Path dependency and Path Creation: Exploring the Possibility of Integration

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Abstract

There is a need to analyze the theories that can explain the identified patterns of change and development over time. Path dependency and path creation models have been generally used in this context. This paper takes an overview of the path dependency and path creation debate by reviewing the relevant literature. The paper initially focuses on the various definitions and general characteristics of path dependency with a purpose to highlight different viewpoints on this concept. Special attention is given to the relation between path dependency and historical institutionalism to bring forth the importance of temporal dimension of public policy making and management in understanding the effectiveness of various policies and management

techniques. The paper also discusses various important issues in path dependency debate including the role of initial conditions and triggering events, contingency, feedback mechanisms, inefficiency and change. The paper then analyzes the path creation model. Finally, the paper examines the differences between the two models and stresses the need for exploring the possibility of integrating the two for developing a more comprehensive framework for comprehending change in organizations.

Introduction

The usefulness of path dependency (PD) concept in analyzing policies and organizational change cannot be overstated. It not only helps in understanding the durability of the whole system or particular organizations but also helps in comprehending change over time. Moreover, PD incorporates the notion of sudden changes in relatively long paths. The extensive usage of PD in explaining change and development has generated much debate on its primary assumptions and critical ideas like path creation (Vergne and Durand, 2010; Garud, Kumaraswamy and Karnoe, 2010). In this paper the two apparently contrasting concepts of path dependency and path creation have been reviewed and the need for integrating them is explored.

Definition of Path Dependence

Path dependence has been conceptualized in broader and narrower sense. In broader conception, a temporal sequence is path dependent when preceding

events have causal link to the subsequent events. According to William Sewell (1996), path dependence implies "that what happened at an earlier point in time will affect the possible outcomes of a sequence of events occurring at a later point in time" (as cited in Pierson, 2000). This is a loose definition pointing only to the common assertion in social sciences that “history matters”. Based on this conception that earlier events influence later events, many scholars have loosely used PD to build up their arguments. Nooteboom (1997) uses the same approach when he suggests that organizational evolution "is path-dependent in the usual sense that directions for future development are foreclosed or inhibited by directions taken in past development."

In narrower sense, Pierson (2000) suggests that a process becomes historically or temporally path dependent when the events occur in a self reinforcing sequence. These are positive feedback processes because once a path is chosen it becomes relatively beneficial to move along the same path or relatively expensive to exit that path over a period of time. David (2001) defines “processes that are non-ergodic, and thus unable to shake free of their history, are said to yield path dependent outcomes” or “a path dependent stochastic process is one whose asymptotic distribution evolves as a consequence (function of) the process’s own history”. According to Vergne and Durand (2010) path dependence is “a property of a stochastic process which obtains under two conditions (contingency and self-reinforcement) and causes lock-in in the absence of exogenous shock”. Douglass North (1990) puts it: path dependency is a process that restricts future choices “At every -

step along the way there are choices – political and economic – that provide…real alternatives. Path dependence is a way to narrow conceptually the choice set and link decision-making through time. It is not a story of inevitability in which the past neatly predicts the future".

General Characteristics of Path Dependence

Arthur (1994) has identified the key characteristics of increasing return processes. According to him these processes are unpredictable, inflexible, non-ergodic and potentially path inefficient. Thus in such processes, initial events are highly influential and random so that ending state cannot be predicted before time and as we go farther switching to other alternatives becomes difficult. Also accidental or chance events cannot be ignored as they help shape future decisions and eventually the locked-in outcome may yield lesser benefits than the alternatives forgone earlier. Pierson (2002) has added sequence as a critical feature of these processes because different sequence of events may lead to different outcomes. So history does matter in these processes. Thus there are certain particular features of path dependent historical processes. "First, *when* a particular event happens in a sequence is very important, because small events early in a sequence can have disproportionately large effects on later events. Second, during the early stages of a sequence– what can be understood as the critical juncture – things are relatively open or permissive but get more restrictive as one move down a path. Third, as one moves further down the path change becomes bounded" (Deeg, 2001). Thus PD starts with an assumption of multiple

equilibria which implies that various alternatives as to the choice of the policy or institution or even technology exist at the beginning. Secondly, contingent events play their role in establishing the selected alternative and finally the feedback mechanisms play their part in reproduction of the PD system and causing the lock-in. So after a phase of production, there is a phase of reproduction where the feedback mechanisms create an inertial state and lead to a lock-in of the path dependent process (Greener, 2002a).

PD can be described as consisting of three major phases. The first phase is of critical juncture in which events initiate movement on a path out of different possible options. The second phase is of reproduction in which movement along the same path is reinforced by positive feedback mechanisms. In final phase, the path comes to an end due to certain new events. So every path initiates and ends with a critical juncture or punctuated equilibrium (Pierson, 2000). Mahoney (2000) further elaborates it "that path dependence characterizes specifically those historical sequences in which contingent events set into motion institutional patterns or event chains that have deterministic properties. The identification of path dependence therefore involves both tracing a given outcome back to a particular set of historical events, and showing how these events are themselves contingent occurrences that cannot be explained on the basis of prior historical conditions". In Mahoney's model of PD, these three basic elements can be identified. First is that the initial conditions are significant. Secondly, the "early historical events" are contingent and thirdly the subsequent events have inertial capacity. The contingent character of initial events and the critical

juncture are therefore an essential part of Pierson and Mahoney conception of PD.

