

Towards a Theory of Ecosystems (with a phenomenological preamble)

Chaire Armand Peugeot Meeting Keynote
Paris, December 14, 2017
Michael G. Jacobides



The world today is *structurally different* from what it was- and this changes how (or whether) you make money

- For a long time, business activities were well delineated
 - From guilds to regulated sectors, business models were clear & static
- Structures were reinforced by tradition, reputation and expertise...
 - ...making it hard for outsiders to challenge and leaving good margins
- But technology, regulation & step-up in competition blew this up
 - Stable boundaries and professions are disrupted, margins implode
 - Technology, globalization, challenge how we structure sectors

**The “geography of competition” is changing:
Consider computers and how they shifted...**

Equipment, Material	Teradyne, Millpore, AM,...
Components	Mosanto, Shipley,...
Product Design	I C A-D-E-F-G-H-I-J-K-L-M-N-O-P-Q-R-S-T-U-V-W-X-Y-Z
Assembly	B o n t r o l
Operating System	M
Applications Software	D a t a
Sales & Distribution	P r o
Field Service	o

Source: Adapted from Andy Grove, 1994

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**...from a stable structure to a modular, disintegrated world
...with new winners and losers**

Equipment, Material	Teradyne, Millpore, AM,...
Components	Intel, AMD, Quantum
Product Design	IBM, Compaq, Dell
Assembly	Solelectron, Celestica
Operating System	Microsoft
Applications Software	Microsoft, Lotus, Borland
Sales & Distribution	CompUSA, Dell,...
Field Service	Independent Contractors

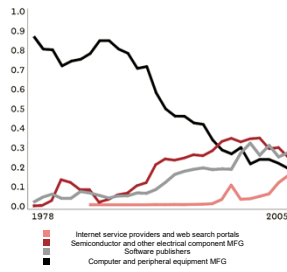
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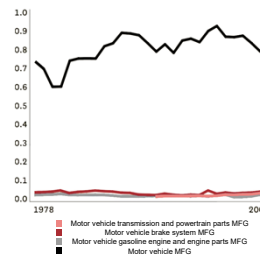
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...which is what underlies the patterns of value migration

Computer OEMs have seen their share of the sector's total market cap fall from more than 80% to less than 20%



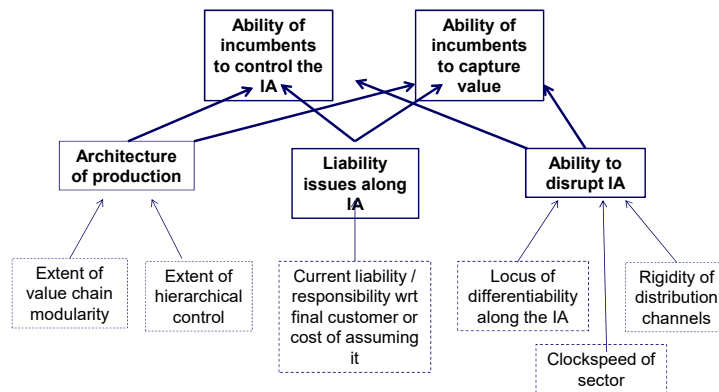
Automotive OEMs retained its share of the sector's total market cap



Jacobides & MacDuffie, Make value migrate your way, *Harvard Business Review*, 2013

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Why did the OEMs drive the agenda?
Understand drivers and implications of *Industry Architecture*

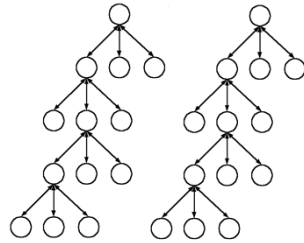


Jacobides, MacDuffie & Tae, Agency, structure, and the dominance of OEMs: Change and stability in the automotive sector, *Strategic Management Journal*, 2016

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...by getting behind the structure which drive behavior...

