Architectural Strategy and Design Evolution in Business Ecosystems: Research Opportunities and Empirical Challenges

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Sponsors: TIM, BPS, ENT, OMT

Scheduled: Saturday, August 10 2013, 10:15AM – 12:45PM
WDW Swan Resort in Swan 3

Abstract
In the last few years, we have seen increased attention to business ecosystems and related phenomena such as industry architectures, platforms, and value networks. While these phenomena present exciting research opportunities, they also raise daunting challenges. For example, business ecosystems are often characterized by complex structures (e.g., intricate links, nested layers, and fuzzy boundaries), as well as complex dynamics (e.g., co-evolution of strategic behavior, technology, and competitive outcomes). Reasoning about strategic design choices in such turbulent environments is difficult and uncertain. Yet, the way an ecosystem’s participants shape the artifacts they produce and their relationships with each other can profoundly affect the ecosystem’s evolutionary trajectory. And while the significance of these design choices has been recognized, the theoretical and methodological tools needed to study them rigorously remain underdeveloped. This PDW aims to address this gap in two ways. First, we will examine the existing body of scholarship that bears on the topic of how firms navigate and strategize in business ecosystems, with an eye toward identifying open research questions that hold particular promise. Second, we will discuss how the emerging research community on business ecosystems can begin to address these questions, with an emphasis on the required advances in architectural representation techniques, data collection, and empirical analysis.

We encourage participants to pre-register and indicate their research interests at: http://smusg.asia.qualtrics.com/SE/?SID=SV_eKy3fAT2Zfuhn01
I. Overview of the workshop

Motivation

In the last few years, we have seen increased attention to business ecosystems and related phenomena such as industry architectures, platforms, and value networks. While these concepts present exciting research opportunities, they also raise daunting challenges. For example, empirically, these phenomena are often characterized by complex structures (e.g., intricate links, nested layers, and fuzzy boundaries), as well as complex dynamics (e.g., co-evolution of strategic behavior, technology, and competitive outcomes). Surveying the existing literature on these topics, we believe the groundwork has been laid to make significant progress. As such, the overarching aim of this PDW is to take stock of the current state of the art and explore how we can move forward.

Broadly conceptualized, industry or business ecosystems refer to interconnected firms, individuals and communities collectively engaged in the creation of a good or service. Given widespread firm specialization, this form of organization has become a pervasive feature of the economy. We are especially interested in the dynamics underlying business ecosystems. For example, under what conditions do these structures change (and when do they remain more stable)? What are the implications for firm strategy in changing environments? What are the broader implications for innovation, profitability, firm entry and exit?

Empirically, changes brought about by business ecosystems appear most visible in the high-tech sector, in particular IT-intensive industries (e.g., computer hardware and software). Even industries not directly related to computers, such as telecommunications and photography, are driven increasingly by IT-related knowledge bases, bringing them into closer contact than ever before. This increasingly dense web of interconnected relationships has grown to include publishing, music, and retail, breaking down traditional industry boundaries and motivating the use of more flexible concepts like networks and ecosystems to describe their structure.

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Objectives

The overall objectives in this PDW are as follows:

A) First, we aim to identify a broader research agenda. Here we collectively identify key research issues related to architectural strategy and design evolution in business ecosystems. For example:

- When are architectural design choices more endogenous or exogenous to a particular firm? How do industry or technology lifecycles affect a firm’s ability to influence a business ecosystem’s structure?
- What can we learn from historical business ecosystem dynamics? What can’t we learn from previous cases (e.g., idiosyncrasies in the case of the IBM PC architecture)?
- Can we assume that products / technologies / services generally become more modular over time? If so, what are the strategic implications for firms operating in business ecosystems?
- Existing work (e.g., Patel & Pavitt, 1997; Luo et al., 2012; von Graevenitz et al., 2011) suggests there are systematic differences between sectors in terms of technological interdependencies. How do these differences affect firm strategies in relation to value creation and capture, as well as value migration (Jacobides et al., 2012)?

B) Second, there are issues in relation to data, methods, and representations. Here we tackle the issue of how we can best address the research topics outlined earlier, with a focus on the data required and the appropriate ways to analyze it, including qualitative and qualitative methods (e.g., case studies, large-sample empirical techniques), formal modeling and simulation (e.g., game theory, agent-based models), and the underlying representation schemes (e.g., DSMs, stacks, layer maps, value networks).

Background

Our belief in the importance of understanding the structure and dynamics of business ecosystems rests on three main premises:

1. A system’s architecture provides a key property for its subsequent development (Simon, 1962; Alexander, 1964; Parnas, 1972).


3. Designers of such systems “see and seek value” (Baldwin & Clark, 2000; Boland & Collopy, 2004; Cross, 2011).

The insights above have spawned a variety of literatures concerning system design, co-evolution, and strategic outcomes. Here we focus on two, partly related, streams of literature.

First, the growing literature on modularity has highlighted the role of modular systems in terms of their implications for product development, competitive advantage, technological trajectories, and entrepreneurial opportunities (e.g., Langlois & Robertson, 1992; Ulrich, 1995, Baldwin & Clark, 2000;
Grounded in Simon’s (1962) insights on hierarchy and near decomposability of complex systems, this line of work has drawn attention to the ways in which a firm’s architectural design choices have important implications, whether they be sometimes unintended or partly emergent. A well-known but perhaps idiosyncratic example is IBM’s decisions to outsource development of their first PC operating system and chipset to Microsoft and Intel respectively; in the longer term, the latter two firms subsequently appropriated most of the sector’s value.

