

## **Path Dependence in Organizational Learning: The Role of Social Power**

### **Abstract**

This paper examines the path dependent characteristics of organizational learning. The agent-based simulation study builds on the well known tension between exploration and exploitation in organizational adaptation (MARCH 1991). I argue that social power severely affects the trade-off between exploration and exploitation and thus the likelihood for an organization to become path dependent. In a similar spirit to that of FANG ET AL. (2010), RODAN (2008), and MILLER ET AL. (2006), organizations are captured as complex, adaptive systems in which individuals as the carriers of knowledge interact with other individuals. Organizational learning emerges from the interaction of the individuals in which one actor influences another to adopt new or to discard old ideas. Social power is reflected in the potential of actors to influence how their peers perceive the value of ideas. Organizational learning is further impacted by contextual conditions. Complexity and turbulence of the organizational environment dramatically influence the learning task the organization faces. Following prominent approaches in organization theory (SIGGELKOW ET AL. 2005; FANG ET AL. 2010), the learning task of the organization is represented as an NK space.

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*“Organizational learning resembles a changing delta of meandering flows, some of which get blocked, while new flows emerge and others get reinforced.”*

(BERENDS ET AL. 2010:1059).

## **Introduction**

In this paper, I develop a model to explore the path dependent characteristics of organizational learning. Although organizational learning has been recognized as a fundamentally political process (BLACKLER ET AL. 2000; COOPEY ET AL. 2000) only very little research has tried to integrate power into a learning framework. Bringing power into the process of organizational learning will provide us with a more effective approach for understanding how organizations learn and which of the available ideas become embedded in the organization (LAWRENCE ET AL. 2005).

The paper is organized as follows. I begin with an overview of the underlying theoretical frameworks. I sketch briefly how organizational learning and power in organizations can be understood, the questions guiding this research and which method will be used. In the following part of the paper, I summarize the state of the art with a special focus on models of organizational learning and subsequently, describe the benefits of an integrated model as well as its prominent features. The last section translates the research question into variables and explains how they are operationalized in the context of the model.

## **Conceptual Framework and Research Questions**

Learning is a central topic in today's life. As our environment changes more and more rapidly, we have to acquire new competences to keep track of our surroundings. Learning in this respect is closely connected to the notion of change. That something has been learned is often identified by an improved handling of situations which before were difficult to cope with (SEEL 2003). Learning for that reason is essentially concerned with getting adjusted to new circumstances. In organization research, learning has been taken to the organizational level dealing with many different questions concerning the creation, transfer and retention of organizational knowledge (ARGOTE ET AL. 2003). Organizational learning is intimately connected with the way firms react to their environment and change. The ability of an organization to learn thus provides the foundations for organizational survival. Still, organizational learning does not only increase knowledge in organizations and hence improve their performance but also involves processes which not only potentially but very truly have a dark side to them.

### ***Theory of Path Dependence***

Path dependence theory explains why and how organizations sometimes end up in a lock-in. The organization is trapped in a situation which only allows for a very limited range of actions. Positive feedback mechanisms pave the way into this end state, creating a dynamic which for the organization is difficult to counteract. Obviously, path dependence cannot be conceived as a general explanation for organizational inertia but refers to a well defined subset of reasons for this widely discussed organizational propensity. Path dependence is often equated with organizational rigidity or stickiness, making it just another synonym for persistence in organizational practices or strategies (SYDOW ET AL. 2009; BERTHOD

ET AL. 2010). A path dependent process is characterised by a rigid outcome but not every organizational inflexibility originates from such a process. Persistence is just one indicator for path dependence. A lock-in is also characterised by its inefficiency meaning that a superior alternative would have been available. Most important, a path dependence perspective does not focus on a static end state but on the dynamic which finally leads to it. In this process small events can cause unforeseen consequences as they set in motion a self-reinforcing pattern (SYDOW ET AL. 2009). The pull these processes develop can be traced down to different mechanisms or effects. The dynamic of learning effects is based on a well-known tension identified in organizational learning research.

### ***Exploitation and Exploration***

In theories of organizational learning, firms are conceived as systems for generating, storing, and distributing knowledge (RODAN 2008). If and how organizations are able to learn can be derived from the learning process itself. Learning can result in major changes, but it can also lead the organization into traps which are difficult or impossible to overcome. This dilemma of learning is reflected by the central tension between the learning processes exploration and exploitation (BURGELMAN 2002; MCGRATH 2001, SIGGELKOW ET AL. 2003; GUPTA ET AL. 2006). Whereas exploration refers to the pursuit of new knowledge, exploitation deals with the refinement of already existing competencies (MARCH 1991; GUPTA ET AL. 2006). In exploitation a strong tendency to build on already acquired knowledge induces a powerful positive feedback (LEVITT ET AL. 1988). The resulting competency traps therefore describe a path dependent end state emanating from learning effects. Learning can therefore be distinguished according to the scope of the activity involved, dividing the relevant processes in efficiency-oriented

incremental learning and a radical search for new alternatives (MINER 1996; LEVITT ET AL. 1988; ARGYRIS ET AL. 1978). MARCH (1991) argues that balancing these two learning processes is essential for the survival of organizations.