Automobiles: Hierarchical Structure



Computers: A set of verticals

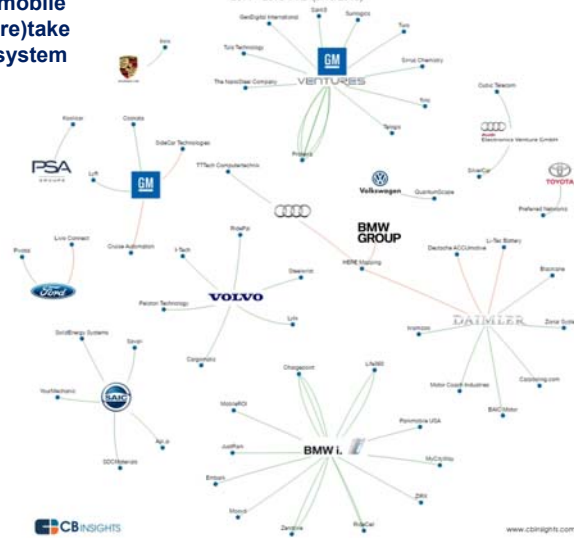
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Jacobides, MacDuffie & Tae, Agency, Structure and the Dominance of OEMs, *Strategic Management Journal*, 2016; Jacobides and MacDuffie, *HBR*, 2013

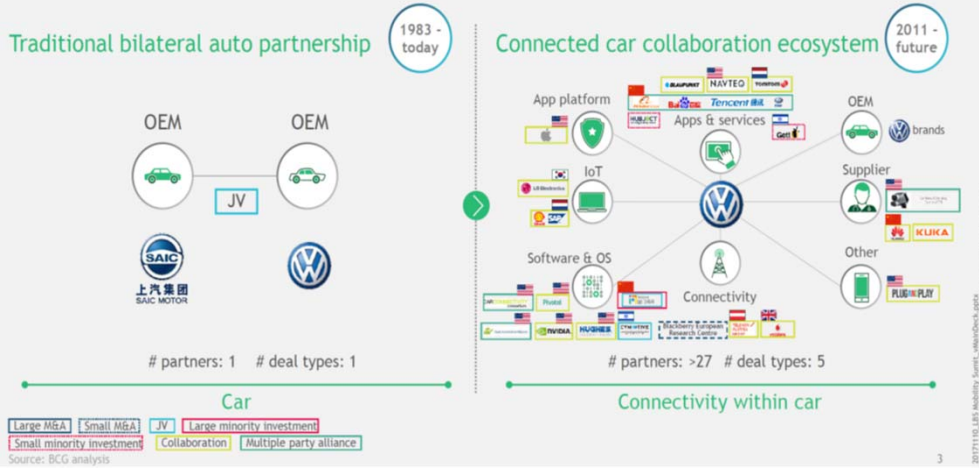
Consider how Automobile OEMs are trying to (re)take control of their ecosystem

Where Major Auto Manufacturers Are Making Private Market Bets
2011 - 2016 YTD (5/10/2016)



Update from a recent LBS workshop on the “future of mobility ecosystems”: N Lang, BCG, view

On top, drastic change of collaboration model for OEMs



...which reflects the view in the room which was that we are shifting to a world of tighter interdependencies

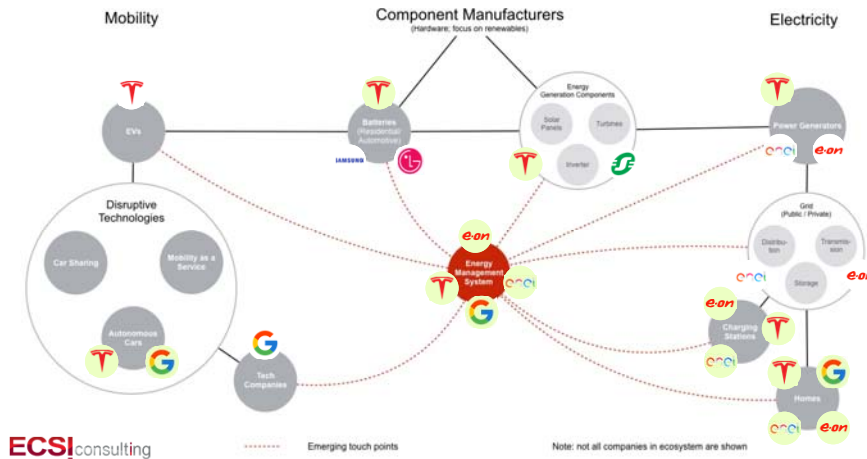
OEMs have to set up complex digital ecosystems

Traditional collaboration model

Digital collaboration ecosystem

Product	Focus	Complex, integrated solution/theme
Mainly JVs and alliances	Deal type	Various deal types
Mostly intra-industry	Industry	Mostly cross-industry
Dominance of mature market incumbents	Geography	Challenge from new emerging market players
Long, >10 years	Duration	Short, <5 years
Rigid value chains	Structure	Highly adaptable ecosystem value webs
Scale and knowledge transfer	Value creation	Innovation leadership and speed to market
Mainly fixed assets, monetary	Contribution & consideration	Mainly IP, monetary and non-monetary

New connections by players trying to dominate their (and other!) sectors, and try to build ecosystems around them.



