MANAGING THE INVISIBLE OBVIOUS:
THE ENTANGLEMENT OF INNOVATION, STRATEGY, AND ORGANIZING

A Dissertation in
Information Sciences and Technology
by
Phillip J. Ayoub

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Submitted in Partial Fulfillment
Of the Requirements
For the Degree of

Doctor of Philosophy

August 2012
The dissertation of Phillip J. Ayoub was reviewed and approved* by the following:

Irene J. Petrick  
Senior Lecturer of Information Sciences and Technology  
Dissertation Advisor  
Chair of Committee

John M. Carroll  
Edward M. Frymoyer Professor of Information Sciences and Technology

Timothy W. Simpson  
Professor of Mechanical and Industrial Engineering

Raghu Garud  
Alvin H. Clemens Professor of Management & Organization

Samuel T. Hunter  
Assistant Professor of Psychology

Professor Mary Beth Rosson  
Associate Dean and Professor of Information Sciences and Technology

*Signatures are on file in the Graduate School
ABSTRACT

The production environments of today are not the same as the production environments of yesterday. The intensification of globalization and increase in market turbulence over the past forty years has exposed the limits of order (e.g., efficiency, predictability, and control) with those of un-order (e.g., emergence, non-linearity, and experimentation). The implication is a need to rethink the nature of the firm and that of innovation.

Such a focus is particularly acute in the context of the established firm, which must remain nimble and adaptive to be able to create new competencies, while simultaneously exploiting but entangled in existing competencies, i.e., innovation’s paradox. Effectively innovating in this context requires more than just the ability to generate new ideas, put strong leaders in place, and provide extensive resources; it also requires a deep competency in managing what may be termed the invisible obvious – the social and material assumptions, meanings, and affordances that are embedded in and guide organizational activity.

What is the invisible obvious in the established organization? This dissertation explores a possible explanation and its implications for innovation and strategic management. Specifically, I conducted a year-long immersive study at the Intel Corporation that examined how people interpret innovation and how those interpretations are entangled with and make up the core competencies of the firm. From this, I found three markedly different conceptions of innovation that drove these entanglements: technologic, economic, and humanistic. I term these conceptions innovation frames and explicate the nature and dynamics of the concept using my ethnographic interviews and a case study based on a newly formed disruptive technology that emerged from within Intel. I tie this newfound concept of innovation frames to the fields of strategy and innovation and argue for a shift in their theoretical and practical conversations that center on the relationship between interpretation and organizing – a link made visible through the examination of individual and the firm-level innovation frames.

In conclusion, I develop a strategic model for innovation, the L’oer Model, that identifies multiple innovation pathways around which firms can create new competencies in the face of innovation’s paradox. A redefining of the firm as a sociomaterial entanglement, the model reshapes our thinking on the question of innovation and suggests that the long-term survival of a firm depends on managing the invisible obvious. The takeaway is that disruption sits not at the fuzzy front end of innovation but at the nexus of innovation, strategy, and organizing.
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GLOSSARY OF TERMS

**Binary**: Having two parts. The binary number system that computers use is composed of the digits 0 and 1.

**Chip**: A tiny, thin square or rectangle that contains integrated electronic circuitry. Die are built in batches on wafers of silicon. A chip is a packaged die. See also "Microprocessor."

**Circuit**: A network of transistors interconnected by wires in a specific configuration to perform a function.

**Constructive confrontation**: A cultural practice within Intel where any individual, no matter their rank, is allowed to question and critique any and all ideas during review meetings. The intent is for all new ideas, particularly if those to be added to a product roadmap, undergo significant vetting.

**Copy Exact!**: A philosophy and methodology focused on matching the manufacturing site to the development site. It enables delivery of product from multiple production sites, which operate as a virtual factory that performs consistently and independent of the manufacturing source site.

**Core competency**: A specific factor that a firm sees as being central to the way it, or its employees, works and develop core products. It is developed through the process of continuous improvements over a period of time.

**Core rigidities**: The downside of core competencies caused by the extension of advantages beyond the situation in which they were created and where the underlying values are not equal.

**Cynefin Model**: A framework for guiding people’s thoughts and actions under different states of uncertainty, outlining a typology of contexts and advising what actions should be taken within or between those states. It is based on theories of complexity and chaos.

**Dominant logic**: The mental map of a firm’s senior managers that is developed through experience in the core business and sometimes applied inappropriately in other businesses. It is both a knowledge structure and a set of management processes.

**Dynamic capabilities**: The capacity of a firm to create, integrate, reconfigure, and transform competencies in order to address rapidly changing environments.

**Encode**: The process of preparing video for output, where the digital video is encoded to meet proper formats and specifications for recording and playback through the use of video encoder software.
**Everyday entrepreneur:** Any of a firm’s internal employees who innovate through their own agency. Stands in contrast to the managerial entrepreneur, where the agency for innovation and chance reside solely with a firm’s senior team.

**Fab:** A shortened term for "fabrication facility," where Intel manufactures silicon chips.

**Framing dynamics:** The mechanisms that instigate and guide the construction and sharing of innovation frames.

**Framing structure:** The nine unique dimensions around which individuals ground their interpretations of innovation, as well as share and co-construct those interpretations with others. They link an individual’s innovation frame with a firm’s predominant innovation frame.

**Incremental disruption:** The idea that disruption does not always occur in a single, overnight moment but rather, across a number of incremental changes.

**Innovation frame:** A firm member’s interpretation of innovation.

**Innovation's paradox:** A firm’s current core competencies, which must be leveraged for short-term profitability, constrain the creation of new core competencies needed for longer term viability, particularly during periods of rapidly changing competitive conditions.

**L’oer Model:** A strategic management model that illustrates how core competencies are created, leading to incumbency and core rigidities. It also identifies three innovation pathways for creating new core competencies based on a sociomaterial entanglement view of the firm.

**Linguistic binary:** Two opposing terms (e.g., incremental vs. radical) used by individuals to create distinct boundaries in situations that are often uncertain or are on a continuum.

**Microprocessor:** The "brain" of a computer. Multiple microprocessors working together are the "hearts" of servers, communications products, and other digital devices. See also "Chip."

**Minimum viable product:** A product development strategy used for fast and quantitative market testing of a product or product feature, where the initial product includes just those features needed for the product to be deployed, and no more.

**Moore’s Law:** A rule of thumb in the computing hardware industry that says the number of transistors per chip that yields the minimum cost per transistor will increase at a rate roughly a factor of two per year. Later statements have revised the performance factor to double every 18 months.

**Motherboard:** The central printed circuit board in many modern PCs and other computing devices. It holds many of the components of the system and provides connectors for other peripherals.
**Nanometer**: One billionth of a meter.

**Ordered state**: A context for action that assumes a level of predictability to the world that is either known or knowable, where a general set of rules or hypothesis that can be empirically derived or discovered. Principles include efficiency, predictability, and control and follow a reductionist approach.