## ***Politics in Organizations***

**Politics** is acknowledged as a natural feature of organizations and we can thus expect power relations to directly mediate the processes of relating to and interpreting knowledge within organizations (COOPEY ET AL. 2000; VINCE 2001). Integrating politics or the dynamics of power (LAWRENCE ET AL 2005) in organizational learning consequently will contribute to develop a richer understanding of the tension between exploration and exploitation, which was identified as one of the main areas requiring future research in organizational learning (GUPTA ET AL. 2006, CROSSAN ET AL. 1999). I therefore ask the following research question:

### **How do politics affect organizational learning?**

In his major review of the literature on power SCOTT (2001) distilled the following definition: *“social power in its most general sense, [...] involves the socially significant affecting of one agent by another in the face of possible resistance.”* This core idea of power reflects the fact that the agents involved in the dynamics of power have a degree of autonomy in shaping their actions and are thus not completely dependent on external factors. Neither are they perfectly informed and unconstrained. They are affected by the intentions and interests of the actors around them. This core idea of power in research has been extended in two directions which emphasize different operational modes of power. The mainstream direction concentrates on the way power can restrict the range of available

actions (LAWRENCE ET AL. 2005). This corrective influence of power builds on the use of resources that as possible sanctions are able to directly affect the interests of the subalterns in power relations (SCOTT 2001). In organizations these resources are often tied to positions in formal hierarchies. In contrast, the second stream of research highlights the role of persuasive influence which operates through arguments and appeals that lead a person to believe that it is appropriate to act in one way rather than another (SCOTT 2001). This mode of power thus affects the costs and benefits that the agents associate with different alternatives. In its most simple way, it can depend on a person's personality or attractiveness to others. Persuasive influence is closely connected to legitimation processes as it attaches value commitments to particular ideas and practices. By changing the perceived value of ideas, it is also likely to affect people's worldview or how they perceive situations (SCOTT 2001). The distinction between the two different operational modes of power is employed by LAWRENCE ET AL. (2005) to develop a more comprehensive theory of organizational learning. Their framework combines the operational modes of power with a distinction relating to the level where power operates. Episodic power originates at the individual level and refers to the strategic acts of the organizational members. Power in this respect is characterised as the capability of actors to influence organizational decision-making (PFEFFER 1981). Systemic modes of power work through the organizational level and are not initiated by single actors. Organization-wide practices or rules impact the behaviour of organizational members, as for example in processes of socialization. In the framework of LAWRENCE ET AL. (2005) power that is located at a certain level relies on different operational modes.

As noted above, organizational learning research has mainly neglected the influence of power. Some studies have analysed the impact of formal design on the learning outcome of organizations. Managerial power is conceived as the right to combine knowledge of

different organizational functions and to decide about its implementation (e.g. SIGGELKOW ET AL 2005) or as a chain of command in which the managers impose their beliefs on their subordinates (e.g. BUTLER ET AL. 2010). These approaches focus on the determination of formal organizational structures in relation to specific tasks the organization encounters which mainly reflect the turbulence imposed by the organizational environment. They offer insights on the mode of power which SCOTT (2001) called the corrective influence or power as restricting the range of action of subalterns. As has been noted in research, organizational learning to a great extent relies on dyadic interactions (RODAN 2008). The knowledge exchange happens outside the formal organizational structure and emphasizes informal contacts of the learners. Studies which concentrate on this approach to organizational learning highlight the impact of network structure on learning without dealing with the heterogeneity of the actors due to power differences (FANG ET AL. 2010; RODAN 2008, LAZER ET AL. 2007). These approaches point out that the interpretation of ideas in organizations is a social process in which meaning is attributed through interaction. Attempting to force understanding and meaning on organizational members is likely to fail (LAWRENCE ET AL. 2005). The underlying dynamics of power are more subtle and involve the possibility to influence the costs and benefits which organizational members associate with respective ideas. Actors can be differentiated according to their potential to affect the cost and benefits of ideas as perceived by their surrounding actors. This potential of powerful actors might be partly due to their hierarchical position in the organization but is also likely to rest in their experience, superior knowledge or culturally appropriate social skills. As I consider organizational learning to mainly take place through dyadic interactions, I claim that episodic power is reflected in the potential of actors to influence how their peers perceive the value of ideas.



Power in organizational learning cannot only originate at the individual level, as noted above, it can also operate in a disembodied form on system level. This mode of power shapes the actions of the organizational members as an ongoing systemic engagement. It is dispersed through all the groups and brings about a kind of mental orientation and routinised action (SCOTT 2001). Examples in organizations include such practices as socialization or training. As does influence on the individual level, discipline shapes the understanding of the costs and benefits of ideas and actions (FOUCAULT 1977; LAWRENCE ET AL. 2005) but its effects spread over the whole system.

### ***Environmental Turbulence***

Learning is conceived as an ever more important source of competitive advantage, and its importance is likely to increase, the faster an organization's environment shifts (RODAN 2008; ARGOTE ET AL. 2000). Contingency researchers claim that organizations have to achieve a fit between their internal processes and structures and the external environment (BURNS ET AL. 1961; LAWRENCE ET AL. 1967). Learning is the process which is supposed to translate environmental change and incorporates it inside the organization. Environmental turbulence reflects changes in demand, competitors, technology and/or regulation. For the purpose of the planned study not the source underlying the change is important but its impact on the learning task of the organization (SIGGELKOW ET AL. 2005). In organization studies, nature and frequency of environmental change have been described using different labels such as velocity (EISENHARDT 1989), uncertainty (GALBRAITH 1973) or dynamism (MINTZBERG 1979). Often, the meaning attached to these labels is quite similar. SIGGELKOW, RIVKIN (2005) put it in a nutshell with the following definition: "*An environment is turbulent, dynamic, etc., if the mapping from firm*

*actions to performance outcomes changes frequently and profoundly, and in ways that are difficult to predict.*” A turbulent environment thus significantly complicates the learning task of an organization.

