



## Discontinuity in the Environment, Firm Response and Dynamic Capabilities

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## **Discontinuity in the Environment, Firm Response, and Dynamic Capabilities**

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### **Abstract**

*This paper identifies and focuses on a specific type of environmental development called discontinuity. Discontinuities in the forms of rapid technological innovations, regulatory reforms, institutional overhauls, and socio-cultural developments are the source of opportunities and threats to the firm. Firm responds to these discontinuities in specific ways in sustaining its existence at different points of time. This paper conceptualizes discontinuity and identifies its natures; explores the possible types of responses by the firm, and their enablers. The capability of sensing, seizing and re-shaping are captured to establish the linkages in the framework of interrelations. It posits a set of propositions based on conceptual development and illustration of two cases.*

## Discontinuity in the Environment, Firm Response, and Dynamic capabilities

*“It is not the strongest of the species that survive, nor most intelligent, but the one that is most responsive to change.”*

*Charles Darwin*

### 1. Introduction

Rapid technological innovations (Teece, 1988; Teece, 1992), regulatory reforms (Angelini and Cetorelli, 2003), socio-cultural developments (Erez, 1986), global integration and differentiation (Douglas and Wind, 1997), and institutional overhauls (Gumport and Sporn, 1999) create discontinuities in the environment and threaten the sustenance of the firm or open new paths for future. The firm requires capabilities in sensing, seizing, and reconfiguring, which also referred as dynamic capabilities (Teece, 2007) to respond to these discontinuities. The firm has to anticipate, comprehend, and interpret the implications of discontinuities for subsequent environmental developments and assess their cumulative impact on its strategy and performance. It has to generate and evaluate options for reconfiguring its ‘aspirations, arena, differentiators, vehicle, staging, and economic logic’ (Hambrick & Fredricson, 1993). It might have to redesign its structures, systems, processes and skills (Miles, Snow, Meyer, & Coleman, 1978) to execute the new responses. Conceptual frameworks for linking firm and its environmental developments (Cyert and March, 1963; Thomson, 1967; Andrews, 1971; Hannan and Freeman, 1977; Pfeffer and Salancik, 1977; Hofer and Schendel, 1978; Aldrich, 1979; Porter, 1980; Astle and Van de Ven, 1983) have not focused on aspects of discontinuity and firm responses. Attempts have been made to identify the attributes of the environment like munificence and hostility; homogeneity and heterogeneity (Venkataraman & Prescott, 1990). A categorization of the environmental developments along dimensions of continuity, discontinuity or additions have not been made. This paper attempts to conceptualize discontinuity as opposed to continued changes in the same dimension or addition of some new dimensions of environment and link with the specific types of responses. Discontinuity is recognized as a distinct development in the environment, where the development denies the firm the support it had received or releases the resistance it had faced thus far. It is argued that response to discontinuity requires critical

evaluation of prioritization, speed, and simultaneity in firms' responses. Hence the natures of dynamic capabilities enabling those specific response patterns are different.

This paper is organized as follows. The next section defines discontinuity and delineates its relevance to the literature on firm and its environment. The third section reviews the extant literature of firm and environment especially in organization theory and strategy for identifying types of responses. It encapsulates the typicality of responses in discontinuity situations. It also captures types of dynamic capabilities enabling those specific responses. It develops an integrating framework for investigating the interrelations of conceptual developments. The framework is illustrated with two case studies in the fourth section. It reflects on the relationships in building some propositions and presents scope for further research in the last section.

## **2. Discontinuity:**

Duncan (1971) makes a distinction between internal (relevant physical and social factors within the boundaries of the organization or decision making unit) and external environment (beyond the organizational boundaries). While the literature on the firm and environment has identified the dimensions of environment like hostility, munificence, heterogeneity, homogeneity, changes with high and low velocities, it presents environmental development as an inclusive expression, without making distinctions like continued 'change' in a given dimension of the environment, 'addition' of a separate dimension or complete 'absence' of one dimension itself. We argue that it is necessary to make such distinctions as the capabilities of the firm to respond to them are different. For this paper we focus on discontinuity as a particular development type in the environment. In mathematical connotation, discontinuity relates to the situation where real value of a function is defined at particular point and function takes completely a different path beyond that point (Tall and Vinner, 1981). In Anthropology, cultural discontinuity relates to conflict due to inability of carrying the cultural cues by a select group under study (Ogubu, 1982). It appreciates disconnect of the domains and inability of carrying values of a societal group in a particular context. In Geological Science, the continuity relates to stream flow of river with predictable morphological and hydrological features, and discontinuity relates to artificially created barriers like dams to control flow and the movement of the river with disequilibrium of