**PAN**: A computer network used for communication among computerized devices. A wireless PAN or WPAN is a PAN carried over a wireless connection such as Bluetooth or Wireless USB.

**Predominant innovation frame**: The primary way an individual or firm interprets based on the different dimensions of the framing themes. Three main predominant innovation frames exist: technologic, economic, and humanistic.

**Resource-base view**: A view of the firm, where competitive advantage is gained from the a firm’s valuable, rare, inimitable, and nonsubstitutable resources and assets.

**Retrospectives**: The post-project gathering of a team or group to review events and lessons learned.

**Semiconductor**: A material (such as silicon) that can be altered to conduct electrical current or block its passage.

**Silicon**: The principal ingredient in common beach sand and the element used to make the wafers upon which chips are fabricated. It is a natural semiconductor and is the most common element on earth after oxygen.

**Sociomaterial entanglement**: A view of the firm that suggests an ontological inseparability between social and material resources and assets, where the core competencies of a firm are created through the entangling of assumptions and actions over time.

**System on a Chip (SoC)**: The integration of a complete set of system components into a single chip.

**Tick-Tock model**: A microprocessor development and manufacturing model developed by Intel Corporation, which alternates on a yearly cadence between a shrinking of processor technology of the previous microarchitecture (“Tick”) and a new microarchitecture (“Tock”).

**Turbulence**: The increase in market dynamism (i.e., frequency and magnitude of change), complexity (i.e., number of and interactions among forces that influence innovation), and competition over scarce resources, partners, and talent.

**Two-in-a-box leadership**: The co-management of a business group by two individuals with complementing skills sets such as operations and technology.
**Un-order state**: A context for action that assumes events in the world are emergent, non-linear, and knowable in full only in hindsight. It is characterized by the two substates of complexity and chaos. Principles include inefficiency, experimentation, and improvisation.

**User experience**: A person’s experiential, affective, meaningful and valuable interactions of an event or in relation to the use of a technology. It also includes a person’s perceptions of utility, ease of use and efficiency of the system.

**UWB**: A radio technology for very low energy level, short-range, high-bandwidth communications such as telephones or other hard-line connections.

**ViiV**: Intel’s media PC concept. Launched in 2006, it included a collection of computing technologies and features such as dual-core processor, advanced graphics, sound capabilities, immediate power on and off functions, and remote control operations.

**WiDi**: Intel Wireless Display technology.
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<td>CEO</td>
<td>Chief Executive Officer</td>
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<tr>
<td>CES</td>
<td>Consumer Electronics Show</td>
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<td>CMR</td>
<td>Corporate Market Research</td>
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<td>CPO</td>
<td>Corporate Platform Office</td>
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<tr>
<td>CPU</td>
<td>Central Processing Unit</td>
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<tr>
<td>DHeG</td>
<td>Digital Health Group</td>
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<td>DHG</td>
<td>Digital Home Group</td>
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<tr>
<td>GPU</td>
<td>Graphics Processing Unit</td>
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<tr>
<td>IAG</td>
<td>Intel Architecture Group</td>
</tr>
<tr>
<td>IXR</td>
<td>Interaction &amp; Experience Research Group</td>
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<tr>
<td>LPCO</td>
<td>Low Power Chipset Organization</td>
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<td>MPG</td>
<td>Mobile Products Group</td>
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<td>NBI</td>
<td>New Business Initiatives Group</td>
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<tr>
<td>P&amp;L</td>
<td>Profit and Loss</td>
</tr>
<tr>
<td>PAN</td>
<td>Personal Area Network</td>
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<td>PAPR</td>
<td>People and Practice Research Group</td>
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<td>PCCG</td>
<td>PC Client Group</td>
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<td>PLBP</td>
<td>Product Line Business Plan</td>
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<td>PLC</td>
<td>Product Life Cycle</td>
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<td>POP</td>
<td>Product Overview Proposal</td>
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<td>POR</td>
<td>Plan of Record</td>
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<td>ROI</td>
<td>Return on Investment</td>
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<td>SLRP</td>
<td>Strategic Long Range Planning</td>
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<td>SSG</td>
<td>Software and Services Group</td>
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<tr>
<td>TMG</td>
<td>Technology and Manufacturing Group</td>
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<tr>
<td>TRP</td>
<td>Technology Readiness Process</td>
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<tr>
<td>TSLRP</td>
<td>Technology Strategic Long Range Planning</td>
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<tr>
<td>UWB</td>
<td>Ultra-Wide Band</td>
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<tr>
<td>UX</td>
<td>User Experience</td>
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<tr>
<td>VRIN</td>
<td>Valuable, Rare, In-imitable, and Non-substitutable resources</td>
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<td>Intel Wireless Display technology</td>
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<tr>
<td>WiMax</td>
<td>Worldwide Interoperability for Microwave Access</td>
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<td>WPAN</td>
<td>Wireless Personal Area Network</td>
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<td>ZBB</td>
<td>Zero-Based Budget</td>
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ACKNOWLEDGEMENTS

I am deeply indebted to the many people who have helped me develop this body of research. Professor Irene Petrick taught me what it means to be a scholar and a professional. She also gave me the wings to fly with the highest of winds and the grounds to always land safely. Her mentorship in my research has been priceless.

My committee – John Carroll, Timothy Simpson, Raghu Garud, and Samuel Hunter – are some of the smartest and most thoughtful people in the world. They listened to me patiently and provided tremendous guidance but also thoughtful provocation. They raised the bar of expectations and showed me how to achieve those expectations. I continue to look forward to conversing with each and every one of them and to taking this research to the next level.

This research would not have been possible without the support and commitment of Intel Corporation. Special thanks to Russ Martinelli, Chris Galluzzo, Ralph Brooks, Debra Lavell, Steve Smith, and everyone at Intel who contributed to and participated in this research. You truly are a great place to work.

I would like to give special thanks to two colleagues and friends: Professor Fred Fonseca who introduced me to the philosophy of science – an introduction that has forever changed the way I see the world; and Professor Stuart Selber for the countless hours of listening to me talk through my research, for teaching me to live like a clock, and for helping me find my own John Walton.

I am forever grateful for all of the conversations with my Penn State colleagues and elsewhere. While there are too many to name, you know who you are. I also cannot imagine making it to this point in my life without all of my friends. Whether you knew the struggles and requirements of the dissertation and PhD or not, you always stood by me with nothing but respect and encouragement. I could ask for nothing more.

My parents, brother, and extended family have seen me throughout this journey, the highs and the lows. It is to them that I dedicate this work.

— Phillip Ayoub
CHAPTER 1
INTRODUCTION

The story goes that three umpires disagreed about the task of calling balls and strikes. The first one said, ‘I call them as they is.’ The second one said, ‘I calls them as I sees them.’ The third and cleverest umpire said, ‘They ain’t nothin’ till I calls them.’