I will focus on the way power, as affecting how actors perceive the costs and benefits of ideas, influences organizational learning under conditions of environmental turbulence. Power can operate on different levels, it takes effect between the individuals and is present in systemic rules which guide the behaviour of the agents. Power affects how ideas travel through an organizational learning system, which ideas are embraced and which are rejected. Simulation modeling offers the possibility to inductively analyse the impact of manipulating features of the modelled system and therefore to increase our understanding of the relationship between the specified parameters. Agent-based modeling as a special type of simulation modeling is particularly useful for studying organizational behavior (LAZER ET AL. 2007). Simple assumptions concerning the properties of the agents lead us to an emergent system behavior which makes it especially prone for the study of the relationship between individual behavior and organizational performance in a temporal framework.

The phase model of path dependence provides us with the means to assess the temporal character of special instances of organizational learning. A path dependent process consists of three different stages, the pre-formation, the formation, and the lock-in phase. The learning process can thus be characterized according to the duration of the three different stages. LAWRENCE ET AL. (2001) defined pace and stability as the main temporal dimensions which represent the distinct time periods of sequential institutionalization processes. I transfer this approach to learning processes in a path dependence framework. Learning speed represents the time the organization spends in the path formation phase whereas stability is the temporal dimension which defines the lock-in phase. I argue that

speed and stability constitute the key temporal characteristics of an organizational learning process.

## **Literature Review: Modeling Approaches for Organizational Learning**

To conceptualize a learning model of an organization, actors and processes operating in the model have to be defined. Approaching the literature with a focus on the different types of learning processes helps to gain access to the current research status concerning learning models. In simulation research exploration and exploitation can be modeled as a mutual adaptation process (MARCH 1991) or in terms of search processes in an NK landscape. Despite dealing with different levels for looking at the exploration exploitation tension, these two approaches share a common outlook and are especially prone for approaching organizational path dependence.

### ***The NK Landscape Approach to Learning***

The NK approach concentrates on the question how organizations make decisions under conditions of complexity (LEVINTHAL 1997; SIGGELKOW ET AL. 2005, 2006; RIVKIN ET AL. 2006, 2007; SIGGELKOW ET AL. 2003, 2005; WINTER ET AL. 2007; BAUMANN ET AL. under review; ALMIRALL ET AL. 2010). The organization learns how to combine its choices to find a good solution. This learning process can be seen as a search process in an NK landscape which represents interdependencies among organizational activities. Clearly many choices that organizations make are interdependent or complex. The value of one choice is influenced by other activity choices taken by the

firm (PORTER ET AL. 2008).<sup>1</sup> Choices therefore have to fit together to result in a solution with high performance. An NK landscape can be defined as “a mapping of all possible sets of a firm’s choices onto performance values“ (SIGGELKOW ET AL. 2003: 652) and can, in a simplified way, be visualized like a real landscape involving higher and lower peaks. The learning process is specified by providing rules how the learner walks this NK landscape. Incremental competence increasing learning is commonly represented by hill-climbing processes. Here the organization cannot jump to different parts of the landscape but has to build on prior experiences. Featuring the myopic aspects of learning (LEVITT ET AL. 1988) the learner can only perceive the outcome of changing a small set of his activities and therefore engages in a process of hill-climbing towards the nearest best choice combination.

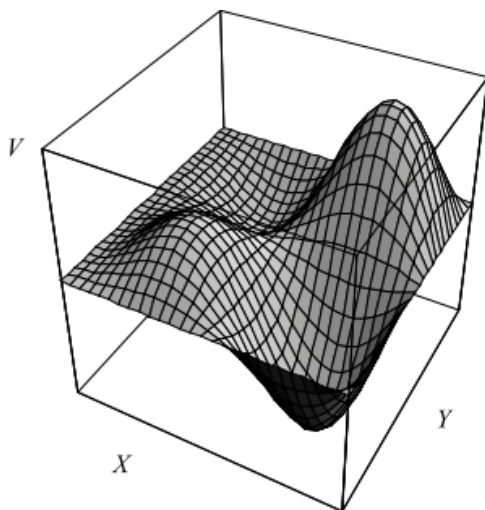


Figure 1: Simple NK landscape showing the choice combinations X and Y as well as performance value V (SIGGELKOW, LEVINTHAL 2003).

For two obvious reasons the “landscape search viewpoint” (WINTER ET AL. 2007) is prone for research on organizational path dependence: First, NK landscapes reflect interrelationships of organizational actions. This allows the analysis of organizational

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<sup>1</sup> See for example the explanations concerning shop design and marketing strategy of Urban Outfitters (Porter et al. 2008) or “Fordism” as a complementary management system (Sydow et al. 2009).

behaviour in complex situations (ALMIRALL ET AL. 2010). Second, it has been shown, when faced with complexity firms that learn incrementally can easily become locked-in on inferior combinations, in other words, they terminate their search on local optima being unable to find the best choice combination.