habitual factors (Johnson, Richardson, and Naimo, 1995). Technological discontinuities are identified as innovations that dramatically advance an industry's price versus performance frontier (Anderson and Tushman, 1990). It occurs when a new technology does not just enhance the current technology, but actually supplants it for a better performance. Schumpeter (1942) refers to discontinuity as creative destruction (destruction of existing forms, norms, and combinations). Discontinuity has been described as innovations that command a decisive cost or quality advantage which strike at the foundations. Discontinuity has been conceptualized as an environmental innovation (Astle and Van De Ven, 1983; Tushman and Romanelli, 1985). Discontinuities are also related to situational uncertainty and complexity faced by the managers (Kaplan, Murray, and Henderson, 2003). It is accepted as a strategic problem in project marketing (Hadjikhani, 1996). Prahalad (1998) identifies discontinuity as dramatic changes in competitive landscape due to globalization, deregulation, volatility, convergence, indetermination of industry boundaries, and eco-sensitivity. Conceptualizations of discontinuity discussed above confirm that the term relates to absence of a certain trend, or evolved conflict due to complete newness in the situation. In this paper, *Discontinuity is defined as a type of environmental development, where the environmental factor under consideration attains a limiting value zero.* We view a particular development in external environment as a discontinuity when the firm loses completely one of its supports for existence in terms of resource or opportunity or a constraint or a threat is eliminated completely. The discontinuity defined as above, impacts the firm's eco system. Discontinuity could be linked to types of environment like technological (Schumpeter, 1942; Tushman and Romanelli, 1985), regulatory (Vernon & Wells, 1986), institutional and competitive (Prahalad, 1998), socio-cultural (Romanelli and Tushman, 1986) or could be linked to 'dimensions' of environment like *Uncertainty, Hostility, Munificence, Dynamism, Complexity, homogeneity, heterogeneity* (Thomson, 1967; Aldrich, 1979; Tung, 1979; Dess and Beard, 1984; Venkatraman and Prescott 1990; and Tan and Lichert 1994). Uncertainty represents the non-predictability of outcomes, while, *Hostility* captures the degree of threat posed by the firm due to multifaceted ness, and intensity of competition and volatility of the industry. *Dynamism (or uncertainty)* is characterized by the rate of change and innovation in the industry as well as the uncertainty and unpredictability in actions of competitors and customers. *Heterogeneity (or complexity)* refers to the variations in firm's market due to

diversity in production and marketing orientations. The triggers for discontinuity and the chain of impacts can be traced through systems theory and organizational economics (Katz and Kahn, 1967; Thomson, 1967; Barney and Ouchi, 1986). These theories explain the long linked involvement of technological and social factors interrelated in a series of actions and reactions in environment. Understanding discontinuity in its character and dimension is crucial for the firms to develop its response. It initiates substantial need for anticipating alternatives and reconfiguring the firm's existing resources to cope with new realities.