The poetic lines of Simon’s (1976, p.29; as presented in Weick, 1979b, p. 1) famous parable introduce three umpires, each explaining how he officiates a baseball game. The first assumes that the answer is out there to be found, and with extensive examination, he will call it right. The second assumes it is all up to interpretation, and his position of observation will determine his call. And the third believes that reality does not exist until he observes it, and it becomes whatever he calls it. The catch, of course, is that all three are officiating the same game. What we do not know though is who is officiating home plate – how they are organized on the field together.

Research on innovation implicitly suggests that new technology developments frequently emerge in much the same way. What innovation is, how it is measured, and how it comes to be is determined by the people involved. Interestingly, the ways innovation is researched appears to follow much of the same approach. Our theories tell us what to measure, and as a result, direct what we see.

What is innovation? The aim in this dissertation is to explain why and to provide a new lens for seeing the phenomena of innovation – a lens that incorporates the three umpires by viewing the firm as a sociomaterial entanglement. As such, innovation arises from the untangling and retangling of assumptions, expectations, and knowledge that make up the core competencies that provide competitive advantage. Collectively, innovation is not a process or a product but both, and more. It is about, what I term, the invisible obvious.
1.1 INTRODUCTION

The production environments of today are not the same as the production environments of yesterday. The intensification of globalization, deregulation of industries, and proliferation of new technologies over the past forty years has led to an ever-turbulent environment. The result has been a changing of organizational forms and an upending of the long-standing assumptions that have driven management and organizational theory (and practice). Specifically, modern management has been dominated by the assumption that an inherent order and predictability exists to the world. However, rapidly changing environments have begun to show otherwise, requiring principles dependent on un-ordered change, i.e., emergent, non-linear, and whose cause-effect is often only known in hindsight. In short, the ordered state sits in stark contrast, even paradox, to that of un-ordered. The implication is that academics and practitioners need to rethink the way we approach the science of organizing.

Such issue is not wholly new. Both parties have seen and studied the effects of un-ordered change, of which the primary have been those associated with the decline or total failure of some of the world’s most established firms. Christensen (1997) best captured the phenomenon in his model of disruptive innovation, where established firms become tied up in their own commitments and inertia and become unable to respond to rapidly changing environments. I term this phenomenon, innovation’s paradox, and with others, suggest that this problem is the central concern for strategic management and the long-term survival of firms.

While innovation’s paradox now lies open for all to see, the challenge for addressing the concern rests with our theories. Specifically, current management and organizational theories (as well as practice) continue for the most part to approach the study of innovation and the governance of a firm’s core competencies from the suppositions of economic theory and from a lens that views the firm as industrial-like resources – the same assumptions that rest on principles of order, i.e., efficiency, predictability, and control. The problem with such assumptions is that they do not account for the entanglements between interpretation and action, nor the relation between the social and the material. In short, these theories fail to take into consideration the human, not as a
mechanistic component, but as a flexible and dynamic being that has agency but who can also become blind to him or herself.

The implications of such approaches have been to reduce the human element as a bias or error, or it has led to continued interrogation for more methodological or conceptual flaws. In alternative, it may be more advantageous to assume such inconsistencies as replicable findings (e.g., Barley, 1986; Poole & Van de Van, 1989); that people are interpretive beings that are inextricably entangled with one another and their environments. In other terms, the organization of a firm is more than just a sum of its parts; it is about the relationship between those parts. Thus, the central challenge of addressing innovation’s paradox turns toward the question of how to untangle the organizing of a firm in a way that enables new entanglements to emerge. Such is the focus of this dissertation.

In this dissertation, I argue that a firm can be viewed as a sociomaterial entanglement, which sits in contrast to popular positions of the resource-based view and the dynamic capabilities view. Furthermore, I suggest that the link to untangling a firm’s core competencies (i.e., those activities that provide a firm with its competitive advantages) resides in understand the relationship between interpretation and organizing, and between the social and material. Specifically, I argue that this link occurs and is made visible through people’s innovation frames – the underlying assumptions, expectations, and knowledge that people hold about innovation and which are interwoven with the context of activity. By making visible these innovation frames and their dynamics within the organizing of a firm’s competencies, I enable scholars and practitioners with a new means for addressing innovation’s paradox. I also provide a new lens for rethinking the question of innovation and for managing the invisible obvious.

1.2 RESEARCH SITE AND APPROACH

This research is based on my ongoing association with Intel Corporation, the world’s largest semiconductor engineering and manufacturing company.\(^1\) Intel is traded on the NASDAQ Stock Market and is listed on the Down Jones Industrial Average, a blue-chip index widely considered

\(^1\) By revenue.
the leading barometer on stock market activity and the health of the US economy. This study was conducted primarily during the 2010 fiscal year but includes information on later operations and outcomes where noted. The 2010 year for Intel was one of its most successful financial in its over forty-year history. It was also one of the firm’s most volatile.

At the close of the 2010 fiscal year, Intel’s 2010 revenue was U.S. $43.6 billion with gross margins of 66 percent, and the firm had over 82,500 employees across their globally distributed operations. Intel’s 2010 revenues were the highest in its 42-year history and testament to the firm’s ability to continuously innovate. On numerous occasions throughout 2010 and 2011, U.S. President Barack Obama touted Intel as the innovation model for American businesses. Intel is also consistently listed as one of the top places to work, top places for leaders, and one of the most admired companies worldwide. The Intel brand also ranks 7th on Interbrand’s 2010 global ranking with a value of US $32 billion. Intel is most well known for its invention of the x86 architecture, which is the processor found in most personal computers (PCs).

These features of Intel make it an ideal company to study the practice of innovation, yet there is one more dynamic that made Intel the ideal case. With forty-plus years under its belt, the 21st century has been a turbulent one for Intel. In the early 2000s, then CEO Craig Barrett began to diversify Intel’s product lines as the firm’s core PC business was changing and new computing spaces emerged such as mobile computing and networking (Burgelman, 2002). In 2005, the firm laid off over 10,000 employees as it reset its focus amidst growing competition. In 2010 alone, Intel went through at least a half dozen reorganizations that involved thousands of employees, all done with the aim of reconfiguring its competencies to address a rapidly changing market. Even more disruptive, the very nature of the market was changing, where development was beginning to revolve around consumers. This was not the enterprise and technology-driven model that had originally brought Intel to its stardom and established it as one of the 20th century titans of the

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2 Intel’s revenues continued to grow exponentially in 2011 and further demonstrate the firm’s position as an establishment and leader in the industry. Reported 2011 revenues were $54 billion (24% increase over 2010) with margins of 63%.