### ***The Mutual Learning Approach***

The mutual adaptation approach, in contrast, does not deal with how learners search for knowledge on an external problem but highlights the social aspects of learning (MARCH 1991; RODAN 2005, 2008; MILLER ET AL. 2006). As can be inferred from its title, the mutual learning model, which is based on a seminal paper by MARCH (1991), deals with a learning process involving different sides. In the original model organizational learning is depicted as an interaction process of individuals and the organizational code which is composed of the organization's shared "*languages, beliefs, and practices*" (MARCH 1991:74). The individuals learn from the code in a kind of socialization process, and the code in turn learns from the individuals (MARCH 1991). Whereas in the original model the knowledge transfer to the individuals is always mediated by the code, in some later extensions the term "mutual" refers to the learning process between organizational members. These approaches omit the organizational code. Still, as a mutual learning model, it always deals with the exchange of knowledge or, in other words, how knowledge is shared.

Since the organization in this approach is perceived as a system of shared meanings which are maintained by everyday social interactions (WALSH ET AL. 1996), exploration and exploitation are characterized in terms of heterogeneity and homogeneity of the system. Conceiving of organizations as interpretive systems (DAFT ET AL. 1984) in which prior

internal knowledge must be present to make use of related external knowledge (COHEN ET AL. 1990), reveals that there is a significant danger in excessive organizational homogeneity. A homogenous organizational belief system or knowledge state is a significant indicator for path dependence. Therefore the described framework can be used to analyse how this tendency in mutual learning can be mitigated, or, in other words, how variety in an organization can be preserved.

Both described learning frameworks deal with important aspects of organizational learning. One characterises learning as a mutual adaptation process the other as a search process in a complex environment. For an analysis of organizational learning from a path dependence perspective it is essential to assess the system's outcome in terms of its stability and inefficiency. An integration of both frameworks provides us with a learning model capable of approaching path dependence phenomena.

## **A Learning Model for Organizational Path Dependence**

The basic model consists of the organizational environment, its members, and two fundamental learning processes. The organization is conceived as a system of actors who learn individually by building on their prior experiences as well as collectively by exchanging information with one another (LAZER ET AL. 2007). Since organizational learning involves both the exchange of ideas between organizational members and searching for new solutions, the model builds on the NK approach and incorporates aspects of mutual learning. The organizational members explore the environment here defined as the NK problem space, and they have the possibility to exploit knowledge already available in the organization by imitating solutions developed by their peers.

A fundamental tension exists between the two learning processes. The tension unfolds between the time that is necessary to explore the environment and the tendencies towards homogeneity induced by the knowledge transfer process in the organization (LAZER ET AL. 2007). The learning process stops when all organizational members have converged on similar solutions. Only the variability of knowledge allows the organization to continue to learn about its environment. Thus, absorptive capacity exerts an influence on organizational learning (COHEN ET AL. 1990).

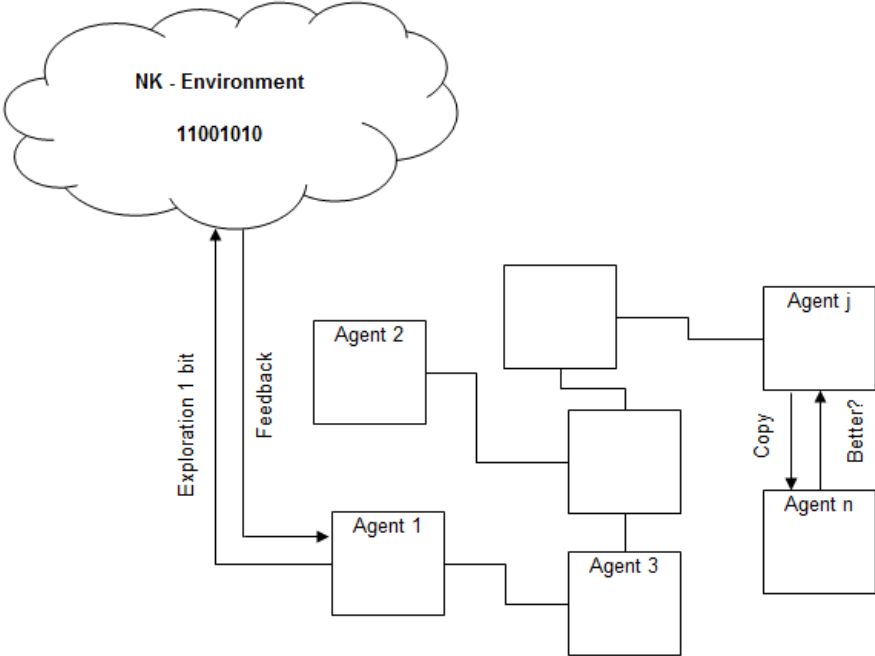


Figure 2: Organizational learning model with imitative and generative learning processes (based on LAZER ET AL. 2007, illustration: author’s own)

