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Path Dependent Platforms: A Process Perspective on Enterprise Ecosystem Governance

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1. Introduction

In their editorial to the workshop on the role of platforms for enterprise ecosystems, Beimborn et al. (2011: 4) emphasize that "the emergence of platforms as backbones for inter-organizational cooperation and collaboration also impacts the way economic activity is organized." In a similar vein, Tiwana et al. (2010: 686) argue that platform-based enterprise ecosystems actually constitute "complex alliance networks", where an approach grounded in literature on inter-organizational relationships might be a helpful complement to "the burgeoning exclusively macro, two-sided markets literature in economics."

Conceptualizing the relationships between platform and module providers as historically contingent, inter-organizational processes exhibits both new explanatory potentials and methodological difficulties. Scholars in the tradition of the two-sided markets paradigm such as Economides and Katsamakas (2006) ask how collaborative or competitive the relationship between platform leader and providers of complementary goods should be. In contrast, focusing on inter-organizational relations (e.g., Dyer and Singh 1998) would acknowledge that such a question cannot be decided in the abstract but rather depends, among others, on a platform's governance history and expected future.

Coming from such an organization-theory perspective, it might sound odd to combine such an approach with insights from path dependence theory, which again roots in works by the economists David (1985) and Arthur (1989). The reason for this choice is threefold: first, while we do want to strengthen the role of managerial contingency in platform governance, we want to warn against overstating managerial leeway too. Second, as pointed out by Langlois (2002: 25), modular innovation promoted by platforms might come at the cost of increasing costs of systemic innovation. Third, recent applications of path dependence theory in an organizational realm (see, for example, Sydow et al. 2009; Dobusch 2010) sensitize for rigidities or even lock-ins in particular, which may result from initially successful governance practices. All these points taken together imply following the recommendation by Tiwana et al. (2010: 685) to "explicitly consider the possibility of nonlinear and threshold effects."

2. Theory: Platform Evolution as a Path Dependent Process

Platforms can be conceptualized as a collection of interdependent standards (Battaglia et al. 2004). These standards are necessary on multiple levels such a data formats, interfaces or module design and enable the interplay of different modules which are jointly operated to provide a composite outcome.

As soon as one acknowledges that, specifically in technological contexts, standards require adaptation, a dynamic perspective on standards – or better: standardization – is needed. Recently, Tiwana et al. (2010) took such a process perspective in a commentary trying to carve out interesting research questions with regard to platform evolution. Theoretically, however, Tiwana et al. juxtapose four different perspectives, ranging from modular systems theory over evolutionary selection and real options theory to bounded rationality approaches.

The path dependence perspective described below is somewhat orthogonal to these four theoretical lenses. Path dependence is, first of all, a phenomenon. Interpreted broadly, path dependence is equivalent with the truism that "history matters" or, in the words of Teece and Pisano (1994), that "bygones are rarely bygones."

In a more narrow sense, which was specifically developed in the realm of technological standardization processes, one can speak of path dependence as a theoretical conception. Those researchers, who intentionally use "path dependence" in such a theoretical and not in a merely metaphorical or heuristic way, overwhelmingly locate their work in the tradition of David (1985) and Arthur (1989), who modelled non-ergodic, history-determined processes as an alternative to the widespread economic assumptions of equilibrium and efficiency.

Recently, Sydow, Schreyögg and Koch (2009) have tried to systematize this approach and to extend its scope of applicability beyond the field of technological standardization into the realm of organizational processes. In a nutshell, Sydow et al. (2009: 691; emphasis in original) "suggest subdividing the whole process of evolving path dependence into three stages governed by *different* causal regimes and constituting different settings for organizational action and decision making" (see Figure 1). The theoretical core is positive feedback mechanisms (phase II), which link initial contingencies (phase I) with an eventual state of hyperstability called "lock-in" (phase III). Path dependence is thus to be located in the realm of mechanism-based theorizing, which aims to explain social phenomena by identifying

the processes through which they are generated (Davis and Marquis 2005). On this level of abstraction path dependence is a theoretical umbrella term covering various processual empirical phenomena.