3 Intel also self-proclaims itself as innovative, which is visible on their public website - “Our success lies in the ability to exceed the expectations of our customers, employees, and stockholders. Learn how we’ve created a unique environment where innovation lives in everything we do.” – and is reiterated in numerous internal statements, including propaganda material, new employee orientation and other annual employee trainings, and other executive statements.
technology industry. Intel was and is in the process of redefining itself for the 21st century; trying to redefine the old in the face of the new, all while trying to lead an industry.

It is this combination of turbulence, the disruption of everyday activities, and the self-questioning and transforming of core competencies that made Intel the ideal candidate for studying the intersection of strategy, innovation, and organizing.

There is, however, a counter argument to such a claim. When compared to other technology firms and more broadly across other industries, some observer may suggest that Intel is by no means an innovative firm as claimed above. For example, many may see Apple Inc., with its recent introductions of the iPhone and iPad, as leading the industry and driving innovation. Another claim is that Intel is too big to innovate; an industry behemoth, creativity is lost in the slow-churning cogs of a machine set on its path.

While both claims may be true, they in fact strengthen the argument of why Intel is the ideal site for studying the phenomena of innovation. If the belief is that innovation is the key to long-term survival, than Intel must be innovative. Otherwise, the only logical conclusion would be that Intel should not be alive today. That is, unless, there is an alternate explanation; how can two people see the same phenomena yet come to opposite conclusions? Therein lies the central concern of this dissertation – what is innovation? While this dissertation focuses on the internal conceptions of innovation (versus an inside-outside comparison), Intel nonetheless is an ideal candidate for examining such paradox.

Approach

As I approached this study, I began with a “hunch” that known theories were not fully explaining the emergent, non-linear, and dynamic nature of innovation. Practitioners also struggled with effectively defining innovation, particularly those in the trenches, not solely senior management. In reviewing the literature on innovation, studies of work, and the examination of practice, I found four methodological requirements for approaching the study. The innovation phenomenon needed to be studied (1) from multiple vantage points (multimodal), (2) across levels of analysis,
In situ, and (4) over time. It is these four methodological requirements that I attempted to hold to throughout this larger study.

In addition, my focus on the practice of innovation is informed by three broad communities of thought: sociomateriality and the entanglement of human activity (e.g., Feldman & Orlikowski, 2011; Giddens, 1984; Latour, 2005; Orlikowski, 2010; Orlikowski & Scott, 2008; Weick, Sutcliffe, & Obstfeld, 2005), complexity and narratives (e.g., Bartel & Garud, 2009; Garud, Gehman, & Kumaraswamy, In Press; Garud & Karnøe, 2001; Van de Ven, Polley, Garud, & Venkataraman, 1999), and human-computer interaction’s (HCI) notions of activity (Hutchins, 1995; Nardi, 1996). Such perspectives view innovation as pluralistic and equivocal, assume agency to be distributed across people, their actions, and the sociomaterial entanglement in which they are embedded, see people’s practices as reflexive and purposive, and centers on activity as the unit of analysis. My intention here is to use the lens of practice to understand how people in the established organization generate, manage and are influenced by the underlying values on which their activities are based, i.e., the invisible obvious.

To explore Intel’s innovation practices, I partook in a full-time 12-month internship between January 2010 and February 2011 as a member of Intel’s Corporate Platform Office (CPO) – a thought leadership group within the company whose charter is to deliver best practices and support in areas of business services and solutions (e.g., program management). My position within CPO provided me direct access to observe and explore an extensive array of Intel’s regular and innovation-oriented product development activities, which ranged from those associated with early-stage product research and conception through product planning, development and manufacturing. Collectively, this position enabled me to conduct an extensive ethnographic study of Intel’s innovation practices, where insights were gathered and induced as an observer, participant, and actor across a host of ongoing organizational activities. An ethnographic approach was selected because of its strengths in exploring complex phenomena at the level of practice, in capturing emergent activity over time, and in its sensitivity to detecting the idiosyncrasies and interactions between people, technology, and work.

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4 CPO is housed within PCCG, the largest business group, not at the corporate level. CPO’s scope, however, spanned the entire firm, which provided me with access to all of the business groups and levels of the hierarchy.
To orient my studies, I examined the flow of regular activities over time and how from the perspective of practice new innovation opportunities emerged in the entanglement of everyday work. I chose new product development activities as the orienting point for my observations because in the terms of those I was observing, new product development was the central “activity” associated with what they did – all tasks and events revolved around and were referenced in relation to the production of new technology. In initiating the study, I chose not to select a particular technology product, business team, or organizational variable (e.g., culture, leadership) to trace as is common in most studies of innovation. Rather, I sought to allow interesting phenomena to emerge in whole and to then determine appropriate means to further examine and measure. This provided a more naturalistic inquiry and the ability to potentially analyze phenomena in new way that might have otherwise been hindered by approaching the context with a preconceived template.5

My year-long observations and participation at the researcher site fell into three broad progressive phases: (1) establish research routines and historical context, (2) conduct deep exploration of emergent innovation phenomenon, and (3) validate and reflect on findings. Each phase built off the prior but overlap did exist, with each phase lasting approximately 4, 6 and 2 months in duration, respectively.6 While preliminary insights and organization of the data occurred while onsite, I spent an additional 15 months post-immersion deeply embedded in analysis of the data and making sense of my experiences as a researcher and participant. The specific methods and results of my immersion and follow-on analyses are detailed within their respective chapters (primarily Chapters 3 and 4).

In exploring innovation in practice, I came to view the firm as a sociomaterial entanglement (see Chapter 2). The result was the development of a new model of innovation, one that sits at the

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5 While I focused on new product development, this did not exclude me from observing or taking note of other forms of innovation seen in the literature such as process, service, or business model. This was a result of my aim to explore the interactions that influence emergence. I also wanted to avoid painting a picture where technology invention was the sole agent for innovation.

6 In practice, ethnographic research has less of a distinction between data analysis and data collection than what I propose herein. However, I have simplified the division of labor for purposes of clarity and to emphasis how the majority of my time was spent across the research process.
nexus of strategy, innovation, and organizing. The exploration also allowed me to empirically examine what I term, innovation frames, or people’s interpretations of innovation (see Chapter 3). Of equal importance, my immersion enabled me to examine how the innovation frames of firm members were intertwined with the social and material make-up of the firm. Lastly, during my immersion, I was presented with the opportunity to examine the dynamics and entanglement of innovation frames as captured and illustrated in the development of Intel’s Wireless Display (WiDi) technology, which I present as a case study (see Chapter 4).

1.3 SUMMARY OF KEY ARGUMENTS AND FINDINGS

The following section summarizes the key arguments and findings that are presented in Chapters 2 through 4, with a discussion on the implications of these findings presented in Chapter 5. Table 1.1.

Table 1.1: Summary of key arguments and findings from Chapters 2, 3, and 4.