***How to Interpret Path Dependence in the Model***

Similarly to MARCH (1991), learning is viewed as an increase in the accuracy of the collectives’ knowledge about the environment (RODAN 2008). In the planned study,

however, the environment will be represented by an NK landscape which provides more consistency for a path dependence perspective. An NK approach allows us to capture the complexity of the environment that the organization and its members encounter. As organizations have to come up with solutions that fit their surroundings, the environment can be interpreted in terms of a problem that the organization has to solve. Problem complexity has a significant influence on search and learning (NICKERSON, ZENGER 2004). Potential solutions to complex problems have a multitude of dimensions that may be synergistic regarding their impact on performance (LAZER ET AL. 2007; SIGGELKOW, LEVINTHAL 2003; LEVINTHAL 1997). The NK landscape can be understood as a space of all possible solutions in which the topography defines the value that goes along with each of the combinations (NICKERSON, ZENGER 2004). Since the impact of each dimension of the solution on performance is contingent on several other dimensions, local optima are produced. NK landscapes, in this way, allow us to model learning as an exploration of a complex problem space. If agents could overlook the complete problem space, they would easily identify the best possible combination. However, in reality agents are unable to survey all problem aspects and are restricted to adding incrementally to their existing competencies. In simulation models, this myopic search is reflected by the assumption that agents are restricted to learning about a limited number of dimensions at a single point in time (LAZER ET AL. 2007). Problem complexity does not in itself create a positive feedback dynamic, only in interaction with the myopic learning process the self-reinforcing of individual competencies unfolds. Still, problem complexity poses a major contextual condition for path development as it raises the probability for an organization and its members to become locked-in (SYDOW ET AL. 2009).

As noted above, NK landscapes as spaces of potential solutions allow us to differentiate between local and global optima. They thus provide a useful background for modeling the



potential inflexibility and inefficiency of a path dependent learning outcome. Two other properties of these entrapping processes, non-predictability and non-ergodicity, relate to the opening stages in the unfolding of the learning process. In the beginning, before the starting points of the learners or their initial competencies are selected, the outcome of the process is indeterminate. Placing the actors in the NK landscape thereby generating their first solution can be called a small event which may even amount to a critical juncture. These initial positions might also be considered as framing of the first stage of a learning process which possibly leads to a lock-in. The first choices of the agents are thus embedded in already existing routines and practices, since an organization does not start from scratch but is imprinted from the past. Therefore, this stage of a path formation process neither holds the assumption of complete indeterminacy nor that of unrestricted choice as it builds on a historically framed contingency (SYDOW ET AL. 2009) that is represented by the starting points of the learners. Several outcomes are possible. The way the process unfolds determines which outcome is selected. The learning process is influenced by how the agents learn about their environment and with whom they exchange knowledge. Events, that compared to the system's outcome, are small and insignificant may cause far reaching consequences and have a major impact on how the system proceeds. As the learning process unfolds, an initially unforeseen action pattern takes the lead and might eventually gain a deterministic character (SYDOW ET AL. 2009). The learning process cannot be anticipated but must be unscrambled in retrospective.

As outlined above, NK landscapes provide the context in which the self-reinforcing process of individual competence increasing learning takes place. This search is most likely to lead the actors to local optima of the landscape, locking them in their individual set of competencies. However, individuals are embedded in an organizational context and do not learn in isolation but have the possibility to mutually exchange knowledge. For considering

the lock-in on the organizational level, the interaction of the two learning processes, individual search and knowledge exchange, is essential. For a system outcome to be called a lock-in, it has to be stable and inefficient, meaning that other, eventually better solutions would have been possible but were not achieved. Inefficiency of a solution can be easily shown in relation to the global optimum of the problem space. The following shall clarify the meaning of stability in the presence of a multitude of learners. As explicated in COHEN ET AL. (1990) the ability of an organization to assimilate new knowledge is a function of the pre-existing knowledge structure. The absorptive capacity of an organization is essentially connected to its diversity of expertise. When a similar practice has diffused throughout the organization leaving it with a homogeneous knowledge structure, the potential for change and innovation in the organization will have ceased to exist. The organization will have lost its capability to connect to valuable external knowledge. The learning process stops when all agents have converged on a similar solution. Consequently, we consider a homogeneous knowledge state to be an indicator for path dependence.

### ***Two Types of Lock-in***

Obviously, the two learning processes constitute two different types of lock-in: a lock-in due to myopic search at the individual level and a lock-in at the organizational level due to excessive homogeneity which is more complex and results from the interaction of the learning processes. Learning in isolation, of a single individual, will most probably lead to a path dependent increase of individual competencies. Nevertheless, for the organization the myopic search of the individual in the environment incorporates new knowledge inside the organizational boundaries. We therefore have to distinguish exploration and exploitation according to the individual and organizational level. The individual actor needs

the exchange with other organizational members to escape his competence enhancing path of myopic search. For him or her knowledge transfer is an explorative activity. From an organizational perspective, however, the transfer of knowledge between organizational members diffuses knowledge inside the organization. The organization exploits already existing competencies. For the organization new knowledge is acquired by the environmental search of its members.

The different perspectives on exploration and exploitation at the organizational and individual level can help to exemplify the tension between both learning processes. The faster the knowledge exchange between the organizational members, the smaller the available amount of time for exploring the environment. In environmental search, new solutions can only be found in the proximity of old solutions. A fast diffusion, consequently, hinders learners from realising the potential of some alternative solutions.

### ***Variables of Interest: Episodic and Systemic Power***

Systemic and episodic power both affect how costs and benefits of ideas are perceived by organizational members. An agent thus has a certain potential to promote his solutions thereby changing their perceivable value. This approach relies on the insight that the perceived value of practices or solutions not only reflects their worth for approaching a problematic situation but is also impacted by social effects. Coordination effects, which “... relate to the heart of organizational functioning” (SYDOW ET AL. 2009: 699) and refer to the benefits of rule guided behavior, impact the perceived value of practices. The more actors adopt a specific rule or practice, the lower the coordination costs among actors will be as following the same rule or practice results in an increasingly efficient interaction. Coordination effects reflect how one actor by adopting a solution changes the costs and

benefits his peers associate with the requisite solution. Following the definition of power as affecting the subjective value of ideas and practices, systemic power can be assumed to determine the height of coordination effects on system level, whereas episodic power influences how coordination effects are distributed among the agents.

