. The last two factors position it as one of the industries with the highest CO2 emissions. As part of the attention to the costs associated with the use of fuel, this industry has worked to improve energy efficiency standards and in the search for alternative sources of fuels, aspects that served as a preamble to the adoption of eco-efficiency and the presentation is the response of the industry to the demands of the stakeholders (Vera, in press). In addition, the industry was organized, first, under the figure of the Cement Sustainability Initiative (CSI) and later in the Global Cement and Concrete Association covering not only the problem of cement but also the value chain, under a circular economy approach (Global Cement and Concrete Association, 2018).

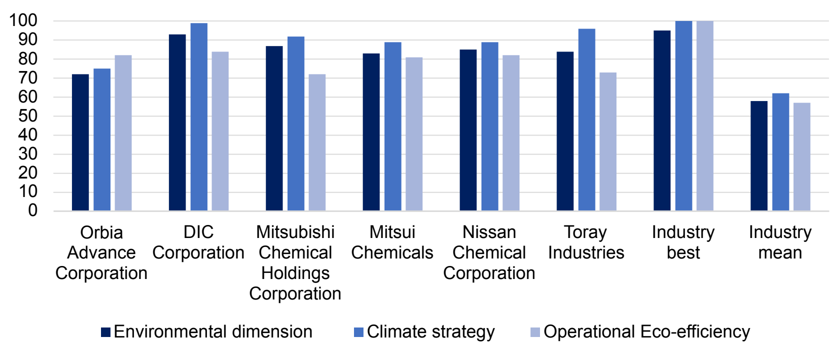
This has meant the development of various capabilities from technical to other social ones. For example, attention to the costs associated with the use of fuel allowed to lay the foundations for the building of the capacity that Hart (1995) calls as pollution prevention. Likewise, the building of capacities related to collaboration with the supply chain, stakeholders and their counterparts, that in the market are rivals and partners in the CSI. In this way, it could be presumed that in this industry there is an environment conducive to the development of this type of capabilities in companies.

Figure 3 shows the counterpart companies for the real estate and chemical industries that share in common with the cement industry the presence of international initiatives and organizations that promote the adoption of sustainability criteria in the industry. For example, in real estate there are LEED and WELL Building Standard certifications (EY, 2021) that together promote the development of eco-efficient infrastructure, among other characteristics. In addition, the United Nations has a Committee that also seeks to promote the policy framework for sustainable real estate markets (United Nations, 2019). Also, in the chemical industry there is the presence of organizations that seek to promote best practices and alliances (World Business Council for Sustainable Development, 2018; United Nations Industrial Development Organization, 2021).

Figure 3. Mexican and Japanese companies listed



(a) Real estate industry



(b) Chemical industry

Source: Data from S&P Global (2021a, 2021b).

About banking, Mizuho Financial Group was listed with an ESG score of 66 (S&P Global, 2021a, 2021b). For this industry, the United Nations also has various initiatives that seek to promote sustainability in finances. In this industry, a thorough analysis is required in search of solid evidence of such changes.

In summary, the few Mexican companies that are listed in the yearbook are observed to belong to industries in the governance structures that have global organizations, industrial associations, in addition to regulations by governments.

Lastly, no Japanese counterpart in the beverage industry was found listed in the yearbook. At the moment, in the beverage industry it is not observed that collaboration between firms has the scope, which does occur in the case of cement, to address sustainability issues.

Conclusions

In the context that surrounds the companies, in the Mexican case in the period of the study, 1990-2015, the reflection of a policy that favors the use of renewable energies is absent. In contrast, in the Japanese case, there is an upward trend in its use.

On the other hand, as observed in the cement, real estate and chemical industries, mainly, it is found as a first common element, which is under the interest of international organizations that their activities move towards sustainability. Second, the presence of the industry organization itself to carry out this transition. The above, without ruling out the existence of government regulation.

For the Japanese case, the previous points seem to reinforce each other and are reflected in the number of companies that reached the necessary score to be in the report and occupy the second position by country. However, the low number of Mexican companies that managed to be included in the report leaves open questions. Is it due to the absence of a government green policy to guide efforts against climate change? Or because of the absence of business associations that jointly address the problem and that leads companies to an environment in which part of the competition -to attend to good practices- is to develop the capacities to face climate change?

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