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>KEY ARGUMENTS &amp; FINDINGS</th>
</tr>
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<tbody>
<tr>
<td>Chapter 2</td>
<td><strong>Innovation’s Paradox</strong></td>
</tr>
<tr>
<td></td>
<td>- The central concern for strategic management is addressing <em>innovation's paradox</em></td>
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<tr>
<td></td>
<td><strong>An Entanglement View of the Firm</strong></td>
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<td></td>
<td>- Addressing innovation's paradox requires a shift in the ontological approach of scholars and managers, from the propositions of economic theory, resource-based view, and dynamic capabilities to those of social practice theory, i.e., a <em>sociomaterial entanglement view of the firm</em></td>
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<td></td>
<td>- An entanglement view of the firm focuses on the relationship between interpretation and action, i.e., people’s <em>frames</em></td>
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<td></td>
<td><strong>L’oer Model</strong></td>
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<tr>
<td></td>
<td>- The L’oer Model is a paradigmatic reconceptualization of dynamic capabilities from an entanglement view, which explains the cyclical, self-reinforcing nature of a firm’s active inertia and core rigidity</td>
</tr>
<tr>
<td></td>
<td>- By focusing on the relationship between sensing, seizing, and transforming, the L’oer Model identifies three innovation pathways: (1) <em>top-down</em>, (2) <em>bottom-up</em>, and (3) <em>crisis response</em></td>
</tr>
<tr>
<td></td>
<td>- The relationship between the individual and the firm is made visible in the L’oer Model by examining the link between interpretation and action, i.e., people’s <em>frames</em></td>
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<tr>
<td>Chapter 3</td>
<td><strong>Innovation Frames</strong></td>
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<td></td>
<td>- Individual firm members hold unique interpretations of innovation that are based on their lived experiences and changing context, i.e., <em>innovation frames</em></td>
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<td></td>
<td><strong>Framing Structures</strong></td>
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<tr>
<td></td>
<td>- Firm members ground their individual and shared interpretations of innovation around nine unique dimensions of the sociomaterial context, i.e., <em>framing structures</em></td>
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<tr>
<td></td>
<td>- Framing structures articulate the link between individual innovation frames and the predominant*</td>
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</table>
innovation frames of the firm, which enables both individual and collective action

- Firm members use linguistic binaries as tools to ground their own interpretations (sensemaking) and to represent those interpretations to others (sensegiving)
- Innovation frames are necessarily incomplete because framing structures are always part of an ongoing (re)constitution and negotiation over what are “facts” (stable) and what are “assumptions” (challengeable/flexible); in being incomplete, innovation frames remain forever flexible
- While analytically separable, framing structures are interdependent and entangled with one another, where a change in one can instigate change in others and vice versa; innovation frames are a “complex” and not simply a set of independent parts

**Predominant Innovation Frames**
- Repeated socialization and interactions between firm members over time leads to the emergence and stabilization of shared interpretations of innovation that guide and enable continued patterns of collective organizing, i.e., predominant innovation frames
- A firm or group’s predominant innovation frames form around different framing themes: functional grouping, position in hierarchy, and position in product life cycle (PLC); The functional grouping is the dominant of the three framing themes
- Three predominant innovation frames persist across the firm and over time: technologic, economic, and humanistic
- The influence of predominant innovation frames is not equal, often with one frame dominating the other two; the balance of influence is relatively stable over time, even as the make-up of framing structures change across context

**Chapter 4 Framing Dynamics**
- The ability to managing multiple, potentially conflicting and competing, innovation frames is critical to successfully developing disruptive opportunities
- New competencies and innovative outcomes emerge simultaneously, not serially
- Disruptive innovations emerge incrementally, not in whole and final form, i.e., incremental disruption
- The minimum viable product has just those features that allow the product to be deployed, and no more; it is a strategy for gaining an initial inertia for new products and is often defined by the humanistic frame of lead users
- Polymodal Temporality - time in its different forms - exposes contrasts and alternatives among frames, which enables reflexivity and the opportunity for agency

**Bottom-up Innovation Strategy**
- Entrepreneurship resides within the embedded competencies and individuals of the firm, not solely with senior management, i.e., bottom-up innovation strategy

Beginning with Chapter 2, I positioned innovation’s paradox as the central concern for strategic management. I then argued for dynamic capabilities as a potential platform for approaching this concern, but one that required significant reformulation because of its suppositions in economic theory. In alternate, I proposed the L’oer Model which is a reexamination of dynamic capabilities from a social practice theory lens. I also suggested a view of the firm as a sociomaterial entanglement. As a result, the L’oer Model invokes a relational ontology, where the reconceptualization cycles around the activities of sensing, seizing, and transforming and focuses
on the entanglement between interpretation and action. In conclusion, I suggested innovation frames as a way to untangle and make visible these relationships.

In Chapter 3, I explored the concept of innovation frames using an empirical study on how firm members at Intel interpret innovation. In doing so, I furthered the concept by identifying other key constructs that enable the innovation frame, including nine framing structures and the notion of three predominant innovation frames, i.e., technological, economic, and humanistic. I also show how framing structures link the individual and the firm, with level of analysis revolving around interactions, not statistical groupings. Lastly, I further articulate the nature of innovation frames by characterizing cardinal framing dynamics such as the necessary incompleteness of frames, the role of linguistic binaries, the entanglement of framing structures, and the general temporality of frames.

In Chapter 4, the WiDi case study is used to illustrate the underlying framing dynamics of innovation frames and to validate the L’oer Model bottom-up innovation strategy. In doing so, the chapter demonstrates frame management. In particular, I highlighted the polymodal nature of temporality and its role in creating moments for reflexivity. I posited that by understanding time, individuals provide themselves with moments to learn which then empowers them with opportunities for agency. I also discuss the importance of absorptive capacity in relation to how much a firm is capable of changing at any given moment, a concept that I articulate through the ideas of the minimum viable product and incremental disruption.

### 1.4 OVERVIEW OF DISSERTATION

The remainder of this dissertation is organized as follows. Chapter 2 presents a review of the literature, a theoretical argument, and novel model that positions innovation frames as the central conversation piece for strategic management. Chapter 3 presents an empirical study on how people interpret innovation. Based on extensive ethnographic interviews, the chapter concludes with a discussion on the nature of innovation frames. Chapter 4 presents a case study on Intel’s WiDi technology, with the intent of illustrating innovation frames in practice and identifying the key dynamics and entanglement of innovation frames. In conclusion, Chapter 5 integrates the
theoretical arguments and model presented in Chapter 1 with the empirical findings of Chapters 3 and 4 and discusses the implications of such at length. Chapter 5 also includes a conversation on the overarching methodology of the dissertation and concluding comments on the invisible obvious.
CHAPTER 2
A REVIEW OF THE LITERATURE

I begin this chapter by reviewing the literature on innovation (see Section 2.1) and posing innovation’s paradox as the central yet unanswered concern for the field of strategy and organizational theory (see Section 2.2). I then outline the nature and microfoundations of dynamic capabilities, which has been positioned as one of the more promising platforms for exploring and addressing this concern - how firms can create and sustain competitive advantage in turbulent markets (see Section 2.3). In reviewing dynamic capabilities, I also draw attention to its criticisms, particularly those resulting from its suppositions in economic theory and a resource-based view of the firm (e.g., ontology of separateness and concepts of path dependence). I then suggest the need for an alternative platform for viewing the firm and for addressing innovation’s paradox.