Systemic power operates on system level and shapes the actions of the organizational members as an ongoing systemic engagement. It is conceived as a systemic rule the organization imposes on its members or as a feature of organizational culture which provides orientation for organizational members in the sense of a basic assumption guiding behaviour (SCHREYÖGG 2007). Hence, systemic power considers the strength of a collective effect. BARNES (1988:57) defined power as “... *a capacity for action that someone has by virtue of the social distribution of knowledge: an individual’s power is their proportion of collective power of the community as a whole, the community whose knowledge they bear and share.*” As systemic power impacts all actors alike, the focus is not on a heterogeneous distribution of collective power but on the consequences of a systemic rule. As a result, I consider the collective power to be homogeneously distributed among the agents, giving each agent a similar potential to promote his solution. Systemic power consequently does not define the heterogeneity of the agents from the outset, but by affecting how agents interact, it constitutes emergent patterns of power. I define systemic power in terms of the height of the system’s coordination effects or as the strength with which the adoption of ideas by the organizational members changes the idea’s subjective value.

This interpretation comes close to MILLER’s concept of internal consistency (1992). Organizations with high internal consistency stress the advantages which can be derived from an internal fit between their various elements. In a system of learners who try to find a set of rules, which corresponds to their environment, the disposition for internal consistency

will not emphasize individual initiatives but will raise the attractiveness of solutions already employed by other learners. Organizations can be differentiated according to their disposition for internal consistency or in other words the susceptibility of their members to coordination effects. As systemic power affects the strength of coordination effects on system level, strong systemic power can be interpreted in terms of a high organizational inclination for internal consistency. In his seminal paper (1991), MARCH stated that fast learning is not always desirable for organizations as it leads to a more rapid decrease of knowledge diversity in the system. Strong coordination effects are not only likely to speed up the diffusion of practices, they also influence the direction the learning process takes. Supposedly, a high disposition for coordination effects impacts the probability for becoming path dependent as well as the inefficiency of the emerging lock-in. As shown by TRIPSAS, GAVETTI (2000) or GILBERT (2005), strong coordination effects are especially problematic when the environment changes, leaving the organization unable to exploit new opportunities. Most likely, this process is affected by the actual rate and scope of change in the environment. The model offers to test the performance of high and low consistency organizations at different rates of environmental turbulence.

With reference to BARNES (1988) notion of the distribution of collective power, we can further expect organizational actors to be heterogeneous with respect to their potential for promoting special ideas or practices. Episodic power influences the distribution of coordination effects among the agents. The actors can hence be differentiated according to their ability to promote particular practices or ideas. The behavior of some agents is supposed to have little social impact while other powerful agents show a high potential to endorse their ideas. The decisions of the powerful agents thus will be reinforced by stronger coordination effects providing the concerned practice with a higher perceived attractiveness and legitimacy. If leadership is conceived as exercising social influence agents with a

higher potential to manipulate the behaviour of their fellow colleagues can be understood as leaders. Leaders do not necessarily have to occupy high positions in the organizational hierarchy. Their position might contribute to their social impact but this might not represent the most important factor. Experience, personal characteristics all add to the potential impact an individual has on the worldview of the people surrounding him or her. It shall be noted briefly, that from a path dependence perspective, these leader agents have a higher potential to harm the system, likewise, they can act as agents of change and contribute to breaking paths.

## Research Design

Computer simulation can help to further expand the theoretical framework of learning and path dependence. It has the potential to reveal how the mechanisms in organizational learning work and how they interact at different levels of the organization and with the environment. Simulation modeling forces the researcher to formally define basic concepts and to apply these concepts throughout the study. Therefore it can be described as “... *creating a computational representation of the underlying theoretical logic that links constructs together*” (DAVIS ET AL. 2007: 481). Simulation modeling consequently contributes to enhancing theoretical precision as well as internal validity of the examined phenomenon (DAVIS ET AL. 2007; HARRISON ET AL. 2007; GILBERT, TROITZSCH 2005). The agent-based simulation will be developed in JAVA using the Eclipse development framework.

Researchers using simulation modeling encounter a specific tension. A simulation model has to be rich enough to provide interesting information but on the other hand has to be simple enough to be transparent (LAZER ET AL. 2007). In the following, I describe the

research design concerning the learning processes, the organizational environment as well as the variables of interest.

### ***The Organizational Environment***

The organizational environment is usually characterised by higher or lower complexity as specified by the interaction between the different dimensions or problem aspects that the environment involves. An NK space will be used to represent the organizational environment and serve as a reference base for the achieved learning outcome of the system. An organizational path is considered to be a pattern of practices which organizational members have learnt but which does not fit the organizational environment, thereby imposing a major threat to organization survival. Inefficiency can be defined in terms of the relation between system performance and the best solution given in the NK environment. The NK space was originally developed by STUART KAUFFMAN (1995) for application in evolutionary biology. It aims at modeling epistasis among genes. LEVINTHAL (1997) discovered the close connection to the structure of complex problems that organizations encounter. Up to now, NK spaces have increasingly been used in organization theory in order to address various complexity-related research topics.