Sydow, Schreyogg and Koch (2009) have characterized these three phases as pre-formation, formation and lock-in phase. Pre-formation phase consists of an open situation in which choices are made not from scratch but are built on historical framework. The initial choices are not de-contextualized. They rather reflect the routines, rules and culture of the organization. As David (1994) notes that the institutions are “carriers of history”, these initial choices are restricted by institution’s historical imprints. Thus they are less random but the non linearity of PD never makes them the causal determinants of the final outcome. These initial choices trigger self-reinforcing processes that can be regarded as critical juncture and mark the end of pre-formation phase. “These junctures are critical because once a particular option is selected it becomes progressively more difficult to return to the initial point when multiple alternatives were still available” Mahoney (2000). Wilsford (1994) suggests “Conjunctures are the fleeting comings together of a number of diverse elements into a new, single combination. Being fleeting, in the grand scheme of history, conjunctures may change quite rapidly”. In formation phase the organizational path slowly starts taking shape. The possible alternatives narrow down with an increasing pull to the adopted path. With the passage of time it becomes difficult to turn around. Decisions made in this phase are still contingent and non-ergodic. Positive feedback or increasing returns constrain the possibilities of switching to other choices.

The third phase of lock-in is characterized by the fixation of the dominant decision pattern. The alternative adopted contingently in the phase of critical juncture is subject to reinforcing mechanisms and becomes locked-in due to elimination of other options. Because of contingency factor, the result of a path dependent process cannot be predicted exclusively from the initial settings. The system cannot get out of this situation endogenously"(Vergne and Durand, 2010). This lock-in causes potential inefficiency as the system "loses its capability to adopt better alternatives" (Sydow *et al,* 2009). The prevalence of QWERTY keyboard in the presence of more efficient alternatives is a relevant case in this regard.

Path Dependency and Historical Institutionalism

PD has been used within institutional framework mainly in political studies. According to Raadschelders (1998) "whatever the discipline…contemporary neo-institutional analysis has one feature in common: the notion of path dependency" (as cited in Kay, 2005). The idea is mainly connected with historical institutionalism and is the most significant characteristic of this school of thought (Thelen 1999; Hall and Taylor 1996). Pierson and Skocpol (2000) maintain "Without the kind of attentiveness to temporally specified process that is a distinctive hallmark of historical institutionalist scholarship, important outcomes may go unobserved, causal relationships may be misunderstood, and valuable hypotheses may never receive consideration". PD has special attraction for historical institutionalism as it highlights string of events in which means that generate a particular set of institutions are

substituted by means that reproduce them. In doing so, it makes the reproduction of institutions a function of these following mechanisms that shape the interest of the actors. So it puts institutions before the individual actors (Schwartz, 2004).

Historical institutionalists consider time as an important element in developing explanations of significant outcomes by incorporating sequences, transformations and evolution of processes over time. “Historical institutionalism embraces the idea that individuals act within institutional arrangements, the present structure and functioning of which are understood only partially when not embedded in a historical perspective” (Kay, 2005). “Institutions evolve in response to changing environmental conditions and ongoing political maneuvering but in ways that are constrained by past trajectories” (Thelen, 1999). Thus path dependency draws its basis from neo institutional approach to organizational theory.

Hall and Taylor (1996) have defined institution as “the formal or informal procedures, routines, norms and conventions embedded in the organizational structure of the polity or political economy. They can range from the rules of a constitutional order to the conventions governing trade union behavior or bank–firm relations. In general, historical institutionalists associate institutions with organizations and the rules or conventions promulgated by formal organization”. Thus the institutions can be at the constitution or policy individual level. It is important to identify which institutional level is path

dependent (Kay, 2005). For example, Holzinger and Knill (2002) analyzed path dependency of institutions at the EU constitutional level (Kay, 2005).

PD has been widely used in comprehending developments at public policy level where this concept has formed the basis for explaining problems in implementation of change or reform. “The path dependency approach focuses on theorizing how policy can become so institutionalized and historically embedded that it becomes nearly impossible to break free from the established policy path” (Greener, 2002b). “ Recent examples of the use of PD to understanding policy development include health care policy in the US (Wilsford 1994) and the UK (Greener 2002); the reform of housing benefit in the UK (Kemp 2000); to UK pension policy (Pemberton 2003); and the Common Agricultural Policy (CAP) of the EU (Kay 2003)” (as cited inKay, 2005). Wilsford (1994) maintains that the institutional reforms in health sector are path dependent for the reason “actors are hemmed in by existing institutions and structures that channel them along established policy paths”. In comparative analysis of American, German, French and British health Care system, Wilsford (1994) has highlighted the importance of structure in PD. The decentralized American political system with relatively autonomous decision makers requires a strong conjunctural element for change. In contrast, German, French and British system are more centralized, hierarchical with agents having relatively less autonomy. These countries have been able to implement big reforms and switch to new paths when the status quo becomes less desirable. Thus centralized political systems can start a new path provided they have made a decision to do so and this

decision requires a conjuncture, may be of a lower intensity. But this does not mean that the movement to a fresh trajectory is always good particularly when the existing path is desirable.