In alternate, I reexamine the dynamic capabilities view from the recently emerging perspective of social practice theory (i.e., relational ontology) and propose view of the firm as a sociomaterial entanglement (see Section 2.4). Based on this entanglement view, I then propose and detail a new model for addressing innovation’s paradox that I call the L’oer Model. This model focuses on the relationships between the elements (i.e., microfoundations) of the dynamic capabilities view. It also explains the linkage between individuals and the firm – a linkage occupied by what I term innovation frames (see Section 2.5). In conclusion, I review the concept of innovation frames and identify key areas of inquiry to which the remaining chapters of this dissertation are dedicated.

2.1 INNOVATION IN THE LITERATURE

The literature on innovation is vast. Scholars from almost every field have researched and commented on the topic. For the purposes of this dissertation, I focus primarily on the
contributions made by those in the organizational sciences, management, and psychology fields because of their examination of innovation within the context of the firm.\textsuperscript{7}

Even so, these communities alone represent an enormous array of findings. To amass a complete review is almost impossible and perhaps inappropriate and unnecessary. Each community expresses a unique lens for understanding the phenomena – lenses that are built on the historical evolution of the assumptions and principles of each field. Therefore, the following review is guided by two aims: (1) to provide a working definition of innovation that is useful in the context of the firm and organizing and (2) to identify the gaps within the literature that are relevant to addressing the central concerns of the dissertation, innovation’s paradox and the invisible obvious.

The dominant theories of innovation divide the process into two broader stages: the creative generation of ideas and the implementation or application of those ideas into novel and useful processes, products, or procedures (West, 2002a, 2002b; West & Anderson, 1996; West & Farr, 1990; Van de Van, 1986). These two broader stages have also been referred to as creativity and innovation (Amabile, 1983; Amabile, Conti, Coon, Lazenby & Herron, 1996), as well as invention vs. innovation (Ruttan, 1959). While some scholars define additional stages within the two extremes (e.g., Cooper, 2001), communities of scholarship have tended also to fall across similar lines. Creativity is most often the focus of psychologists aimed at uncovering the generation of ideas and scientific discovery, while implementation draws the attention of management scholars and economists focused on the commercialization of those ideas. The bifurcation even resembles the practical division seen in research and development, where basic research leads to invention and development groups handle aspects of commercialization.

Unifying these two broad communities is their agreement that innovation is a mechanism of what Van de Van and Poole (1995) would type as a life cycle model of change and development. Popular instances of the life cycle model are seen in Rogers’ (1995) model of innovation diffusion and Cooper’s (2001) StageGate model of product development. Holding a particular

\textsuperscript{7} Any reference to a community of practice or field is done with respect to these communities, unless otherwise noted.
conception of change, life cycle models tend to be technically orientated, focused on risk reduction, suggest a linear flow of tasks, and revolve a single path idea to market transformation (Cooper, 2001; Van de Van, 1986; Verganti, 2009). Such theories and models have proven quite useful in the industrial development of tangible goods, where the processes and outputs of production are visible and easily measured. The majority of research on innovation has revolved around the further definition and explication of life cycle models.

While the notion that people generate a number of ideas (creativity) and then select the best idea to implement provides a seemingly more manageable approach to innovation, an innovation is often the synergy of multiple ideas that are combined over time and emerge in use (Van de Van et al., 1999). Also, new innovations do not occur in solitude but often in clusters as many ideas come about collectively. While a single person may get credit for a specific idea, the broader notion of “ideas” is the cumulative result of many people’s contributions (Sutton & Hargadon, 1996; Sawyer, 2007), and many of those ideas may come to fruition simultaneously, often building off on another.

In short, the life cycle model has proven useful in many respects, but it hides much of the activity of how innovation occurs in practice. “All theories of organization are based upon a philosophy of science and theory of society” (Burrell & Morgan, 1979, p. 1) though, and the life cycle model is no different. The paradigm that most often employs life cycle theories of innovation, and which dominates the innovation thinking, falls into what Burrell and Morgan (1979) classify as a “functionalist” approach. Under this paradigm, process is denoted as sets of autonomous variables that can be optimally organized (organizational structure) for the efficient production of goods and services. When innovation is treated as such, four presumptions tend to follow: that innovation is objective, that it is autonomous, that it is ordered, and that relations hold true across contexts. As a result, socio-cultural dimensions are often overlooked because of their fuzzy nature and their difficulty in quantifying. Notice that the construction of “meaning” is rarely the topic of R&D groups and that “value” is discussed mostly in technical and economic terms (Verganti, 2009), yet the very definitions from the functionalist view of innovation – novelty and usefulness – are constructs of a social order. Furthermore, the dominant use of the variance approach (Poole, Van de Van, Dooley & Holmes, 2000) leads only to indirect examinations of
innovation and explains the relation between variables in presumptive descriptions. As a result, innovation is seen as linear and orderly only in hindsight because the discontinuous, situated and emergent nature of human activity is “black boxed,” a view that is easily presented in the life cycle format.

Van de Van and Poole (1995) posit the life cycle as one of four motors of change: life cycle, teleological, dialectical, and evolutionary. Examples of each are strewn throughout the various literatures on innovation, such as Cooper’s (2001) StageGate model (life cycle), Newell and Simon’s (1972) models of human problem solving or March and Simon’s (1958) theory of organizational decisions (teleological), Garud and Karnoe’s (2001) distributed and dialectical model of path creation as mindful deviation (dialectical), or Hannan and Freeman’s (1977, 1989) biological view of change (evolutionary). Van de Van and Poole (1995) further suggest that these forces may act simultaneously and most of the time act in concert with each other. The most notable example of coinciding motors of change is Weick’s (1979) theory on the social psychology of organizing that engages stages of change with the construction of goals and evolutionary episodes. However, as Poole et al. (2000) and Van de Van and Poole (1995) point out, there is little evidence examining the synchronous and overlapping engagement of multiple generative forces nor theories that explain such. More work on these concepts is still necessary.