NK spaces derive their name from the two parameters which make up the configuration of a landscape. Whereas N represents how many dimensions define the landscape, K represents their interaction or the complexity imposed by the environment. Each dimension of the environment is characterised by a binary number, so that a specific configuration is represented by a string of 0's and 1's. If  $K = 3$ , every dimensions of the environment will be contingent on the value of three other dimensions. For the learner this means that he or she cannot simply arrive at the best solution by adjusting one dimension at a time. As

outlined above, NK landscapes in a simplified version can be depicted as a real landscape, getting more rugged with higher K. The configuration of the problem space in this study is not finalized yet, but it is likely to incorporate more than 10 but less than 20 dimensions which makes it close to other research projects in organizational theory (SIGGELKOW ET AL. 2005, 2006; RIVKIN ET AL. 2002, 2006). As complexity is a contextual condition which is likely to influence the probability of path formation, the impact of K on the learning outcome will be tested, thus I define K as the first independent variable.

### ***Environmental Turbulence***

In the planned study, learners will be confronted with environments that differ according to their complexity or the difficulty of the learning task. Even in a stable environment, in which learners are confronted with the same unchanging NK landscape for the whole simulation run, complexity can hamper learning dramatically (LAZER ET AL. 2007).

Environmental turbulence is a major condition which characterizes the environment of firms. Scope and frequency of environmental change reflect how often and how profoundly information about the environment becomes inaccurate or obsolete. Both parameters offer interesting insights into the process of path formation. Shocks in the environmental landscape might be strong enough to interrupt the formation of an organizational path or the frequency of environmental change might prevent the system from locking-in. Moreover, it is possible that an environmental change turns a once optimal solution into an inefficient one without the learners being able to adapt to the change. A turbulent environment is thus defined as undergoing periodic shocks which have a specified impact on the performance landscape. To incorporate this in the simulation, I use the approach introduced by SIGGELKOW, RIVKIN (2005). Every  $x$  periods the contribution value of each dimension



of the landscape  $C_i$  is replaced by  $(\tau \cdot C_i) + (1 - \tau) \cdot u$ . The parameter  $u$  is a random draw from a uniform distribution. With the parameter  $\tau$  the scope of the change can be adjusted. If  $\tau > 0$  a positive correlation between the former landscape and the future one exists. Thus, one extreme case would be learners who have to deal with environments with high  $x$  and low  $\tau$  resulting in frequent as well as substantial changes.

### ***Behavioral Rules***

Consider an organization that consists of  $M$  agents. At first, the organizational members are randomly assigned a starting position in the landscape representing the historically framed contingency of the learning task. A starting position in the case of  $N = 5$ , for example, could be in the form of the bit string 10011. The value that an agent achieves depends on how the agent configures each dimension of the landscape (LAZER ET AL. 2007; HANAKI ET AL. 2010). As such, the value behind a special configuration of dimensions represents the match between the practice that the agent employs and the organizational environment. At every point in time, each actor occupies such a solution score. Change in the actors' solution scores happens due to the defined learning processes. Exploring the environment, learners are assumed to be myopic, as such they are not able to evaluate the potential of solutions which greatly depart from their current solution. For the knowledge transfer process with their peers, agents are able to perceive the performance of their contacts. Every time step of the simulation, each organizational member undertakes the following steps: First, he looks around if any of his or her contacts performs better. If this is true he learns from the identified individual by imitating his idea. If he is unable to find a better performer among his contacts, the learner will turn to the environment to search individually. As this search for new solutions is assumed to be myopic, he is restricted to

altering only one dimension at a time. Thus, he randomly changes one dimension in his strategy, and, given that this change generates a higher value than his status quo, he adopts the solution (LAZER ET AL. 2007).

## ***Systemic Power***

The central question of this study is concerned with the impact of politics on organizational learning. To operationalize systemic and episodic power, I consider different strengths and distributions of coordination effects.

As a collective effect, systemic power impacts the strength with which the adoption of ideas by the organizational members changes the idea's subjective value. With reference to MILLER, FRIESEN (1984) and MILLER (1992), I differentiate between organizations with high and low internal consistency. Coordination effects are incorporated into the model as affecting the perceived attractiveness of a practice and reflect how much orientation the accumulated behaviour of their peers provides for the organizational members. The objective value of a specific practice or idea can be determined with relation to the performance landscape providing the researcher with a reference frame for determining the efficiency of the learning outcome. Coordination effects change how the value of an idea or practice is perceived by creating an additional benefit. Having many people employing a specific practice, endows it with a worth high above its objective value, consequently changing the learners' behavior.

When a practice is adopted by a learner its value is multiplied with parameter  $c$  ( $c > 1$ ) thus increasing its subjective value. By varying  $c$  organizations with high and low internal consistency can be tested. MILLER (1992) claimed that internal and external forces pull in

opposite directions, referring to the difficulty organizations with high internal consistency might have to react to the change of their external environment. I will further test which environmental conditions, as defined by the scope and frequency of environmental change, prove difficult for the different types of firms.

### ***Episodic Power***

Systemic power can be interpreted in terms of an organizational rule or framework which affects the behaviour of all organizational members and above was approached as a collective effect. Episodic power on the other hand is characterised as the capability of individual actors to influence organizational decision-making (PFEFFER 1981). The actors can hence be differentiated according to their ability to promote particular practices or ideas. The behavior of some agents is supposed to have little social impact while other powerful agents show a high potential to endorse their ideas. The decisions of the powerful agents thus will be reinforced by stronger coordination effects providing the concerned practice with a higher perceived attractiveness and legitimacy. This implies a heterogeneous distribution of coordination effects among the actors so that the actions of some organizational members are perceived to be more important and thus have a higher propensity to influence the behaviour of the rest.