Historical institutionalism approach to PD is characterized by its focus on critical junctures and policy feedbacks. Critical junctures involve “crucial founding moments of institutional formation” that set different paths of development for different countries and are used as the basis for tracking the origin of variations among different nations (Thelen, 1999). Literature on critical junctures has focused on the timing and sequence of political and economic processes and their impact on institutional formation and growth. Ertman’s *Birth of the Leviathan*, is an important work on critical junctures. In this classic study, the origin of state institutions across different European countries is traced from twelfth to the eighteenth century. Ertman maintains that the nature of state institutions across the continent toward the end of eighteenth century can be accounted for largely by the difference in the beginning time of long term geopolitical competition. The study highlights the interaction between common international forces and political developments at domestic level. The countries faced with early geopolitical competition provided concessions to merchants, financers and administrators who favored bureaucracy thus leading to patrimonial systems. In contrast, nations facing this competition later had more developed education and finance thus resulting in greater bureaucratic autonomy (as cited in Thelen, 1999). Other similar studies like Collier and Collier (1991), Ikenberry 1994) and Gerschenkron (1962) involve analysis of temporal sequences with particular

attention to the crucial events that set different patterns of development across different nations. These events are critical because they had effects that were difficult to reverse (as cited in Thelen, 1999).

However, these studies on critical junctures have not given sufficient attention to the mechanisms that reproduce the selected institutional form. This issue has been answered in policy feedback literature. Ikenberry (1994) has identified two major types of feedback mechanisms. The functional mechanisms mainly include incentive structure or coordination effects. Various studies have shown that the existence of a particular institutional framework, regulatory structures or developmental policies can influence the firm's strategies and in turn reinforce this institutional form. The second feedback mechanism is related to the distributional effects of institutions. Certain political arrangements and power distribution reinforce particular institutions while limiting others (as cited in Thelen, 1999).

Initial Conditions and Triggering Events in Path Dependency

It is vital to discuss the part of initial conditions in PD. Some literature on PD indicates high sensitivity of the subsequent events to initial conditions in a causal sequence (Liebowitz and Margolis, 1995). Paul Pierson (2000) notes, in a path-dependent pattern "earlier parts of a sequence matter much more than later parts, an event that happens 'too late' may have no effect, although it might have been of great consequence if the timing had been different". Mahoney (2000) maintains that initial conditions does matter and uses

Arthur's discussion of Polya Urn experiment as a classic example to support his argument. In filling an empty urn with colored balls, after the random selection of the first color the probability of selection of subsequent colors depend on the proportion of colors in the urn. According to Arthur the colors selected in first few rounds determine the ultimate composition of the urn as the proportion of colors converge on a fixed point based on mathematical probabilities. But at the same time Mahoney (2000) notes that "early historical events are contingent occurrences that cannot be explained on the basis of prior events or initial conditions". Goldstone (1998) suggests "Path dependence is a property of a system such that the outcome over a period of time is not determined by any particular set of initial conditions. Rather, a system that exhibits path dependency is one in which outcomes are related stochastically to initial conditions". In other words, the possibility of determining the final outcome from initial conditions is ruled out. Due to the stochastic nature of the path dependent processes, PD can lead to a large variety of outcomes and initial conditions cannot determine which equilibrium will dominate.

Another related issue to initial events is that whether these are small or big events. Arthur (1994) maintains that these initial choices are "small events" which can lead to unintentional and long lasting consequences. This point can be supported by the famous "butterfly effect" where a small event like the flap of a butterfly's wings starts a chain of events that can cause a large scale change in the system like a tornado. Mahoney (2000) and Pierson (2000) also stress the role of small events in producing large, long term and inefficient

consequences. Pierson (2000) says “large consequences may result from relatively small or contingent events”. This assumption of smallness is based on certain logic. PD distinguishes the mechanisms of production from mechanisms of reproduction in terms of Stinchcombes’s (1968) historical causes and new constant causes. If the initial events are of larger magnitude then they will remain the primary source of reproduction also and in Stinchcombes’s terminology the historical causes would then become the constant causes thus eliminating PD’s distinction between mechanisms of production and reproduction (as cited in Schwartz, 2004). This assumption of smallness has been questioned by many scholars. Schwartz (2004), for example, sees that this assumption detaches small causes from the structural causes that not only influence the outcome but also make these small causes relevant to the situation. No institutional form exists independent of others. The selection of an alternative, the development of an organizational form or technology does not take place in isolation. The structural forces can influence the outcome in much larger way than incorporated in PD. Some literature shows that considering the organizations as social systems the initial events may not be so random and small. The dominance of VHS technology was the result of a major agreement between Matsushita and big Hollywood studio, an event that was not small and random. So PD can occur even by big events or strategies (Sydow *et al,* 2009). The important point here is that whether these are big or small events, they cannot determine the final outcome because of the non-linear assumption of PD.