### **3. Firm Response to Discontinuity**

Response to any environmental development requires top managers to anticipate, learn, unlearn, and revisit priorities. The abilities are seen as emerging (Eisenhardt, 1989), inclusive, and entrepreneurial (Child, 1972; Pfeffer and Salanick, 1978) decision making abilities. In situations of discontinuity, the capabilities of anticipating the extent of impact and timing of developments through scanning processes (Aguilar, 1967) would be different. Discussing the literature, Burns and Stalker (1961) find two distinctive different management methods of response to environmental developments like 'mechanistic' (in more stable environment) and 'organic' (for continuously changing environment). Chandler (1962) studies the changes in the structure and the communication system as a response to different environmental set ups. Thomson (1967) portrays the basic decision dilemmas of the organization as achieving rationality in an uncertain world, either through internal strategies of adaptation or through external strategies of innovative interaction with other firms. Khandwala (1976) finds that managers perceiving uncertain environmental developments respond with either comprehensive strategy formation or innovation in adaptation. Astley and Van de Ven (1983) poses higher level question of theoretical pluralisms in making comprehensive response like adaptation and selection facing environmental developments. Hrebiniak and Joyce (1985) try to find the changes in firm adaptations as interaction between strategic choice and environmental determinism. So it links towards the fact that, firms engage with streams of 'innovations' for adaptations in environment (Tushman and Anderson, 1986; Romanelli and Tushman, 1995; Magnusson, Lindstorm, and Berggren (2003) to respond to the environmental developments. Theories of organization learning also emphasize 'adaptive' view of organizational response (Levinthal and March, 1981; Nelson

and Winter, 1982), through identifying, comprehending, and interpreting environmental cues and making choices to respond (Porter, 1980). Firm response to discontinuity is not separately mentioned in literature. Focusing on discontinuity requires particularizing these and identifying what is typical. The firm needs to build the scenario of new reality and identify the redundancies in existing resources and new resources required. It needs to unlearn while learning to build new competencies and alliances. This paper proposes that the options before the firm and the capabilities required to identify these options, evaluate, choose and execute are different when a firm faces discontinuity. They would differ in 'processes for decision making' and 'content'. They could be knee jerk and impromptu, radical as against linear, or planned. They could differ in speed, scale, and simultaneity. They could be cautious, concise, and sequential or highly risky. The firm could be anxious depending upon whether the discontinuity was sudden or anticipated and could decide to go alone in handling the response or work in alliances. The involvement of different levels of management, incorporation of learning from prior experiences of having dealt with similar type of developments could be different. It needs to be appreciated that the response depends on the ability of environmental scanning processes in the organization (Weick, 1987; Conger and Kanungo, 1988; Kotter, 1988). Discontinuity makes the response critical in terms of its preparedness, timing, and finding opportunities. It makes the response specific in terms of dealing uncertainty of priorities and preferences. It makes the response contextual in terms of recognizing options and extent of unlearning possibilities.

It is argued that firm responses are governed by their dynamic capabilities (Collis, 1994; Teece Pisano, and Shuen, 1997; Eisenhardt and Martin, 2000; Rindova and Kotha, 2001; Zollo and Winter, 2002). The definition of dynamic capability has undergone many changes depending on the super-structural theoretical perspective to define it. Dynamic capability is defined as the firm's ability to integrate build and reconfigure internal and external competences to address rapidly changing environment (Collis, 1994). Dynamic capability has been described as insights or capacity of renewing competences and resource base (Teece, Pisano, and Shuen, 1997). These capabilities are embedded in processes and high level routines (Eisenhardt and Martin, 2000; Zollo and winter, 2002) for adaptations in changing environment. They are higher order capabilities help to create, extend, upgrade, protect and keep relevant the enterprise's unique asset base (Teece, 2007). The capability of

'sensing' opportunities and threats from the changing environment; the capability of 'seizing' opportunities and shielding from threats; and capability of 're-shaping' through enhancing, combining, and reconfiguring resource base of the firm are identified as microfoundations of dynamic capabilities (Teece, 2007).