Depending on his strength, a leader might have the power to drag the organization into a lock-in state. Therefore, I will test organizations which have few and powerful leaders and compare them with organizations with less inequality in power. The power distribution in organizations can be represented by different functions distributing the coordination effects between the agents (e.g. exponential for high inequality, linear for low).

Another potential of leaders points to a further avenue to expand this research. Leaders are said to be the ones who can most easily deviate from existing rules, as they often are granted to move away from current practice. Innovations are thus frequently initiated by these individuals (SCHREYÖGG 2007, HOLLANDER 1958). Leaders in the model could themselves be less influenced by coordination effects, therefore having the potential to possibly break existing lock-ins (with respect to network effects see UOTILA ET AL. 2010).

### ***Speed and Stability of Learning***

To report the results of the different model configurations, I refer to two variables which enable us to assess how fast the learning process proceeds as well the stability of the generated results. As noted above, speed and stability are the critical temporal dimensions of the learning process. By following the learning success of the organization and the heterogeneity of the system, in terms of the number of internally available ideas or solutions over time, the unfolding of an organizational path can be demonstrated. These variables not only permit the assessment of whether the organization develops a homogenous knowledge state and how fast this process takes place, we can also gauge the efficiency of the learning outcome by looking at the learning success in relation to the global optimum of the NK environment.

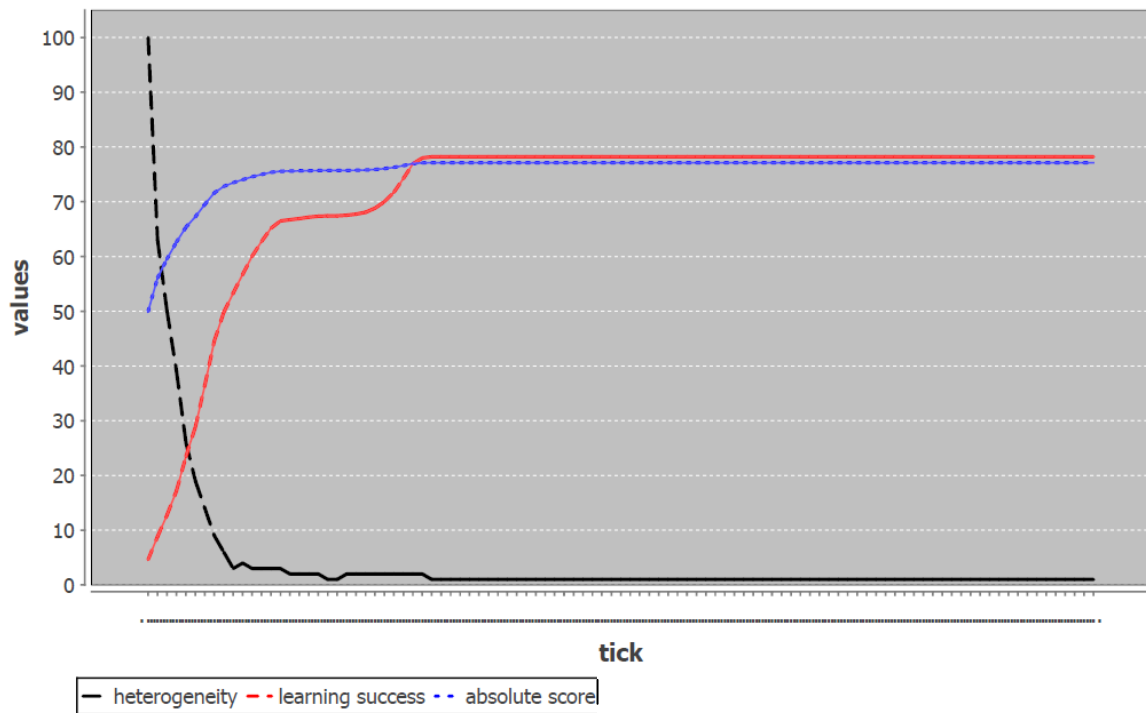


Figure 3: Graphical example of the simulation output

The planned study contributes in several ways to the literature on organizational learning and path dependence. With relation to path dependence theory, I provide a model of organizational path dependence with which the impact of organizational and environmental conditions on the probability for a path dependent outcome can be analysed. By using an NK approach, the model furthermore allows us to assess the inefficiency of emerging lock-ins and how the process of path formation accounts for learning success or respectively failure in learning. The model incorporates the impact of environmental change on the formation of organizational paths. Scope and frequency of change are expected to have a major effect on the path formation process. Supposedly, a highly turbulent environment can leave an organization paralyzed and unable to react. An investigation which environmental conditions foster the development of organizational paths thus seems to be a worthwhile task.

With respect to organizational learning theory, the model adds another aspect of organizational relations to the existing learning approaches. Social power is claimed to be underrepresented in current research on organizational learning (LAWRENCE ET AL. 2005). Apparently, power as changing the perceived costs and benefits of a solution, is one of many possible ways to operationalize this social impact. If we conceive of organizational learning as emerging from the interaction of the individuals in which one actor influences another to adopt new or to discard old ideas, power creates attractors around which the learning process gravitates.

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