Contingency in Path Dependency

The next question should be what contingency is in PD model. Arthur (1989) maintains that contingency means unpredictibility and randomness. He suggests that these historical events are outside “the ex-ante knowledge of the observer - beyond the resolving power of his 'model' or abstraction of the situation”. Mahoney (2000), however, considers that these initial events are not totally chance or without prior causes. But these may be particular events such as the assassination of a political leader or individual’s choices that cannot be accounted for by established theories or these may be big events like natural disasters or market failures that cannot be completely predicted. “Analysts may also treat an outcome as contingent if it contradicts the predictions of a particular theoretical framework specifically designed to account for this outcome”. Contingency is the hallmark of selection processes during critical juncture period. It entails that the selection of a particular alternative cannot be determined by initial conditions or through an established theoretical framework. The adoption of one alternative out of many possibilities is therefore a contingent event in PD. Mahoney (2000) further elaborates that “social analysts will consider an event to be contingent when its explanation appears to fall outside of existing scientific theory”. This contingency in initial selection processes makes PD different from the neoclassical economic theory that considers knowledge accumulation as the guiding factor. It is because of the contingency factor that the path dependent processes are considered unpredictable and inefficient. But it is hard to show that the initial alternative in a path dependent process is contingent. Thus in

using the initial lead argument to explain the selection of VHS over Betamax, it has to be justified that the initial lead was contingent. Vergne and Durand (2010) maintain that it is difficult to verify the contingency assumption. Even in falsifying it, one needs to show that the adoption of one alternative over another is due to some differences in these alternatives. They cite Arthur's (1990) argument for the victory of VHS over Betamax to explain this falsification. Arthur (1990) makes the two technologies similar in terms of their price, entry time in market and early share of the market. He notes that in the presence of these similarities the final selection of VHS can only be accounted for by a conditional lead reinforced by rising returns (as cited in Vergne and Durand, 2010). This explanation, however, has been criticized by Liebowitz and Margolis (1995) who have brought forth another property of VHS, namely longer recording time, which could possibly account for the prevalence of VHS.

Feedback Mechanisms in Path Dependency

The second phase of reproduction follows from self-reinforcing processes. The path becomes more deterministic as the "institutional reproduction is explained by mechanisms derived from predominant theories" (Mahoney, 2000). The important issue here is that what these feedback mechanisms are. Some scholars consider increasing returns as the focal feedback mechanism. Pierson (2000) suggests that movement along the same path takes place due to what he calls increasing returns. Thus for processes to be path dependent increasing returns must exist as they allow for many possible outcomes and

make the small events significant by tipping the system into the selected alternative (Arthur, 1989). In a series of papers Arthur (1989, 1994) has stressed the role of “increasing returns to adoption”. He has identified four characteristics of a technology and its social environment that leads to increasing returns, namely, fixed costs, learning effects, coordination effects and adaptive expectations (Arthur, 1994). The first characteristic is large setup or fixed costs. As the size of production rises, the fixed costs get distributed over larger units leading to higher returns. Moreover, with huge setup costs organizations and individuals have the incentive to stick to that single option. The second characteristic is learning effects. According to the learning effect theory the more frequently an action is carried out the more efficiency will be achieved by repetition (Sydow *et al,* 2009). The actors become more skillful and knowledgeable and do the task speedily and accurately, thereby, reducing average cost per unit of output. This in turn reduces the attraction of other “learning sites where the actors have to start from scratch” (Sydow *et al,* 2009). However, sometimes this too much focus on the selected alternative may force the organization to ignore other opportunities. Miller (1993) suggests that this positive feedback mechanism can lead to unintentional simplicity and finally “turns into a monolithic, narrowly focused version of its former self, converting a formula for success into a path toward failure” (as cited in Sydow *et al,* 2009). The third characteristic is coordination effects. They are based on the advantages gained from rule-guided behavior. As more actors stick to a particular rule, more efficiency is derived from the interaction of these actors because others’ behavior becomes more predictable leading to reduction in coordination costs

(North, 1990). Thus coordination effects occur due to the benefits of engaging in the same activity or rule to which others want to conform. Similarly, if there are network externalities involved in the use of a technology, then more people will adopt it. These coordination effects become prominent particularly when the technology is compatible with the linked infrastructure (Pierson, 2000). The fourth characteristic is adaptive expectations. “This mechanism is operative when actors *expect* other actors to adopt a particular option (follow a particular path) so the first set of actors adopts that option in order not to be left behind” (Deeg, 2001). Here, it is assumed that actors’ preferences change in response to the expectations of others. The more actors are expected to choose a particular option, the more attractive that option becomes.