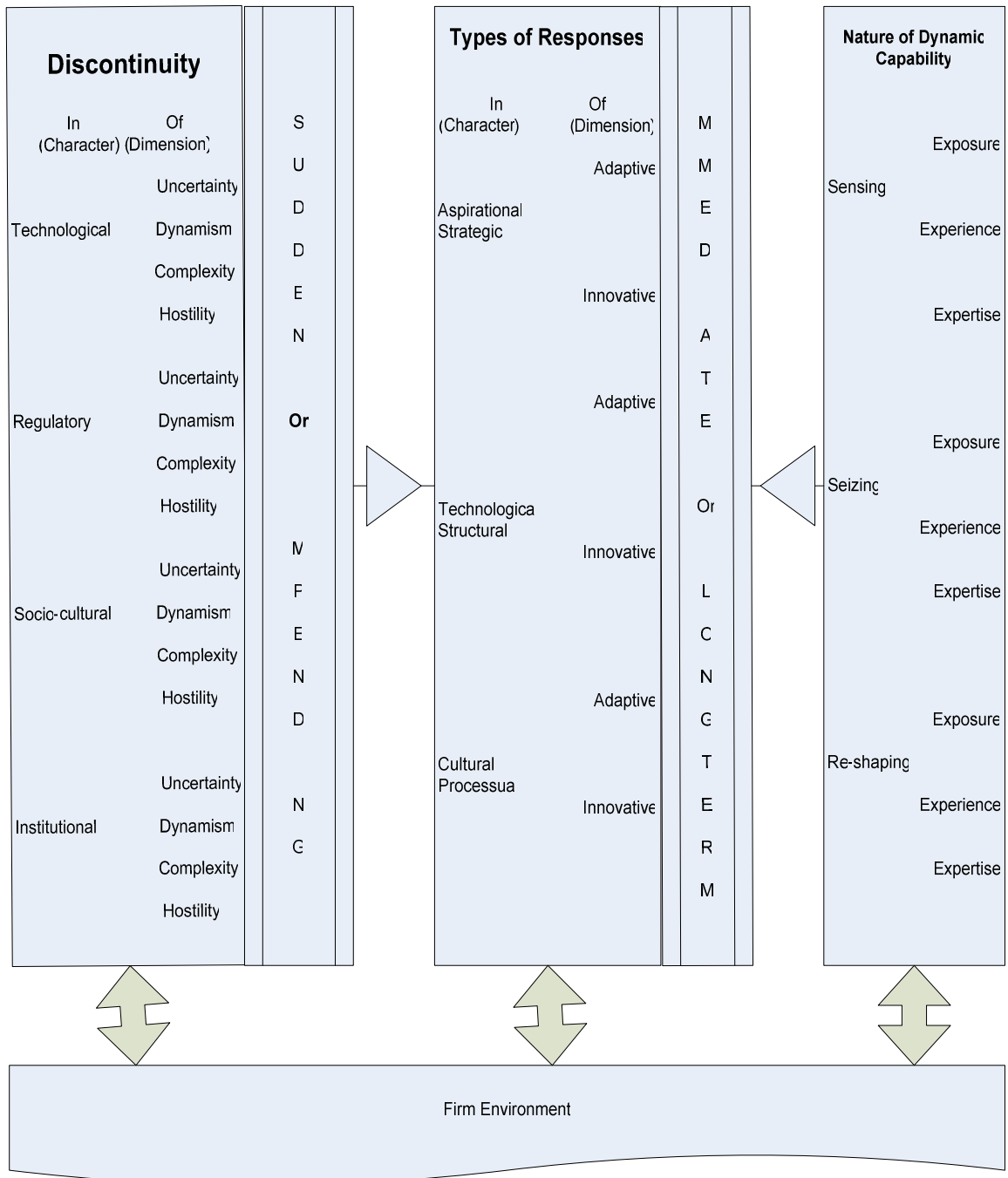
This paper suggests that firm has to depend on a 'portfolio of capabilities' to respond to specific environmental developments like discontinuity. This is because, the response is anticipated, crafted, and implemented by the firm as an integrated action (see Annexure I). Sensing of scenarios, opportunities, and resources gives the firm ability to respond better. 'Sensing' in discontinuity encompasses the abilities of scanning environment, anticipating the impacts on the ecosystem, creating scenarios of new reality, comprehending the opportunities and threats, interpreting the larger cues, and calibrating resource availabilities. Scanning in discontinuity faces either ambiguity or non-availability of information. Anticipating multiple impacts lead to complexity of decision making possibilities. Comprehending the new scenario would face conflict in aspirations and involvements. Sensing would thus definitely require making a macro level understanding of resource requirements with a micro view of contribution of existing capabilities. It is important to make a choice of possible response through seizing type of technology, organization, and cultural unity. 'Seizing' captures strategic choice of options concurrent to the new boundary and aspiration drawn, with a rationale of managing complementarity and co-specialization (Teece, 1997) possibilities in the discontinued environment. Seizing capabilities would necessarily balance the drive of aspirations with realities of environmental offerings, especially in a discontinued situation. Re-shaping includes the ability of managing assets, structures, processes, routines with new asset orchestration, innovation, and governance structures. The micro-foundations of these dynamic capabilities responding to discontinuity find their base in its existing aspirations and value bases, historical endowments of experience, exposure, and expertise.