ECSI consulting

..... Emerging touch points

Note: not all companies in ecosystem are shown

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From the phenomenon to the theory



Towards a Theory of Ecosystems
 Joint w C. Cennamo & A. Gawer (SMJ u.f.r.)

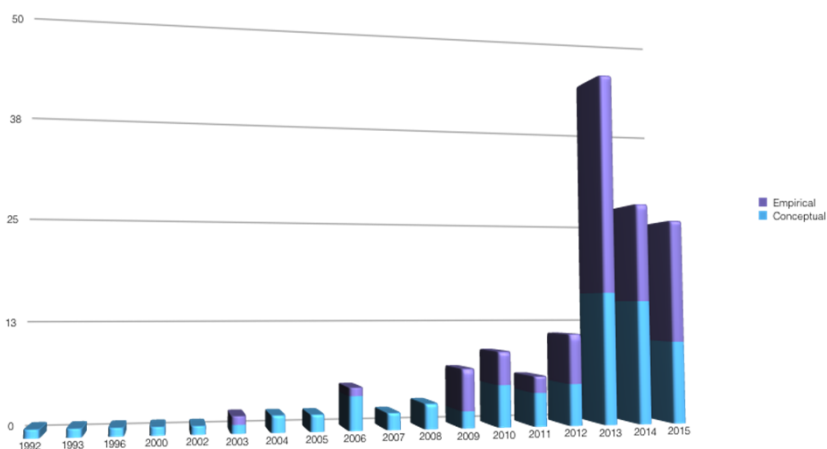


Recent excitement about ecosystems

- Use of business ecosystem increasing in practice:
 - In its 2014 IPO prospectus compiled to describe its vision, philosophy, and growth strategy, Alibaba used one word no fewer than 160 times: “ecosystem.”
 - Accenture’s recent “new thinking” is on “ecosystem platform strategy” (think Apple’s ecosystem and Google/ Android’s ecosystem)
- But- what does it come down to? How is this different or new or academically relevant?
 - E.g.: “Ecosystems are dynamic and co-evolving communities of diverse actors who create and capture new value through collaboration and competition” “Businesses are moving beyond traditional industry silos and coalescing into richly networked ecosystems, creating new opportunities for innovation alongside new challenges for many incumbent enterprises” (Kelly, Deloitte University Report: Business Ecosystems Come of Age, 2015).
- “Drawing the precise boundaries of an ecosystem is an impossible and, in any case, academic exercise.” (Iansiti & Levien, 2004)
- Bring it on! Critical review of what has been said and ways forward

It’s not just practice: Papers on ecosystems

- Published items containing the term “ecosystem” in the title, abstract, or keywords in business outlets returned by ISI Web of Science N = 150 (after excluding studies that only generically use the term). up to 2015 (included)



Understanding the excitement: From “what” to “why and when”

- Why might this be? Changes in the world, changes in theoretical focus
 - Practice: Unbundling of sectors, dis-integration of production & integration of trade, outsourcing, reintegrating, powerful new groups w/o ownership
 - Increasing role of modular architecture? (we shall return to it later)
 - Theory: It's been long since we really obsessed about the aggregate. Focus on the firm, capabilities, their change, now migrating back into looking at their context and how to leverage it.
 - A bit of cynicism: Struggle for novelty, creation of labels that are “hot”...
- Ecosystems are here- but, what exactly are they? More important, **why** do they matter, and **when** should we expect them to arise?
 - Why are ecosystems relevant from a theory standpoint (ie., how are they novel in terms of *mechanisms* compared to related, existing literature)?
 - Why do we see firms coalesce into ecosystems? Seen from a CIA perspective, **when** do we expect them to displace “firms” or “markets”?