Mahoney (2000) has grouped the above four factors in a ‘utilitarian’ explanation of institutional reproduction. The basic assumption of these feedback mechanisms is that in the choice and the reproduction of an alternative the agents are guided by their interest. But he sees limited applicability of these outside the marketplace. He therefore has included political authority or power as another factor that can push the movement along the same path. Pierson (2000) has also accepted it as a possibility. Another feedback mechanism is legitimacy because as the actors accept something as appropriate and legitimate others are also encouraged to do the same (Deeg, 2001). In his later work, Arthur (1994) has proposed increasing returns in “spatial location of production”. The areas that became the center of economic activity early on attract the subsequent economic actors and influence their location decisions. Based on this argument, the development

centers of specialized economic activity like the Silicon Valley has been explained (Pierson, 2000). North (1990) has extended the existence of these increasing return characteristics identified by Arthur (1994) to institutional development. He maintains that PD occupies a significant place in explaining institutional persistence as well as change. Moreover, it is not one institution which experiences increasing returns but also "complementary configurations of organizations and institutions" where action of one is influenced by the presence of others. Deeg (2001) has applied this argument to the German financial system as working of banks, insurance companies, stock exchanges, tax laws and regulations is interrelated.

Other literature on PD suggests that increasing returns are significant but not the only mechanism that leads to PD. Arrow (2000) maintains that even without increasing returns, PD can occur due to sunk costs or "irreversible element to capital formation" and sequence of the events. Most work on PD involves increasing returns but with a subtle element of irreversibility. To support his argument he has utilized Veblen's study of rise of Germany to industrial power (1915). According to this study, even though a late comer in industrial development, Germany surpassed Great Britain by virtue of being the follower. Great Britain used narrow gauge railroads and built equipments to carry freight from railroads to ships. Later technological developments showed that standard–gauge railroads were more efficient. Germany developing later adopted this technology. Britain could not make use of this available technology as it had already invested too much in narrow-gauge technology that made it difficult to replace. Thorstein Veblen (1915) mention

the "silly little bobtailed carriages" as a case of how industrial development may be restricted by "the restraining dead hand of … past achievement".

Veblen's analysis provided the base for considering technical and institutional interrelatedness as important feedback mechanisms in PD and became the foundation of David's early vision on path dependence. David (1985) showed “technical interrelatedness, economies of scale, and quasi-irreversibility of investment” as the key characteristics of “QWERTY-nomics”. Type writers in 1890s became an important part of a technically interrelated system that involved the manufacturers, buyers, the typists and the typing training organizations. Also “touch” typing technique invented in 1880s was compatible with QWERTY keyboard right from its inception. The typing schools and manuals provided instruction in eight-finger "touch" typing first for QWERTY. The accessibility of skilled typists provided an impetus to the potential employers to buy QWERTY keyboard which in turn stimulated the budding typists to learn QWERTY. Thus the cost of typewriting system, founded on QWERTY, generally tended to decline as it gained dominance over other systems. These positive returns increased QWERTY's market share until it became the de facto standard keyboard. The lock-in of QWERTY also resulted from higher conversion costs of the software and “quasi-irreversibility of investment” in typical touch typing skills. Thus the sequence of development of events made it profitable for the system to make machines as per the requirements of the humans rather the other way around. So as scale of production increased QWERTY keyboard production yielded economies of scale as fixed cost got distributed among larger number of units.

Kay (2005) has identified certain other factors that can lead to PD. These include sunk costs, policies enabling certain groups and constraining others, change in administrative infrastructure through investment or disinvestment and the establishment of formal and informal contracts with individuals (as cited in Pollit, 2008). Greener (2005) has identified that a path dependent system is produced "where both structural and cultural vested interest groups are dependent upon one another to hold power". PD theorists "draw on functional, utilitarian, political and cultural arguments to explain institutional genesis and persistence" (Thelen, 2003). Certain literature shows that movement along the same path is reinforced due to the mechanism that makes other choices less attractive (Page, 2006; Kay, 2005; Arrow, 2000). In case of QWERTY keyboard, "learning loops for users" not only increases the attractiveness of QWERTY but also makes other alternatives less desirable due to the time required to acquire the typing speed of an skilled user on a new type of keyboard (Vergne and Durand 2010). Therefore powerful self reinforcement requires "at least one negative externality" to lower the attractiveness of alternate choices (Vergne and Durand, 2010).

Inefficiency Issue in Path Dependency

Lock-in of inefficient outcome in PD has been much debated. For some scholars the question of inefficiency is open and empirical (Hay and Wincott, 1998) whereas some believe that PD involves the inception of more suitable and rational organizational forms or policies (Greener, 2005). However, it is

generally claimed that the locked-in outcome/ policy/institutional form is inefficient. This is a strong theoretical claim and can be supported through the counterfactual analysis of the situation showing that another efficient alternative could have been achieved had there been no PD. Kay (2005) has cited the work of Wilsford (1994), Kemp (2001), Greener (2002) and Kay (2003) that ascribes certain inefficiencies at policy level to PD. In the economic history literature, increasing returns have been used as a reason to high light the perseverance of various inefficient technologies, including types of typewriter keyboards, automobiles, video recorders, electricity supplies, nuclear power plants, railroad gauges, pesticides, televisions, pollution control systems, and computer programming language (Arthur, 1989; David, 1988; Cowan, 1990; Cowan and Gunby, 1990). Cowan (1990) study of nuclear power reactors shows that the inferior light water technology for power reactors got locked -in "due to early adoption" and network externalities in the form of information about the operations, safety regulations and accident response that could easily be shared among the users of the same technology. Also "both types of learning-learning-by-doing and learning-about-pay-offs were present throughout the history of nuclear power". The early use of light water technology by US naval program enhanced the learning of this technology at the very start of the competition. So when civil use for power reactors started, light water technology was way up along its learning curve as compared to its competing technologies. Similarly, Schreyogg and Blinn (2008) study of dubbing in German film industry indicates that dubbing has continued in various countries with small cinema audience even with its huge

fixed costs and the availability of a better choice in the form of subtitles (as cited in Vergne and Durand, 2010).