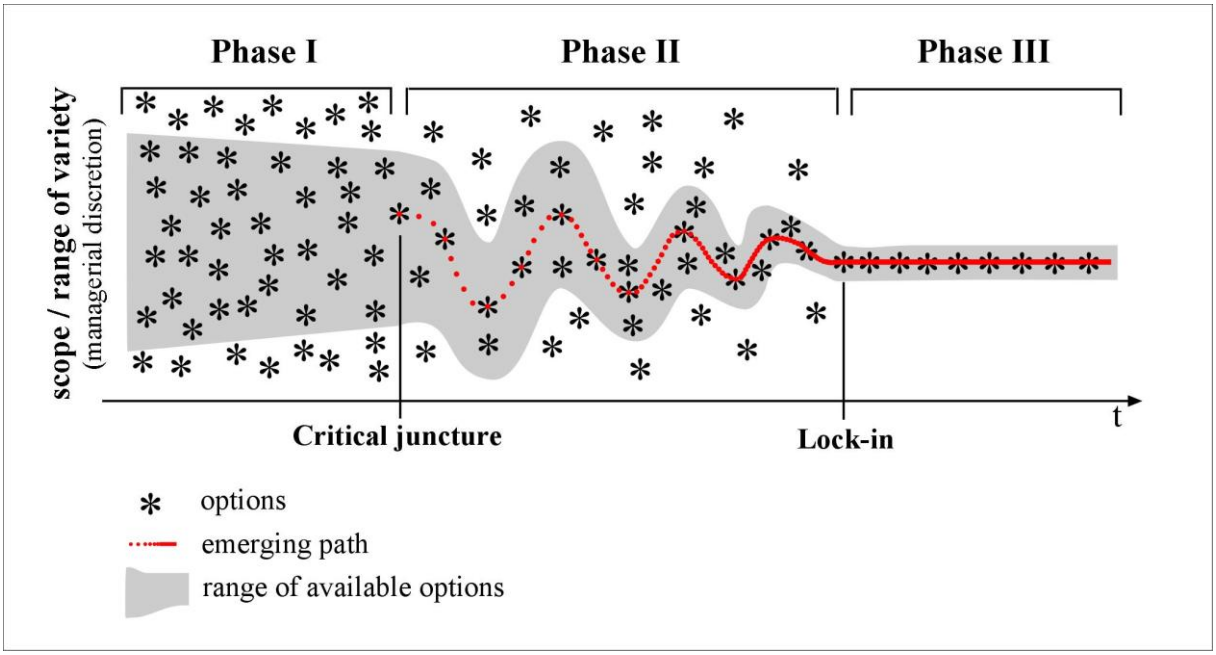

Figure 1: Phases of a path dependent process (taken from Sydow et al. 2009: 692)

The next three subsections are devoted to explaining the peculiarities of each of the three phases of such a path dependent process. We thereby try to allude to current discussions on platform-based enterprise ecosystems where we see fit (for details on the following see Sydow et al. 2009 as well as Dobusch and Kapeller 2011).

2.1 Preformation: Platforms between Path Creation and Emergence

In the beginning of path dependent processes there is contingency. It is at this stage where comparably "small events" (Arthur 1989) play a decisive role. Arthur (1989: 117-118) argues that small events matter since they "are not averaged away and 'forgotten' by the dynamics – they may decide the outcome" but at the same time "are outside the ex-ante knowledge of the observer – beyond the resolving power of his 'model' or abstraction of the situation"; the latter is what makes small events responsible for the ex-ante non-ergodicity of path dependent processes.

Consistent with this definition of small events are thus both "unpredictable, non-purposive, and somewhat random events" (Vergne and Durand 2010: 11) and actors that are "able to

improvise and bricolage their ways through an emergent process" (Garud et al. 2010: 8). Theorizing from the perspective of the actors involved in the process: what appears as purely random for one observer may be attributed causally to intentional actions by another one. Thus even a "big event" at the time being is included as it may appear as a small and random event in retrospect (Sydow et al. 2009: 693).

In the context of platform governance, we can also observe both these perspectives. For one, regularly platforms are (re-)designed being under the expectation of increasing difficulties to change certain standards at later stages of process (Langlois 2002; Tiwana et al. 2010). But even such a path creation perspective faces the challenges of unanticipated developments (Baldwin and Woodward 2009) and, more generally, of unintentional consequences of intentional decision-making (Giddens 1984).