Our paper: Beyond literature sense-making... what is new? (not just trendy!), focus on **why and when**

- Critical review of the ecosystem literature in business and strategy
 - Systematic analysis to organize our understanding, and articulate what is said, focusing on the novelty of the explanatory mechanisms put forth
- Proposed agenda to progress with a “theory of business ecosystems”
 - *What* are the theoretical foundations of ecosystems; *Why* shall we care about them; *When* is the ecosystem analytically useful and *why*
 - Consider *why* firms align (more or less) and, crucially, *when* we expect “ecosystems” to emerge as a form (or not) and why
- Part of a broader agenda of increasing attention to “the aggregate”
 - With transformations to the business environment and neglect in the academic context, there's a spike of interest, and maybe some new canonical structures
 - Existing work tangential and not fully equipped; new work emerging without link to theory. Novelty sexes things up....

Different Angles:	Firm angle N=82 (55% of articles)	Innovation angle N=35 (23%)	Platform angle N=33 (22%)
Representative definition	The community of organizations, institutions and individuals that impact the enterprise and the enterprise's customers and suppliers (Teece 2007)	Collaborative arrangements through which firms combine their individual offerings into a coherent, customer-facing solution (Adner 2006)	The network of innovation to produce complements that make a platform more valuable (Ceccagnoli et al. 2012)
Ecosystem as	Firm's extended Community (supportive/operating environment)	Interlinked firms' innovation (group-related actors)	Set of firms specializing in a platform technology
Unit/Focus of analysis	Mainly Firm; new venture, product niches	Interfirm links/activities; firm's innovation; subindustries	Platform; Core and peripheral technologies
Dynamics of interest	Firm evolution (learning/capabilities)	Value co-creation	Technology evolution/adoption
Empirical studies (% within group)	40% (73% qualitative)	57% (35% qualitative)	58% (32% qualitative)
Empirical setting/sectors	Automotive industry; Internet sector (startups); mobile devices; IT	Package software; IT; Solar photovoltaic; PC gaming; Semiconductor; Hospital-medical imaging	Mobile internet service; ERP software; Videogaming; ICT (mobile data services)
Representative studies	Iansiti & Levien (2004); Moore (1993); Pierce (2009); Williamson & DeMeyer (2012); Teece (2007); Zahra and Nambisan (2012); Zackarakis et al. (2003)	Adner & Kapoor (2010, 2015); Alexy et al. (2013); Kapoor & Lee (2013); Frankort (2013); Leten et al. (2013); Iyer et al. (2006); Brusoni & Prencipe (2013); West & Wood (2013)	Ceccagnoli et al. (2012); Cennamo & Santaló (2013); Cennamo (2006); Gawer & Cusumano (2002, 2008); Wareham et al. (2014); Tiwana et al. (2010);

Ecosystems: Some key open issues

- **Variance in definitions** and operationalisations: different angles of the same phenomenon? Or, different types of ecosystems? Or, different views of the key definitional characteristics of an ecosystem?
 - New context where firms' activities are embedded (e.g., Adner & Kapoor 10)?
 - New organisational form ("meta-organizations" –Gulati et al 12; "semi-regulated markets" as hybrid between markets and hierarchy –Wareham et al. 14)?
- What is the **novelty in terms of theory**? Risk of reinventing the wheel
 - Consider Tripsas (1997), with a new label of "ecosystem". What would have changed? Need to integrate insights from complementary asset investigations, Network Dynamics, Industry Architecture work...
 - Better / tighter / clearer definition should go hand in hand with greater focus on what's new and what's not
 - Move beyond "elective affinities" (eg w CGT) and *use theory or amend it*
- Focus on **structure** and how this drives **behaviour** and not on **outcomes**
 - Elusive attraction of co-competition or cooperation; need to start with primers and then articulate mechanisms, showing how they differ in ecosystems of various sorts

Progress and questions still unanswered

- Adner (2017): *“The ecosystem is defined by the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize”*
 - Important step forward towards a “structural view”
 - Offers a useful “grammar” and clarifies differences on the overarching phenomena with respect to existing research: the concept of ecosystem is *“neither necessary nor sufficient, but increasingly critical”*
 - Focus though is on the “value proposition”, and the “alignment structure” – structure and behavior: how do we separate them? What causes what? How do we identify the “alignment structure”? On which basis? What factors make firms want to align via an ecosystem? And what makes ecosystems *theoretically* distinct than existing research?
- A very useful approach, albeit one focused on helping managers understand the complexity of the world around them. Useful *for some purposes* – but, will it serve research?