Second, the literature on business ecosystems draws attention to the way a particular system is often embedded in a larger network, which may have important strategic implications (e.g., Moore, 1996; Gawer & Cusumano, 2002; Iansiti & Levien, 2004; Adner & Kapoor, 2010). In certain cases, the performance of a product may depend most directly on its suppliers or complementors. In other cases, a product may be developed by a network of loosely connected firms, with a central “hub” firm providing coordination and governance. This stream of work, drawing on a long line of research that has analyzed technology and industry co-evolution (e.g., Abernathy & Utterback, 1978; Tushman & Anderson, 1986; Suarez, 2004; Murmann & Frenken, 2006), draws attention to the relational structure surrounding the development of the focal system.

Taken together, this literature suggests that:

A) The architecture of a given system (product, service or technology) can have important strategic implications, for example, in terms of the creation and appropriation of value, the value of a firm’s existing resource base, and a firm’s ability to control and coordinate its technological trajectory and innovate.

B) Firms can, to a greater or lesser extent, influence the relationships surrounding the development of their system in ways that are beneficial to them, for example, in terms of value capture, alignment with capabilities, technological trajectories, and service provision.

Open issues

Though recent work has started to address architectural strategy and the strategic implications of design evolution in business ecosystems, there are still many open issues in relation to these topics. While not meant to be exhaustive, we would like to highlight in particular these topics and associated issues:

Analyzing structure and dynamics
The complexity and structure of a particular business ecosystem is time and sector dependent. Beyond the task of representing a business ecosystem’s structure at a point in time, the issue of dynamics is perhaps the most interesting and also the most challenging. In certain settings (e.g., Internet-based services) ecosystem structure often changes rapidly, yet other settings (e.g., mining and agriculture) are more stable. We think that understanding the reconfiguration and evolution of ecosystems remains an important question. What are underlying drivers of change (or stability)? Where and when does technological change play a key role, or when do firm actions influence change? Can we observe patterns within or across particular sectors?

Beyond metaphors and dichotomies
The concept of a business ecosystem is one of many ideas that have been imported into management research from other fields, particularly biology. While scholars have long recognized the dangers of applying these analogies too loosely, they have also proven fruitful, both as metaphors and as literal descriptions of reality (e.g., the economy as an evolving complex system, cf. Beinhocker, 2006). Similarly, a variety of dichotomies (open vs. closed, modular vs. integral, core vs. peripheral subsystems) have been proposed to help us make sense of empirical phenomena, even though we all understand that
the world does not neatly divide itself into black-and-white categories. We would like to assess the benefits and limits to these metaphors and dichotomies. What are the boundary conditions of biological metaphors in the management domain? To what extent do the dichotomies we employ limit our ability to recognize important non-binary distinctions?

Measuring value systematically
Much attention, rightly so in our opinion, has been given to value creation and value capture. Yet, it remains a challenge to systematically measure how value is created, captured, or migrates among firms. Publicly listed firms provide some information, but even in these cases, strategic concerns may motivate firms to provide data at a very general level. Building on existing approaches (e.g., layer maps), we would like to explore how we can best address this issue.

Incorporating multiple levels of analysis
The ecosystem construct encompasses multiple domains or levels of analysis, involving firms or other actors operating in one or more industries. This raises the question of how we address these different domains and levels in our research designs? For instance, systematic data on user involvement is often difficult to come by, and how to measure value capture for firms operating across industries can be challenging. While we recognize that there will be no universal answer to this question, we think it is valuable to address how we can make sensible trade-offs between parsimony and expansiveness.

Matching data, methods, and representations
We strongly believe heterogeneity in terms of data and methods is beneficial for the community of researchers addressing the topics outlined in this PDW. Examples of data include large-sample datasets (Adner & Kapoor, 2010), in-depth comparative historical cases (Murmann, 2003), and individual case studies (Brusoni & Prencipe, 2006; MacCormack et al., 2006). Likewise, there are a variety of representations (DSMs, DSNs, layer maps, value networks and value stacks) and methods (agent-based models) that have allowed us to tackle a variety of issues. This PDW can allow us to see how we can most fruitfully combine particular data, methods, and representations.

II. Workshop format

Our PDW starts with a plenary program where several researchers active in the field share their experiences, focusing on the questions outlined below. These presentations are followed by comments from two discussants. Next we have a breakout session where audience members participate in a roundtable session, likewise addressing the questions listed below. The discussions in the individual roundtables are followed by a plenary discussion.

Main questions to be addressed by panelists and roundtable participants

1) What are you working on that is related to the structure or dynamics of business ecosystems?

2) Where have you personally gotten stuck? To what extent has the bottleneck been related to theory, methods, or empirical data?

3) How can we as a community focus our efforts to achieve deeper and more rapid progress?
Program overview *(total time: 150 minutes)*

*Welcome and introduction*  
(10 mins)  
Christopher Tucci (EPFL) and Jason Woodard (SMU)

*Panelists*  
(40 mins)  
Andrea Prencipe (LUISS Guido Carli)  
Arnaldo Camuffo (Bocconi)  
Rahul Kapoor (Wharton)  
Richard Tee (EPFL)

*Discussants*  
(20 mins)  
Johann Peter Murmann (ASB)  
Carliss Baldwin (HBS)

*Break*  
(10 mins)

*Roundtable breakout sessions*  
(30 mins)

*Plenary discussion*  
(30 mins)  
Moderator: Elizabeth Jane Altman (HBS)

*Closing and wrap-up*  
(10 mins)  
Christopher Tucci (EPFL)

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[http://smusg.asia.qualtrics.com/SE/?SID=SV_eKy3fAT2Zfuhn01](http://smusg.asia.qualtrics.com/SE/?SID=SV_eKy3fAT2Zfuhn01)
References