Based on the above discussion a framework of interrelations is designed to enable the investigation of firm's response to discontinuity. The framework is further illustrated with two cases in next section. In the framework discontinuity is related with firm response with an assumption that discontinuities initiate responses of different types. As discontinuity relates to suspension of one environmental character or dimension, it captures the



classifications into technological, regulatory, socio-cultural, and institutional based on existing literature. The environment qualifiers which relate to these characters in identifying types of discontinuities in firm ecosystem are identified from existing research base and listed as uncertainty, dynamism, complexity, and hostility. These specific developments are further characterized in terms of its timing like sudden or impending based on the preparedness and ability of recognition for a particular discontinuity. The classifications are detailed in the framework and captured within a broad conceptual subsection. The framework relates discontinuity and firm response with a unidirectional arrow confirming the antecedent and successor relationships. The types of response being aspirational, strategic, technological, structural, cultural and processual with qualifiers like adaptive and innovative depending on nature and involvement. The framework also identifies the role of dynamic capabilities in the form of sensing, seizing and re-shaping. The dynamic capability is related with firm response with a reverse arrow, allowing propositions that responses are enabled by dynamic capability and their nature. The framework appreciates the importance of top management in developing and deploying these capabilities with domain expertise, management experience, and exposure to similar developments in the past. The framework is described as an open system of dynamic interrelationships where discontinuity, firm response, and dynamic capability are connected with firm environment through two way arrows. The framework re-emphasizes facts like continuous interaction of firm and the environment through their demands and commands. The intensity and direction of demands and commands are captured by the relative bargaining power of environment and firm within the eco-system. The multiplier effects create further discontinuities of different types at different times in the ecosystem building uncertainties much more complex.

Figure1. Conceptual framework for Investigation of Interrelations in Firm response to Discontinuity



#### **4. Illustrating the Framework**

In this section two case studies are presented in enabling to illustrate the framework of interrelations in the context of discontinuity. The cases are from the printing industry where the old heavy iron based printing technology was giving way to digital printing and entertainment industry where PVC as medium for recording music and playing back was giving way to magnetic medium. In one case the firm involved was anticipating the discontinuity and preparing itself for change. It had to learn and unlearn in a punctuated fashion. In the entertainment industry the firm could not anticipate the speed of discontinuity and hence was ill prepared to respond. Both cases put together provide very significant insights into the content and processes in response to discontinuity.

##### **4.1 R. R. Donnelley & Sons: The Digital Division**

R. R. Donnelley & Sons (RRD) experience (Garvin and March, 1996) in dealing with impending discontinuity is a reflection of an entrenched firm faces difficulties in responding to impending discontinuities. The firm anticipated the development of digital printing and began making changes. RRD was founded in 1864 in Chicago as a family run printing house. By 1995 it had become world's largest printer with 41000 employees in 22 countries. RRD went public in 1956. The main customers of RRD were telephone companies, direct mail merchandisers, retail houses who require large scale printing for their business. In late nineties RRD had eight business groups with 38 divisions. The main technology used in printing for high volume works are gravure press and offset printing. RRD used to have long term contractual orders from its loyal customer bases. The traditional print business was based on high fixed cost (of machineries and accessories) and low variable cost. The entry barrier in high volume printing was due to its nature of high fixed cost. RRD had its market share higher more than next nine competitors put together. The scale of its network and volume of business across the world spoke about its absolute leadership in this sector.