Methodological foundations and Theoretical primers

- Ecosystem should best describe a structure, separating incentive alignment and cooperation (that can be assessed as resulting behaviors); a “theory of ecosystems” should help explain *why* ecosystems have emerged (especially compared to other modes of organizing economic activities)
- We posit that modularity and different types of complementarities play an important driving role
- Key aspect of ecosystems: balance between need for coordination between interrelated organizations and autonomy. This is possible because of modular architecture (Baldwin & Clark ‘00) – distinct parts of the ecosystem represent organizations that are separated by “thin crossing points” (Baldwin, 2010), ie discrete parts of the production process
- **Modularity** allows for alignment to occur and for the lack of explicit coordination from a central agent (but modularity *isn’t* always open)

The role of complementarities at the root of ecosystems

- Ecosystems may constitute a distinct kind of solution to an inter-firm coordination problem arising under circumstances of modularity. Coordination need arises when there are complementarities across actors.
- Distinct types (and varying intensity) of complementarities:
 - **Unique** (or “strict”) complementarity (“A doesn’t function without B”) (eg. Hart & Moore 90) – often dominant in production
 - The two elements are unproductive unless they are used together, which makes coordination of investments in the two elements critical to maximize the marginal return on investment
 - **Super-modular** (or “Edgeworth”) complementarity (“more of X makes Y more valuable”) – often dominant in consumption (or in-use)- Topkis, 1978, 1998; Milgrom & Roberts 90)
 - In production: coordinated investments in both X and Y yield higher returns (lower costs) than uncoordinated equivalents (sum of costs) (eg. Arora & Gambardella 90; Cassiman & Veugelers 06; Lee et al. 10); In consumption: is famously the basis of direct/indirect network effects (eg. Farrell & Saloner 85; Parker & Van Alstyne 05)

The role of complementarities at the root of ecosystems

- Both types can be generic or specific (cf Teece 86) at the system level depending on the *system’s given purpose* (see Hart & Moore 90)
- Generic -> elements are fungible across many applications (in production/consumption) – i.e., it’s standardized
- Specific -> elements involve *some level of customization/specialization* to achieve complementarity
- The *purpose* of the system defines the extent of complementarities among the elements, and thus the need for coordination

The role of complementarities at the root of ecosystems

- Ecosystems contain *groups* of firms that must deal with *non-generic** unique and/or supermodular complementarity. Thus:
 - their fates are intertwined, and
 - they tend to have some degree of co-dependence as a result, but
 - complementarities can be contained and coordinated without the need for vertical integration – (co-)specialization at the *group level*
- Ecosystems allow for some degree of coordination without requiring hierarchical governance, precisely because of the ability to use some standards or base requirements that allow complementors to make their own decisions (in terms of design, prices, etc.), while still allowing for a complex interdependent product or service to be produced

*This also sets apart MSPs (multi-sided platform markets) from ecosystems



Unique Complementarity			
Specific	Group-level (co-)Specialization in Components Coordination needed across producers to allow production of compatible components (which would be unproductive when produced independently) (e.g., solar photovoltaic panels producers, racking producers, installation providers; 3D integrated chips, compatible memories, displays, devices, and software)	Group-level (co-)Specialization in Components & Complements Group-level coordination needed for production of compatible components and consumption of complements (e.g., Android OS and hardware manufactures, and providers of Android apps; Sony-compatible video games and Sony videogame consoles; Electric Vehicle (incompatible) systems, compatible batteries, and compatible charging stations)	
	No Group-level (co-)Specialization No group-level coordination needed to allow production of compatible components or consumption of individual complements (which can be consumed independently or jointly with others) (e.g., tea-cup-sugar; Tennis courts-tennis rackets-tennis balls; 4G-compatible telecommunications networks and compatible devices; Multi-sided platforms (MSPs) such as eBay, or Airbnb)	Group-level (co-)Specialization in Complements Group-level coordination needed to allow consumption of complements (which have less or no value when not consumed together) (e.g., Nike's products and connected wearable technology devices and sport apps; 5G-compatible Internet-of-Things product systems (5G is not standardized yet))	
Generic	Generic	Specific	Super-Modular Complementarity

These 3 blocks are ecosystems

And the resulting proposal wrt definition

(thanks to Dewey & James)