For another, not all platform-related developments are immediately recognized in terms of their potential for path dependent outcomes. This is particularly true for processes taking place on complementary but reciprocally interrelated levels such as technological standards and organizational structures (see Dobusch 2010). In such cases of path emergence, the respective dynamics can be considered to take place behind the back of the agents – at least until the rise of a seemingly superior alternative makes the path visible.

In both cases of path creation and emergence, the end of the historically contingent preformation phase is reached as soon as positive feedback kicks in.

2.2 Formation: Positive Feedback between Technology and Organization

Many cases of platform technologies such as the DVD (Dranove and Gandal 2003) or mobile telecommunication standards (Koski and Kretschmer 2005) are explained via positive feedback with increasing returns to adoption that occur for several reasons (for a comprehensive discussion of positive feedback mechanisms, see Dobusch and Schüßler 2007).

First, platform technologies, specifically with high levels of modularity (Langlois 2002), are accompanied with high set-up, but low manufacturing costs, and costs fall rapidly as sales increase. Such *dynamic economies of scale* enable first movers to reinvest the returns in product innovation, thus making further growth more likely. Second, platforms become more

attractive the more they are adopted due to *network effects*. In the realm of platform technologies, the most important type are *indirect* network effects, stemming from the variety and quality of complementary goods – modules – supplied by third parties – the enterprise ecosystem –, thus making the platform technology more attractive for current and potential users (Katz and Shapiro 1985; Weitzel et al. 2006). Third, there are *learning effects* with regard to both the platform (on the side of module providers and consumers) and the individual modules (on the side of consumers). Once users of a particular platform and/or platform-specific modules have invested in training, they are "grooved in" to the technology (Arthur 1996: 103) and experience switching costs when changing to an alternative technology. Fourth, not only the extant installed base but also expected future choices of other agents matter. The platform "that is *expected* to become the standard *will* become the standard. Self-fulfilling expectations are one manifestation of positive-feedback economics and bandwagon effects" (Shapiro and Varian 1999: 13-14; italics by the authors)

Mechanism category	*Description of the mechanism*
Coordination effects	The more something is done, the greater the benefits (also for the individual actor) of doing it.
Complementarity effects	Adding more complementary items to a system makes using the system more attractive
Expectation effects	Anticipation of the choices of others leads to local decisions and can result in a self-reinforcing pattern on a population level
Investment and learning effects	An investment (cognitive, emotional, financial) leads to further investment into the same

Table 1: Categories of positive feedback mechanisms (adapted taken from Sydow et al. 2009)

These more or less well known examples of positive feedback in technology markets may be further complicated – reinforced – by complementary dynamics within or between organizations. In the still young field of organizational path dependence, Sydow et al. (2009) consequently speak of "self-reinforcement" and distinguish four mechanism categories: *coordination effects*, *complementarity effects*, *adaptive expectations* and *learning effects* (see Table 1). While being similar to the mechanisms discussed in the context of technological standardization, these categories refer to (inter-)organizational rules, resources, practices, and strategies.

In the context of platforms, the interplay between technological and (inter-) organizational structures may best be illustrated by pointing to "everyone's favorite example" (Shapiro and Varian 1999: 24) for phenomena such as increasing returns or lock-in: Microsoft Windows. In desktop software markets the literature is full of descriptions how the large installed base of

Windows leads application programmers to develop their software predominantly for that platform – specifically in the field of special purpose applications with rather small niche markets. This, in turn, makes the platform Windows more attractive for users that value software diversity and application quality (see, for example, Shapiro and Varian 1999). Another much more organizational part of this story remains however often untold. Organizational adopters of Windows adapt their organizational routines and structures to the standard and, over time, build up huge stocks of platform specific competencies and special purpose applications. As a consequence, Microsoft needs not fear substantial competition in its core markets even though functionally equivalent alternatives on open source basis have been available for over a decade now (for details see Dobusch 2008, 2010). Organizational users of Microsoft Windows are locked-in.

2.3 Lock-in: Platform, Module Providers and Users

The final lock-in phase of a path dependent process represents a situation where no viable – in terms of switching efforts – alternative to a given technology, institution or strategy can be realized. This broad definition already points to the fact that in the context of platform technologies all three groups of actors – platform and module providers as well as platform/module users – might be locked-in. Referencing Giddens (1984), Sydow et al. (2009, 694) argue that a lock-in may be of a predominantly cognitive, normative, or resource-based nature; while on the market level a lock-in can gain "deterministic character" in form of (technological) monopoly, in the organizational realm Sydow et al. (2009, 695) "suggest conceptualizing the final stage of a path dependent process in a less restrictive way – as a predominant social influence, leaving some scope for variation."