The existing literature gives little clue as to why suboptimal outcomes are locked-in. The important issue has been whether inefficient outcomes can be locked-in by market processes (Stack and Gartland, 2003). Liebowitz and Margolis (1995) note that if inefficiency in PD only means that a locked-in alternative becomes sub-optimal ex post because of the revelation of new information then PD can be described as inter temporal propagation of error occurring due to incomplete information. They note that rational economic agents can avoid the effects of the past. They have identified foresight of future and opportunities to coordinate choices of people as two factors that can prevent lock-in of inefficient outcome. Arthur (1994) has countered this critique by arguing that the actors have imperfect foresight or their "expectations are based on limited information". Thus there is still a need to elaborate on the inefficiency of outcomes.

Change and Path Dependency

If institutions and policies are path dependent then how can they break free from the history and how does change occur. Another important issue is the intensity of change. In historical institutionalism the policies represent punctuated equilibria where change can occur in the phase of critical junctures or Kingdon's (1995) policy windows (as cited in Greener, 2005). The reasons for the emergence of critical junctures are still not well articulated and

change is considered to be an exogenous characteristic of PD (Hall and Taylor, 1996). Most theorists take the position that only radical and complete change constitutes a new path. North (1990) considers discontinuous change such as wars, revolutions, conquest, or natural disasters as the source of a switch over to a new path. This implies that in the absence of such discontinuous change, this switching to "a new path is always an evolutionary process" (Deeg, 2001). Institutional perspective accounts for incremental changes in the organization. March and Olsen has suggested six ways of change that are all evolutionary: "variation and selection, problem solving, experiential learning, conflict, contagion and turnover" (as cited in Greener, 2000a). PD is therefore considered analogous to the evolutionary theory's idea of punctuated equilibrium.

The problem lies in explaining drastic changes involving complete makeover of structure and practices. In evolutionary theory, drastic changes occur due to exogenous climate changes and asteroids. Similarly, PD assumes that an exogenous shock can cause huge institutional change followed by a period of normal and insignificant evolution. Schwartz (2004) notes that "Critical junctures thus allow PD to segregate exogenous mechanisms for production from its powerful, endogenous increasing returns mechanism for reproduction. Critical junctures permit the identification of the beginning and end of a given path". Wilsford (1994) has also used the concept of junctures to account for drastic changes. He maintains that structures work as the "endogenous universe" that provides the framework for decision making. This universe is subject to exogenous shocks in the organization's form of conjunctures that

are according to Wilsford a mix of “contingencies and structures”. He has considered technological developments as “one conjectural element that may permit non-incremental change from the path” (Wilsford, 1994). Greener (2002b) also makes a distinction between permanent features of the policy which he calls structural factors and temporary factors or conjectural factors making both of them necessary for change to occur. He, however, maintains that the notion of conjunctures has limited use in accounting for the conditions necessary for reforms. Rather, they are more useful in explaining the timing of these reforms. Deeg (2001) maintains that the change is not always evolutionary in PD model. In case of German financial system the new path is “characterized by a hybridization process (not convergence) in which many of the institutions of the old path continue as before, some old institutions are transformed to new purposes, and new institutions are introduced”.

A related question to change is whether only exogenous shocks can break the path or any endogenous activity can lead to a new path. PD model’s assumes that only exogenous change can cause movement to a new path. However, some theorists believe that endogenous factors can also initiate the change. These may include actions taken by the actors within the institutional framework. Deeg (2001), for example, has shown that in Germany the decreased dependence of large firms on banks led them to search for other options thus pushing them to change the financial system as a whole. This endogenous change in the system became more significant with the internationalization of financial markets and integration of European financial system. So the change in the system has resulted from a combination of

endogenous and exogenous activity. In other words, a critical juncture may develop from within the path changes (Schwartz, 2001). Similar argument has been put forward by Greener (2005). According to him, there is “a mechanism for change in a path-dependent system, located not in the cultural or structural spheres, nor in human agency, but in the interactions between all three”.

PD incorporates small within path changes and maintains that major change to a new path occurs in the phase of critical junctures. The classic model of PD calls for exogenous factors for the dramatic change to a new path. This, however, is recently questioned by some institutional historians. Pollit (2008) cites Streeck and Thelen (2005) who have tried to blur the distinction between radical change and long term stability by arguing that the big change can come from a series of small steps. They have suggested a number of processes through which gradual but eventually fundamental change can occur. These include “displacement”, “layering”, “drift”, “conversion” and “exhaustion”. All these processes have the common feature that a series of small changes which are mostly endogenous rather than external can ultimately lead to a new path. So the important question arises that how we can distinguish between within path changes and the critical junctures. In this regard the concepts of institutional layering and institutional conversion given by Thelen (2003) become useful. Institutional layering allows the actors to adapt the pre existing system leaving as such the elements which they cannot alter. Institutional conversion involves redirection of the institution to a new ends rather than the initially designed goals. In both these cases change occur within a path –determined institutional framework (Pollit, 2008). Thelen

(2003) cites the work of Eric Shickler (1999, 2001) on the U.S. congress that embodies elements of both innovation and lock-in as an example for institutional layering. She maintains that this layering occurs when context changes and poses new challenges while the main actors do not change. Whereas institutional conversion takes place when new or previously excluded groups are made a part of the institutional framework. Thelen (2003) has cited Weir (1992) study of Lyndon Johnson's Great Society program which shows the conversion of the program's goal from poverty reduction to the distribution of funds to blacks in the face of rising racial unrest.