- *A business ecosystem is a set of actors with varying degrees of group-level, non-generic complementarities without full hierarchical control.*
 - Focus on connected **set of firms**, to study the interdependencies
 - **Group level cospecialization**: necessary condition and defining attribute
 - Those who (co-)specialize with the hub obtain a vested interest in the success of the ecosystem as a whole – different problem than traditional TCE focus on tradeoffs at level of dyad
 - Connecting to an ecosystem involves *some* investment that is *not fully fungible*
 - Explicit “anchor” (and associated purpose)- basis of common agenda
 - Defines nature of shared objective across ecosystem members, and thus nature of group-level complementarities and specialization
- **No unilateral hierarchical control** –contrast with supply chains eg Toyota



Benefits of shifting from “what” & “how” to “why” & “when”, part 1: Ecosystem coordination

- **Modularity** is a predictor of ecosystem emergence & design variable
- NB: sometimes there is **accidental** creation of ecosystems (e.g., Apple early Apps for iOS), which can be coopted or lead to bleeding.
- Sometimes it is **intentional but wrong-headed** (see Jacobides, MacDuffie & Tae, 2016 *SMJ* on automobiles)
- Modularity does *not* mean openness- though, regulators, customers may want to *push* for open standards which will **endogenously implode** ecosystems.
- Governance and rules in ecosystems *reflect and drive coordination*



Benefits of shifting from “what” & “how” to “why” & “when”, part 2: Ecosystem collaboration

- Nature and intensity of the collaboration depends on the **nature of complementarities**: Supermodular “binds” firms together more, because it makes participation more valuable as benefits accrue not only in more sales but in more value (coming from customers)
- Crucial question around the **fungibility** of the investment related to ecosystem participation. The lower it is, the more ecosystem members see their common fate binding, *and* the more difficult it becomes to recruit ecosystem members (concerned about lock-in)
- Governance and rules in ecosystems *key strategic and welfare issue*

Benefits of shifting from “what” & “how” to “why” & “when”, part 3: Ecosystem value capture

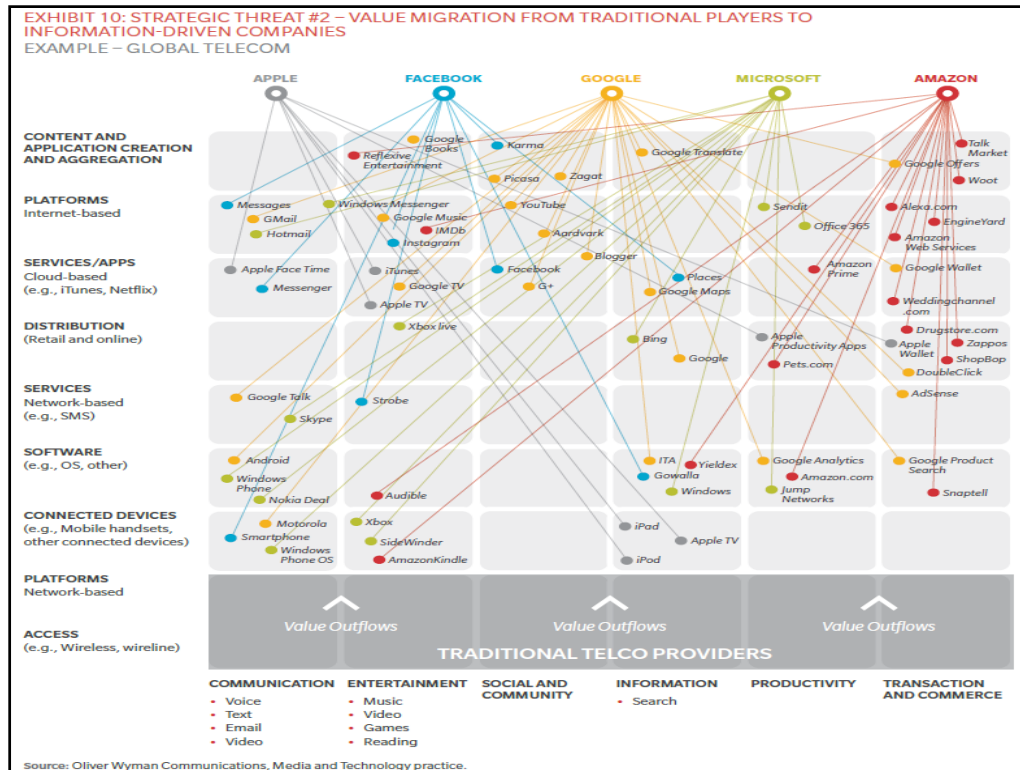
- In addition to the type of complementarities, their **directionality** also matters. They are **not symmetric** or bi-directional; mapping them a key tool for understanding not only participation but also value
- **Tactics for building** supermodular ecosystems will be different to unique-complementarity based ones: The former will have subsidies and extreme early attraction, and ruthless domination later
- This leads to **competitive context** implications. In supermodular ecosystems *in particular*, a lot of impact of rules in one ecosystem for participation in another: Android rules affect Apple App participation.
- Governance and rules in ecosystems *need to be understood within their competitive context*- consider Symbian demise despite early dominance