Kurtz and Snowden (2003) draw on complexity theory to propose what could be considered a fifth motor of change. What they term the Cynefin framework is an evolution of the complex adaptive systems literature, a framework comprised of four states of order: simple – complicated – complex – chaotic – disorder. Different forms of innovation occur as organizations move in and out of these different states. This is similar to Nutt’s (1998) explanation of decision situations, which he suggests are shaped by a person’s perceived level of complexity: understood – complicated – discouraged – blocked. Garud, Gehman and Kumaraswamy (2011) use complexity to talk about complexity arrangements, which include “relational complexity” that emerges from “micro-level” interactions occurring in response to local conditions (Drazin & Sandelands, 1992; Tsoukas, 2008; Weick, 1979), as well as “temporal complexity.” Garud et al. apply this to how organizations sustain innovation for continued growth. Garud, Dunbar, and Bartel (2011) introduce innovation narratives as ways to learn and innovate from unusual
experiences by connecting memories linking a firm’s past, present and future (see also Bartel & Garud, 2009). Garud & Kumarswamy (2005) have applied complexity to viscous and virtuous cycles in knowledge management by looking at how different complex arrangements are sustained and broken – a form of *mindful deviation* (Garud & Karnoe, 2001). Collectively, these approaches follow more of a hermeneutic philosophy, which sits in contrast to the functionalist approach driving the development of life cycle models.

Collectively, the above review provides a general map of the innovation literature. The major concern is reconciling these different motors of change, particularly as they play out in practice. The main variable missing in most of these theories is context and how such influence the way innovation is conceptualized and acted upon. In the end, many have tried to create a unifying definition but none appears to have held. Perhaps this is the point; that this is how it is in practice as well and it is context that defines “what is innovation”. In turning to practice, this appears to be the case; the tensions that exist in theory also appear to exist in practice – a tension and challenge that I term, *innovation’s paradox*. This is the central concern of this dissertation and the topic of the next section.

### 2.1. INNOVATION’S PARADOX

Firms are made up of core competencies – the learned harmonization of resources that enable competitive advantage (Prahalad & Hamel, 1990). Core competencies are not like physical resources though in that they do not deteriorate with use. In fact, they work in just the opposite manner, where gains in productivity lead to improvements in the efficiency of those core competencies. These self-renewing, self-reinforcing cycles lift the firm to greater levels of establishment, and as an incumbent, provide a continued advantage over new competitive entrants. More is better.
The increasing turbulence of world markets over the past few decades has begun to expose a limit to the incumbency model and resource-based view of competitive advantage. More is not always better. At its foundation, the resource-based view assumes a level of order and predictability to the world, yet the failure of many established firms – those with the most financial, physical, and intellectual resources – has demonstrated time and time again that the underlying rules of competition can and do change (Brown & Eisenhardt, 1998; Eisenhardt & Sull, 2001). All competitive advantages are fleeting (Wiggins & Ruefli, 2002). Firms must therefore redirect and create competencies anew as the environment changes in order to survive over time.

Modern management practices (e.g., total quality management, reengineering, six sigma) are rooted in principles of efficiency, predictability, and control – all of which assume a level of order to the world. While these practices drive productivity gains and lead to incumbency, they are not suited for addressing what Kurtz and Snowden (2003) term un-ordered states where cause and effect are unknown and even unknowable. Commonly characterized as complex or chaotic, un-ordered states are where the “rules of the game” can change seemingly overnight, and dramatic, or even traumatic, shifts can occur across the norms, processes, and goals that guide firms and whole industries. Practices in un-ordered states revolve around improvisation, experimentation, and learning through failure (e.g., trial-and-error). Table 2.1 compares the differences between ordered and un-ordered states.

Further complicating matters, the shift between states of order and un-order is inevitable yet unpredictable. Even more, the two often co-exist leaving firms to address both concurrently. Firms must therefore exploit existing competencies for short-term profitability, while simultaneously exploring new competencies for future viability (March, 1991). Yet, the very practices that drive productivity gains during order create a core rigidity (Leonard-Barton, 1992) or inflexibility in a firm’s ability to adapt and change its competencies during un-order.9

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8 Turbulence can be defined as increases in market dynamism (i.e., frequency and magnitude of change), complexity (i.e., number of and interactions among forces that influence innovation), and competition over scarce resources, partners, and talent (Sull, 2009).

9 It is important to note that firms are never standing still, even in periods of order. Stability does not imply a lack of action and change. In fact, what firms are doing during ordered (i.e., stable) environments is “practicing” -
Christensen (1997) refers to these two states of innovation as sustaining and disruptive. He also famously showed that established firms almost always win out when competing on sustaining innovations (i.e., those created in periods of order), but that they often fail when facing a disruptive innovation (i.e., those created in periods of un-order).

Table 2.1: Comparing ordered and un-ordered states (Kurtz & Snowden, 2003).

<table>
<thead>
<tr>
<th>Ontological States</th>
<th>ORDER</th>
<th>UN-ORDER</th>
</tr>
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<tbody>
<tr>
<td>Simple</td>
<td>Complicated</td>
<td>Complex</td>
</tr>
<tr>
<td>Known - Repeatable, perceivable, and predictable</td>
<td>Knowable - Separated over time and space</td>
<td>Emergent relations that are only coherent in retrospect</td>
</tr>
<tr>
<td>Sense-making Process</td>
<td>Sense-categorize-respond</td>
<td>Sense-analyze-respond</td>
</tr>
<tr>
<td>Best practices, standard operating procedures, and reengineering</td>
<td>Extensive analysis and reliance on expertise; Learning organization and adaptive systems</td>
<td>Probe-sense-respond</td>
</tr>
<tr>
<td>Approach</td>
<td>Pattern management and perspective filters</td>
<td>Stability-focused interventions, enactment tools, and crisis management</td>
</tr>
</tbody>
</table>

Herein lies innovation’s paradox. What gives a firm its competitive advantage today may not hold for tomorrow, and in fact, those existing competencies that made a firm successful in the first place hold it hostage from addressing un-ordered change and creating new core competencies. In short, success becomes its own trap. How firms can overcome innovation’s paradox is the central concern for studies and practices in strategic management and innovation.

Observation of innovation’s paradox is not new to the academy. Schumpeter (1942) discussed the importance of “creative destruction” as a core component of economic growth, where capitalist economic development arises out of the destruction of some prior economic order.

reinforcing and improving upon existing behaviors and routines. This “practicing” is also part of what makes it hard to unlearn those learned routines.
Abernathy (1978) described how a firm’s productivity gains inhibited its ability to remain flexible and to innovate, which he explains as the “productivity dilemma.” Similarly, March (1991) claimed that the heart of a firm’s survival over time lies in its ability to exploit and explore simultaneously.

In this sense, innovation’s paradox results from a tension over scarce resources, but a tension that is shaped by an ever-changing environment (Uotila, Maula, Keil, & Zahra, 2009). Christensen’s (1997) classic work “The Innovator’s Dilemma” brought the paradox to the attention of the popular press, where he used it to explain why established firms fail. Specifically, he suggested that the incumbent firm always wins out during periods of order, but often fail to sense or seize opportunities in emergent environments (i.e., un-ordered) because their methods for allocating resources are bent in favor of existing customers (see also Christensen & Bower, 1996) or the existing entanglement of processes, resources, and values did not allow for the development of new competencies. Table 2.2 summarizes the many characterizations of innovation’s paradox from the management and organization literature.