In late nineties technological development was noted. The customer also began demanding customized products. A customized product with relatively small quantities to be delivered at the doorsteps of customers in limited period of delivery time was the need captured by the leading players. The new capabilities required satisfying customers like Microsoft, IBM, and other IT sector companies were speed, simultaneous global distribution,

and revising materials quickly. The sharply rising postal rates, paper costs and delivery charges put pressure on cost side. A major change in office computing facilities created new opportunities in printing and its distribution facilities. The desk top publishing became popular due to its flexibility and speed (technological discontinuity). Film less printing technologies like digital four color, computer to plate were gaining momentum in printing horizon. The flexibility, reduced cycle time and customizing facilities helped to grow the digital printing presses during the same time across the world. Initial investment came down and huge alliances appeared in industries to give big fights to the larger printing presses with less fixed investments and networks of small printers. In 1995 digital growth was forecasted like 16% annually, while traditional printing was growing 3% annually. RRD read the lines of emerging competition with differentiated technology platform and reacted boldly forming a new division called 'digital division' to focus (seizing opportunity) on new technology. This ensures sensing of an impending discontinuity and being prepared for it. RRD restructured the divisions (structural response) and introduced new information architecture (technology response) having connection with upstream players like content owners, and down stream customers (cultural response). RRD virtually became an electronic ware house and distributor with critical ability to print on demand (strategic response). In the new infrastructure facilities, data files were received and stored in data bases and copies were made on particular demand from any store. It reduces 60% cost of publishing by print on demand in any corner of the world and made supply within 24 hours. The economy comes in the way that cost per copy is independent of run length, and customized delivery is possible. Total cycle time came down from twenty days to two days. RRD created a venture capital fund (structural response), new print related technologies and ensures digital future. One team of technologists was put to review economic and technical validations of new venture (structural response). In 1994 seven teams were put in action to reengineer the process of corporate center. The new teams devised new processes (processual response) guided by the objective of greater speed, improved financial data and checkpoints for better effectiveness. The opportunity in the differentiated demand (socio-cultural discontinuity) than existing huge printing facilities created another discontinuity in printing technology (digital printing). The response of RRD was very timely to get into new business format with adapting new technology platform and re-confirm its leadership in the printing industry. The capability of

sensing the direction of new printing technology led early capturing technology and knowledge base (seizing) for new platform. The capability of re-shaping its resource base reflected in building its network all over the world and delivering the value to the customer base was in line to the framework. The response was made in changing its structure, culture, processes in adapting new technology through exposure in new technology platform. The dynamic capability of sensing the problems early helped to seize the option for technology development and trial in small market and finally seizing opportunity through resource re-orientations. It is to be appreciated that the re-organization was not that easy as it had its huge customer base and delivery mechanism based on a particular technology platform. The internal organizational processes of creation of smaller units, making the trial for new technology, getting right people for new technology and convincing internally as well as externally of building new capabilities were critical in facing technological discontinuity.

#### **4.2 Gramophone Company of India Limited**

Gramophone Company of India Limited (Budhiyaraja and Athreya, 1996) is a classic representation of a firm facing multiple discontinuities like regulatory, technological, socio-cultural, and institutional. This case demonstrates a struggle to respond to the discontinuities leading to a near closure of the company. It failed to anticipate developments in the horizon, once realized threats could not make response to that. Gramophone Company India Limited (GCIL) was established in 1901 as a trading organization and started manufacturing gramophone records in 1907. Till 1970 in India, they were the sole manufacturer of that kind of records. GCIL had three manufacturing facilities (two at Kolkata, and one at Mumbai). GCIL was the first overseas branch of Electric and Musical Industries Limited (EMI), London. In 1968, the company went public with 40% foreign holding conforming to Foreign Exchange Regulation Act (FERA) act 1976. Company has seen a phenomenal sales as well as profit increase during sixties and seventies. It started its consumer electronics products division in 1960 to provide lower end record players to increase the use of records in India. It became the household name for entertainment through music in India. During seventies, there was discontinuity in technology of music listening. The use of long playing records virtually came down due to different reasons of convenience and new technology in music systems. Cassette players and recorders during this time came in to market heavily

(discontinuity led opportunities towards cassette players and recorders). The competitor companies like 'Philips', 'Sony' came heavily in cassettes and recorders.