To do: Study the structure and evolution of ecosystems

- Consider the emergence, demise, and mutation of ecosystems
 - Look at the context which enables their emergence or failure, and contrast this with “standard” industrial settings, in comparative examination- shift from one to another form (open to managed ecosystem to supply chain, eg?)
- Document governance and rules in ecosystems
 - How they are structured; how different structures (co-)exist; how and why they change; what seem to be the performance implications of different choices
 - Look at how participation rules and exclusivity in ecosystems changes over time
- Understand fungibility of investments and its impact
 - Fungibility as a defining attribute, as it shapes ecosystem/platform economics. How does it emerge, change, affect actors? How does this relate to standards.
- Consider the role of ecosystems on society and welfare
 - Focus not only within the ecosystem but on how activities are organized in a new way, given the growth of multiple-ecosystem giants such as FB and Google
 - Understand how different ecosystems interact and shape final customers

To do: Study value creation & appropriation in ecosystems

- Take the “hub/keystone” more seriously (ie with a grain of salt)
 - When should a firm try to become a hub? Which firms have tried *but failed* to create an ecosystem and when have they succeeded? (example: hsubject)
 - How should hubs balance their desire to appropriate with their need to have the ecosystem succeed? Is it a simple life-cycle story? What affects this?
- Take the small guys- and the multiple ecosystems into account
 - There’s a handful of Apples and Googles but most advice is how to emulate them. How does the perspective change in considering *hoi polloi*?
 - What results hold, and what do not, when we take into account the role of alternative / competitive ecosystems? Uber and Hailo in context...
- Consider process and organizational challenges
 - What are the process requirements that allow firms to be successful in ecosystems and managing their role, and how do they differ from the standard entrepreneurship advice (eg Eisenhardt, Ozcan, Santos et al)?
 - What are the organizational challenges for firms operating in complex ecosystems? How do they need to change internally to compete effectively?



So what could we learn, in principle, from ecosystems?

- **Alliance literature** has subtler links: Ecosystems may *consist of* distinct *types* of alliances, and may be the *result of* tight alliance links
 - Ecosystems do not involve JVs, and ecosystem participation may be a quasi-alliance, akin to a menu adoption, worthy of separate study
 - Ecosystems (like the Wintel one) are often driven by *alliance at the level of a few corporates*, and this can be studied separately
 - Ecosystem network of alliances offer a new aggregate level of focus, *distinct* from alliance portfolios, as they are directed and particular; ecosystem links distinct!
- **Network research** could benefit from the analysis of the *peculiar types of networks that alliances are, and vice versa*
 - Standard network measures to be assessed, and tested theoretically: Do they matter? Should they? Links between hubs and centrality? Of use? Trivial?
 - Focus on ecosystems' particular interdependence of dynamics *between* ecosystems and *within* ecosystems could mirror network dynamics *between & within*

Learning, in principle, from ecosystems - cont'd.

- **Links with co-specialization** crucial. What can we learn from alliances that we don't know already from TCE or its simple extrapolation?
 - Mutual co-specialization, *combined with* lack of hierarchical (principal-agent) structure changes the economics of the relationships. What I sell as an app developer isn't the platform's decision; my success is partly linked to the platform success
 - Usual focus on the buyer-supplier analogy and related contractual governance mechanisms is obviated by different nature of interdependencies => economic relation
 - Need to see how existing theory can help aggregate up and adapt to these distinct features; and ability to see how structural solutions to the problem of ecosystem governance inform our understanding of how best to organize
 - Study of ecosystems can expand and deepen purview of existing work
- Understanding specific varieties of **mechanisms** in an ecosystem, and **how ecosystems relate** to each other, appear as the most **promising research** dimensions.