Methodologically, however, the state of lock-in is virtually inseparable from the previous stages of positive feedback mechanisms and path creation/emergence: even the empirical question whether positive feedback can still be found in situations of alleged lock-in requires identification and measurement of these very mechanisms. The question whether any other alternative would have been or still was viable or even superior compared to the status quo, might in turn require ideographic reasoning susceptible to the idiosyncrasies of the case at hand.

3 Discussion: Implications for Ecosystem governance

With regard to governance of platform-based enterprise ecosystems, which regularly means taking the perspective of a focal platform leader (cf. Beimborn et al. 2011), two issues seem to be particularly interesting for further research. First, when and why does successful path creation turn into inefficient path dependence? Second, how can inefficient paths be broken?

3.1 Paths from Efficiency to Inefficiency

The original economic debates on path dependence were dominated by the claim that, under certain circumstances, markets might lead to inefficient outcomes (see David 1985, 2001; Liebowitz and Margolis 1990, 1994). In the most recent works on path dependence this dispute has been settled with the consensus that paths should be considered "potentially inefficient" (Sydow et al. 2009: 692).

For the designer of a platform for enterprise ecosystems, creating a path that exhibits substantial positive feedback effects among module providers and platform users is a desirable goal. Successful design of platform characteristics in terms of architecture, interfaces and standards (Langlois 2002) may then lead to growing adoption up to a point, where the positive feedback leads to further platform adoption. Success breeds success.

It is however exactly this self-supporting dynamic that already contains the seed for failure in the future. While platform adoption is still rising, this might be more and more due to network effects and less due to the right design and governance decisions. For one, the rate of innovation might decrease due to reduced competitive pressures. For another, platform leaders might be tempted to exploit their powerful position vis-à-vis both module providers and/or platform users. Taken together, these dynamics might then fuel radical innovation outside of the platform-based ecosystem.

For research, this raises difficult questions. How can the different sources of platform success be differentiated empirically? What is attributable to network effects and other forms of positive feedback, what to platform quality? These are questions also of highly practical value for managers of successful platforms, who want to avoid falling into a "success trap", where success breeds success breeds failure.

3.2 Path-breaking?

The second question, how inefficient paths can be broken, can again be asked from three different perspectives – platform and module providers as well as platform users. In the literature, the dominant issue for all three groups of actors is switching costs (Shapiro and Varian 1999); this question is, however, only pertinent if there is an alternative, which is considered to be functionally viable by the actors of interest. Furthermore, under circumstances of anticipated path dependent dynamics, current viability might be even less important than expected viability, which in turn depends on the expectations of other actors in the field. This points to the fact that switching costs are only a small part of the story in path dependent processes.

From a research perspective, the difficulty lies also deciding whether we have a case of "unlocking" or „path-breaking" (e.g. Sydow et al. 2009) or whether there was no path dependence in the first place.

4 Conclusions and Outlook

In the realm of platform-based enterprise ecosystems, path dependent developments are likely to not be the exception but the rule. Many – if not most – of the core design decisions are contingently made upfront and become increasingly difficult to change as the ecosystem gains momentum; distinguishing between different categories of positive feedback mechanisms may be helpful to systematize the explanation of these developments and to cover the interaction between technological and organizational dynamics. The latter is of particular importance, since platform success due to increasing returns to adoption may crowd out innovation incentives or inspire defunct governance practices, which then lead to platform demise in the long run.

When addressing the issue of a path's (in-)efficiency, the most important question to clarify is who should be considered as being path dependent. While actions of all three groups of actors – platform providers, module developers, and platform users – together create and shape a path dependent process, the implications on each of the groups leeway my be far from symmetrical. For future research on path dependence in platform-based enterprise ecosystems, this implies combining an interorganizational perspective in evaluating platform governance with a clear focus on one type of actor in assessing potential path dependent dynamics.

References

Arthur, W.B. (1989): Competing technologies, increasing returns, and lock-in by historical events. *Economic Journal*, 99, 116-131.

Arthur, W.B. (1996): Increasing returns and the new world of business. *Harvard Business Review*, July-August, 100-109.