GCIL had no option than to open music cassette division with a licensed capacity of 1.2 million per year with some export obligation. GCIL was late in making that response. As a result, GCIL faced huge competition of small operators who copy film songs in low quality music cassettes and sold it in the market. This was a very good example of how technological discontinuity led the other institutional discontinuities. Some of the operators like T-series made their business model on selling low prices film music songs. GCIL faced huge losses from consumer electronics and cassettes divisions. GCIL tried to outsource cassettes to manage low pricing, but caught in quality complaints from the customers. It demonstrated the failure of sensing the problems early and make multilevel response to discontinuity. The response dilemma of GCIL could easily be attributed to the inability to sense of building new capability and absence of flexibility in unlearning. The demand of records went further lower in the face of cheaper cassette competition. The then copyright act helped other cassette manufacturers to produce and sale in Indian markets like T series, Venus, Tips etc. The entire music entertainment market was flooded by prerecorded cassettes, while GCIL could not change with time and new technology up gradations (regulatory discontinuity). GCIL was taken over by RP Goenka group (RPG) and operated in the direction of utilizing existing asset bases but lost ground in its core business of records and cassettes. This could be inferred as GCIL misses opportunity in identifying technological changes in the horizon, gets caught through competition from complete different platforms. GCIL faces regulatory discontinuity like section 52 of copyright act which allowed competitors to use same music by different singers and once again failed to respond to this. GCIL fail to sustain in piracy boom and got closed in 1991-1992. Complete absence of dynamic capability of sensing developments in the horizon made handicapped to seize the opportunity of different technology platform and business as a whole.

### 4.3 Discussion

The discussions on above two cases confirm identifying types of discontinuities and abilities of response by the firms. They also confirm impact of discontinuities at multiple levels with uncertainties of resource relevance (RRD case), failure of apt and timely response

(GCIL case) leading to sustenance issues. The GCIL case is a good example of multiple discontinuity and challenges to sustaining its relevance over time. GCIL fails respond in time in changing technology base and compete in the market. This is evident in lack of sensing abilities in GCIL. As it does not sense well, it fails to identify the options available to them and finally seize any opportunity in the development. It fails in going to exposure to developments and having lack in expertise and required experience to face the environmental challenges. The evidences of different discontinuity patterns like technological (digital printing, music cassettes), regulatory (music patent act, copyright protection acts), socio-cultural (using tape recorders, buying cheap cassettes), and institutional (Gulsan Kumar T-series cassette company) are evident from two cases. RRD's anticipation and forming digital division or GCIL's inability to identify discontinuity in horizon and respond to the challenges become good examples of failed responses. Sensing the change, seizing the opportunity, and shaping (re-configuring) came out strongly from the discussed cases. These cases also demonstrated adaptive response (RRD case), through capabilities of sensing scenarios and preparing for response. The conceptual framework is built on different possibilities of relationships at different levels. The broad level of propositions made through this framework of environmental discontinuities (of the nature of technological, regulatory, socio-cultural, and institutional) triggers responses (aspirational, strategic, technological, structural, cultural, and processual) by the firms which are enabled by dynamic capabilities (of sensing, seizing, and reshaping) depending on the environmental supports and complementarity. This paper posits the following propositions based on the understanding of the conceptual development of the framework and illustrations of two cases.

*Proposition1. Environmental discontinuity having particular character would lead to multiple discontinuities of different dimensions through eco-system impacts*

*Proposition2. Earlier the firm senses the character of discontinuity and related impacts on eco-system based on the dimensions the better would be the choice of timing and response*

*Proposition3. Earlier the recognition of the discontinuity as sudden or impending makes the firm better prepared for the response*

*Proposition4. Better sensing capabilities for identifying opportunities by the firm would lead to better preparedness for multiple responses*

*Proposition5. Better Seizing capabilities in making choice by the firm would lead to effective response facing multiple discontinuities*