When discussing the change in PD, a critical question is how a particular situation can be categorized as path breaking. In other words, the crucial issue is the identification of critical juncture. Sydow *et al* (2009) suggests that restoration of choice availability as the "minimum condition for a situation to be categorized as path breaking". However, this new alternative has to be better than the prevalent alternative (Arthur, 19994) because replacement by an inferior option does not incorporate the true choice. Since path dependent processes are reproduced by self reinforcing or positive feedback mechanisms, path breaking involves breaking the logic of these mechanisms. The prospects of restoring a choice situation thus depend on the nature of these feedback mechanisms and the possibility of developing a new superior alternative (Sydow *et al,* 2009). According to Arthur (1994), the important factors in this situation are commitment, reversibility and resource commitment. The underlying self reinforcing process determines these factors. If path dependency occurs because of learning effects, the

reversibility becomes an issue. Learning effects accrue in specific fields and to match or surpass the learning effects of a present path is difficult. Here the need for an extra effort arises for the provision of a better choice. Thus according to Arthur (1994) a subsidy can help the new choice to match the existing one. The situation will be different, if coordination effects are driving the path dependent process. Since they accrue due to conformation to rules, switching to a new alternative requires willingness to conform to new set of rules. This in turn depends on the certainty level for the adoption of new rules. The more is the assurance that the others favor new rules the more is the willingness to switch. Thus additional efforts may be required to reduce this uncertainty (Sydow *et al,* 2009).

Path Creation

This takes us to another critical debate in PD as to whether the path simply occurs or can be intentionally created by the actors. The idea of path creation has been introduced by Garud and Karnoe (2001) based on Schumpeter's (1942) concept of "destroying" entrepreneurship. The idea of creative destruction serves as the central point for strategic change, innovation and entrepreneurship. Schumpeter (1942) in proposing his concept of creative destruction argues that no system can remain efficient forever. So a new system has to be introduced to replace the existing one. This innovation may take time as new ideas get refined. Thus time is an important element in the process of creative destruction (as cited in Garud and Karnoe 2001). Instead of considering lock-in as a chance event or historical mishap, this school of

thought focuses on the entrepreneurial capabilities of the actors and their interaction with the environment (Stack and Gartland, 2003). Garud, Kumaraswamy and Karnoe (2010) maintain that the PD model has outsider's ontology because of its excessive reliance on contingencies and exogenous shocks. In other words, it involves a de-contextualized analysis of the phenomena over a period. In contrast to this approach, path creation viewpoint is founded on insider's ontological assumption. It is a "culturally embedded, scenario-based approach to experiencing phenomena". Path creation draws its basis from dynamic efficiency and dynamic equilibria in economics literature, socio-psychological concept of enactment, and processes of creation and diffusion of new technologies. This perspective involves the interaction of social, economic and institutional forces and proposes that the human activity is both the medium and the outcome of this interaction (Garud and Karnoe, 2001).

Path creation can be distinguished from PD on the basis of two main ideas, namely, "real- time influence and mindful deviation" (Gartland, 2005). According to Garud and Karnoe (2001) "entrepreneurs meaningfully navigate a flow of events even as they constitute them.... (E)ntrepreneurs attempt to shape paths in real time, by setting processes in motion that actively shape emerging social practices and artifacts, only some of which may result in the creation of a new technological field". This is in contrast to PD post hoc explanations. The second idea is "the process of mindful deviation" (Stack and Gartland, 2003). In PD model actors assume a passive role in shaping the path which emerges without their deliberate activity. Moreover, increasing

returns and lock-in are emergent processes not involving purposeful action and planning by the actors (Meyer and Schubert, 2007). However, path creation theorists allow actors to actively interact with their environment. Mindful deviation implies that the actors can purposefully change the endogenous structures, practices and regulations as they see fit in the situation. “This process has nothing to do with optimization, since it is the role of the entrepreneur to endogenize a new structure from which they, though not necessarily their competitors or customers, will benefit” (Stack and Gartland, 2003).