Battaglia, P.A./Byers, C.C./Guth, L.A./Holliday, A./Spinelli, C./Tong, J.J. (2004): Modular platform vision and strategy. *Bell Labs Technical Journal*, 9 (1), 121-142

Beimborn, D./Mädche, A./Müller, B. (2011): Editorial: Workshop on the tole of platforms for Enterprise Ecosystems (3EP). Berlin.

David, P.A. (1985): Clio and the economics of QWERTY. *American Economic Review Proceedings*, 75, 332-337.

David, P.A. (2001): Path dependence, its critics and the quest for "historical economics' economics. In: Pierre Garrouste (ed.): *Evolution and path dependence in economic ideas: Past and present*. Cheltenham: Edgar Elgar, 15-40.

Davis, G.F./Marquis, C. (2005): Prospects for organization theory in the early twenty-first century: Institutional fields and mechanisms. *Organization Science* 16, 332-343.

Dranove, D/Gandal, N. (2003): The DVD-vs.-DIVX standard war: Empirical evidence of network effects and preannouncement effects. *Journal of Economics and Management Strategy*, 12 (3), 363-386.

Dobusch, L. (2008): *Windows versus Linux: Markt – Organisation – Pfad.* Wiesbaden: VS Verlag für Sozialwissenschaften.

Dobusch, L. (2010): Kaskaden der Komplementarität: Pfadabhängigkeit organisationaler und technischer Strukturen. *Zeitschrift für betriebswirtschaftliche Forschung*, 62, 422-451.

Dobusch, L./Kapeller, J. (2011): Striking new paths: Theory and method in path dependence research. Paper presented at the 2nd International Conference on Path Dependence, March 3-4, 2011, Berlin, Germany

Dobusch, L./Schüßler, E. (2007): From storytelling to theory: Unlocking path dependency from metaphorical usage. Paper presented at the 23rd EGOS Colloquium, 5-7 July 2007, Vienna, Sub-theme 14: Path dependencies and beyond.

Dyer, J.H./Singh, H. (1998): The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage. Academy of Management Review, 23 (4), 660-679

Economides, N./Katsamakas, E. (2006): Two-dided competition of proprietary vs. open source technology platforms and the implications for the software industry. *Management Science*, 52 (7), 1057-1071.

Garud, R./Kumaraswamy, A./Karnøe, P. (2010): Path dependence and creation. *Journal of Management Studies* 47, 760-774.

Giddens, A. (1984): *The constitution of society: Outline of the theory of structuration*. University of California Press.

Katz, M.L./Shapiro, C. (1985): Network externalities, competition and compatibility. *American Economic Review*, 75 (3), 424-440.

Koski, H./Kretschmer, T. (2004): Survey on competing in network industries: Firm strategies, market outcomes, and policy implications. *Journal of Industry, Competition and Trade*, Bank Papers, 5-31.

Langlois, R.N. (2002): Modularity in technology and organization. *Journal of Economic Behavior and Organization*, 49, 19-37.

Liebowitz, S.J./Margolis, S.E. (1990): The fable of the keys. *Journal of Law & Economics* 33, 1-27.

Liebowitz, S.J./Margolis, S.E. (1994): Network externality: an uncommon tragedy. *Journal of Economic Perspectives* 8, 133-150.

Shapiro, C./Varian, H.R. (1999): *Information Rules: A Strategic Guide to the Network Economy*. Boston: Harvard Business School Press.

Sydow, J./Schreyögg, G./Koch, J. (2009): Organizational path fependence: Opening the black box. *Academy of Management Review*, 34, 689-709.

Teece, D./Pisano, G. (1994): The dynamic capabilities of firms: an introduction. *Industrial and Corporate Change*, 3 (3), 537-556

Tiwana, A./Konsynski, B./Bush, A.A. (2010): Platform evolution: Coevolution of platform architecture, governance, and environmental dynamics. *Information Systems Research*, 21 (4), 675-687

Vergne, J. and Durand, R. (2010): The missing link between the theory and empirics of path dependence: Conceptual clarification, testability issue, and methodological implications, *Journal of Management Studies* 47, 736-759.

Weitzel, T./Beimborn, D./König, D. (2006): A unified economic model of standard diffusion: Impact of standardization cost, network effects, and network topology. *MIS Quarterly*, 30, 489-514.