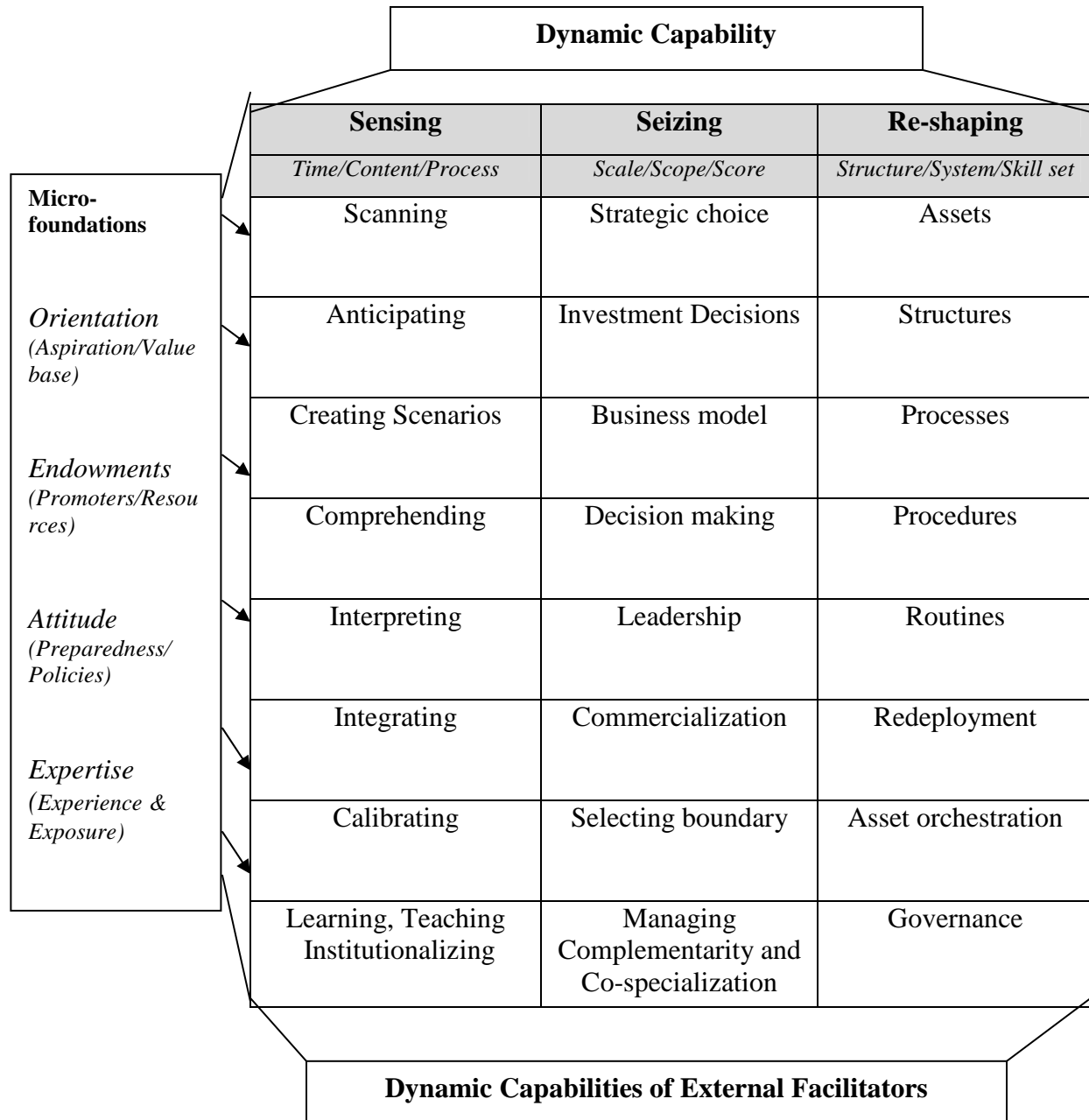
*Proposition6. Better capability of re-shaping through asset reorientations by the firm would lead response effectiveness of the firm facing discontinuity*

## **5. Conclusion**

This paper attempts to focus on discontinuity as a specific development in the environment. It begins with defining the term and discusses on classification of discontinuity. It explores types of responses by the firm and their uniqueness in specific situations. It extends the discussion in identifying the capabilities enabling those responses. The dynamic capabilities are deconstructed and appraised on their respective contributions through illustrations. This paper also offers a comprehensive framework of interrelationships with a set of propositions establishing the conceptual developments. It remains to the future researchers to investigate and evaluate relationships conforming, extending and making modifications of the proposed framework.



## Annexure I

**Dynamic Capability Facing Discontinuities***(Captured conceptualization of Dynamic Capability from Teece, 2007)*

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