The path creation viewpoint holds a view of agency unlike the one in PD. According to Garud *et al (*2010) “Path creation entertains a notion of agency that is distributed and emergent through relational processes that constitute phenomena”. They have built their concept of agency on Stacey’s (2007) critique of complex adaptive systems perspective. For Stacey, theory of emergence requires that the actors themselves go through and build developing complex processes through “discussions, debate, and experimentation” (as cited in Garud *et al* 2010). The concept of agency brings into play not only the structural and institutional forces but also socio-cognitive processes that help in creation of new states. Path creation incorporates the concept of human “agency as a temporally embedded process of social engagement, informed by the past (in its habitual aspect), but also oriented toward the future (as a capacity to imagine alternative possibilities) and toward the present (as a capacity to contextualize past habits and future projects within the contingencies of the moment)” (Emirbayer and Mische,

1998). These three moments, however, cannot be separated as some memories of the past can give rise to some practices in the present and some guidelines for the future. Similarly, different conception of the future will call for organization of past in different ways. This future vision and past activation will energize particular actions in the present (Garud *et al* 2010).

According to Garud and Karnoe (2005), the concept of distributed agency implies that the outcome of long term actions cannot be ascribed to a single person. It is the interaction between the actors, artifacts, rules and routines that create a network of action within which these long term processes operate. They cite the work of Hutchins (1995) to explain the notion of distributed agency that plays its role it in the navigation of ships to the harbor. They maintain that the rules and the artifacts keep the distributed actors “in time, space and sequence to generate a successful outcome”. They further elaborate that in a network the center of action can move from one part to another depending upon the actors’ level of involvement and mind frame. They refer to development of 3M Post- it-Notes to show the role of actors particularly of Spencer Silver in shaping an emerging path. Drawing from “Actor-Network-Theory (ANT)”, they explain, how he was able to "mobilize" various resources like "minds", "time", and "molecules". Thus each actor in the network puts in efforts that may lead to the development of an emerging path. As the actors continue to pile up inputs that path gains momentum and in turn facilitates and restricts the activities of the actors. So “agency is not only distributed, it is also embedded (Garud and Karnoe, 2003)”. Actors can exercise their discretion not without limits. “Rather, entrepreneurs are

embedded in structures that they jointly create and from which they mindfully depart" (Garud and Karnoe, 2001).

Path creation perspective identifies that fresh paths are not produced in isolation from previously existing social and technological structures. Path creation focuses on innovation and change without negating the role of history. In other words, path creation presupposes the idea of path dependency (David, 1985; Arthur, 1989). So path creation cannot be separated from PD. According to Garud and Karnøe (2003) "the term 'path' suggests that the accumulation of inputs at any point in the development of a technology is as much a position that actors have reached as it is one that they may depart from". Meyer and Schubert (2007) have given the idea of path constitution to integrate the advantages of path creation and PD and see path constitution as a combination of emergent processes and intentional actions. They suggest an analytical distinction between "modes and phases of path constitution". In modes of path constitution, PD and path creation are seen as "two ends of a continuum". In the analysis of empirical cases, it can be observed that the different cases can be at different point on the continuum. The QWERTY keyboard case, for example is close to the emergent processes end of the continuum. In contrast, the Post-it-Note case is very much the result of deliberate action of the actors. Between these two ends are the cases in which actors do not completely direct the emergence of the path and influence it to some extent with their intentional activity. The reasons for this limited control of actors can be the scarcity of resources or lack of will to spend resources for controlling the activity. However, contrary to

purely emergent processes, the actors are conscious of the growth of the path and may commit sources on the basis of chances of success of a particular alternative. The three phases of path constitution are generation, continuation and termination. The generation of path depends on the modes of path constitution. So a path can be generated by path creation or through emergent processes. But once a path has been generated the feedback mechanisms set in and the path is locked-in. The continuation phase shows more or less the same features in cases of intentionally created paths and path dependent cases. The locked-in paths end in the termination phase. If the ending is intentional then it is labeled as path breaking and if it's the result of emergent processes then it is called path dissolution (Meyer and Schubert, 2007)

Conclusion

David (1997) notes "that 'path dependence' has now acquired many distinct shades of meaning, not all of which are consistent with one another" and it is "vital enough to make it worthwhile trying to establish some terminological consensus in the field". Management scholars are exploring the meaning of PD and much debate and critique has been generated. Many PD theorists have worked on proposing a formal definition of PD and develop standard characteristics of the model. Nevertheless, path dependent processes are generally characterized by contingent initial conditions that trigger events which are subject to feedback mechanisms leading to lock-in of a relatively sub-optimal outcome. This situation of lock-in can come to an end only

because of an exogenous shock. In contrast to this, path creation perspective considers that initial conditions are cultivated by the actors through organizing events from the past. Path creation analysis focuses on the role of agency in creating new trajectories in innovation (Garud and Karnøe 2001, 2003). Path dependency and path creation differ in their conception of path constitution. PD ascribes path development to un-intended consequences of actions and the stochastic properties of the resulting processes. Path creation, on the other hand, focuses on deliberate influencing of the path by innovative actors. The actors are not passively responding to the environment. Rather, they are actively involved in the stream of events to grab the coming opportunities and architect change and innovation. The important issue here is whether these two models are mutually exclusive or they complement each other. Sydow et al (2009) think that these two complement and any process is driven by their mix. Garud *et al* (2010) argue this stance and maintain that this will lead to mixing of ontologies. The challenge for future research is to explore the possibilities of integrating these two models in order to produce a more comprehensive theory of stability and change.

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