10 Christensen’s contribution was of central importance because it explained that technological discontinuity was not the result of technology cycles or the S-curve and it explained why firms with some of the best leaders and managers in the world could still fail. It also broke with the commonly held assumption that whoever had the most resources would win (i.e., incumbency and resource-based view of competitive advantage).
Table 2.2: Characterizations of innovation's paradox.

<table>
<thead>
<tr>
<th>CITATION</th>
<th>OBSERVATION</th>
<th>TERMINOLOGY\textsuperscript{11}</th>
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<tbody>
<tr>
<td>Abernathy (1978)</td>
<td>Gains in productivity efficiency lead to inflexibility and rigidity toward innovate (i.e., process management; Benner &amp; Tushman, 2003)</td>
<td>Productivity Dilemma</td>
</tr>
<tr>
<td>Christensen (1997) Christensen &amp; Bower (1996)</td>
<td>Established firms always win in existing markets, but fail to see emergent markets (disruptive) due to methods of resource allocation; Technological discontinuity</td>
<td>Innovator’s Dilemma (Sustaining vs. Disruptive Innovation)</td>
</tr>
<tr>
<td>Cynefin Framework of Kurtz &amp; Snowden (2003)</td>
<td>Different ontological states (i.e., varying cause-effect relationships)</td>
<td>Order vs. Un-order</td>
</tr>
<tr>
<td>Leonard-Barton (1992)</td>
<td>Core capabilities have a flipside in that they can also be core rigidities</td>
<td>Core Rigidity</td>
</tr>
<tr>
<td>Schumpeter (1942)</td>
<td>Capitalist economic development arises out of the destruction of some prior economic order</td>
<td>Creative Destruction</td>
</tr>
<tr>
<td>Smith &amp; Tushman (2005)</td>
<td>Exploitation is rooted in variance-decreasing activities, while exploration is rooted in variance-increasing activities, which create contradictory logic for top management</td>
<td>Strategic Contradictions</td>
</tr>
<tr>
<td>Sull (2009)</td>
<td>Managers must make commitments (binding decisions for a future course of action) based on flawed mental maps of the future (map paradox), and over time a hardening of those commitments occurs as actions become intertwined with the firm’s frames, resources, processes, relationships, and values</td>
<td>Map Paradox and Active Inertia</td>
</tr>
<tr>
<td>Thompson (1967)</td>
<td>Administration seeks both certainty and flexibility at the same time</td>
<td>Paradox of Administration (Certainty vs. Flexibility)</td>
</tr>
</tbody>
</table>

Innovation’s paradox is equally a concern of cognitive contradiction (Smith & Tushman, 2005) as it is a tension over the scarcity of tangible resources. Again, management practices best suited for competing during order are based on principles of efficiency, predictability, and control, while un-order is best addressed with improvisation, trial-and-error, and experimentation. Switching between opposing views is beyond challenging because collective action requires trust.

\textsuperscript{11} From here forward, I use the terms order and un-order to refer to the different sides of innovation’s paradox.
and friendship, which is built on a set of stable assumptions – if with every contradicting fact people changed their beliefs, then they may be unable to forgive, make mistakes, or aggregate their knowledge. People’s “cognitive inertia” also causes those beliefs and values to endure beyond the situation in which they were created (Hodgkinson, 1997). A firm can undergo a similar phenomenon called “active inertia” (Sull, 2009), where people in the firm make long-term commitments based on imperfect mental maps and then these commitments harden or become “locked in” over time as they become more and more entangled in the firm’s distribution of resources, processes, relationships, and values. Active inertia is advantageous as long as the environment remains ordered. Problems arise when un-ordered change from turbulence makes those mental maps obsolete and managers operate on false and outdated assumptions. To address these issues, practitioners need to adopt a paradoxical lens as contradictions amplify, continuously questioning conventions (Smith, Binns, & Tushman, 2010; Smith & Lewis, 2011).

Managing innovation’s paradox is the central problem for most established firms. It requires the ability to manage core competencies in relation to both continuing and changing opportunities simultaneously. Given that the life span of most firms is not as long as that of the average American (Stubbart & Knight, 2006), it is obvious that this remains an unanswered concern for scholars and practitioners alike.

2.2. DYNAMIC CAPABILITIES: NATURE, MICROFOUNDATIONS, AND CRITICISMS

In the following section, I review and critique the nature and microfoundations of dynamic capabilities as the platform for addressing innovation’s paradox. In doing so, I first review the nature of dynamic capabilities from its roots in evolutionary and behavioral economics and as an extension to the resource-based view of the firm. Second, I review the microfoundations that make up dynamic capabilities. And third, I discuss the core assumptions of dynamic capabilities that are imposed by its historical roots and critique how such assumptions are constraining the view’s progress toward addressing innovation’s paradox. In conclusion, I pose the need to reexamine dynamic capabilities from an alternative perspective in order to address these
constraints and to identify new gaps in understanding innovation’s paradox and managing the invisible obvious.

2.2.1. Nature

The concept of dynamic capabilities emerged in the early-to-mid 1990s in response to the growing challenges that firms faced in adequately addressing the impact of technological change and rising market turbulence. At the time, prevailing strategies followed the resource-based view of the firm, where a firm gained competitive advantage from its valuable, rare, inimitable, and nonsubstitutable (i.e., so called VRIN attributes) resources and assets (Barney, 1991; Wernerfelt, 1984). In many ways this led to the “bigger is better mentality.” In the early 1990s, however, increasing turbulence in world markets led to the observation that while established firms had accumulated large stocks of seemingly valuable resources, they were inflexible and unable to reconfigure those resources in ways that could competitively address the rapidly changing environment, i.e., in states of un-order. This effect is what then became known as the “innovator’s dilemma” (Christensen, 1997).

Thus, the concept of dynamic capabilities is one of the first streams of research to address innovation’s paradox. Specifically, dynamic capabilities refer to the capacity of a firm to create, integrate, reconfigure, and transform competencies in order to address rapidly changing environments (Teece, 2007, 2009; Teece & Pisano, 1994; Teece, et al., 1997). While not the source of competitive advantage, the main purpose of dynamic capabilities is to govern the rate, as well as direction, of change in a firm’s competencies (Eisenhardt & Martin, 2000). As an extension of the resource-based view, it is heavily influenced by economic analysis and builds

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12 The concept of dynamic capabilities first appeared in the working papers of Teece et al. (1990a, 1990b) and was first seen in publication in Teece and Pisano (1994) and extended in Teece et al. (1997).
13 In testament to the potential and scholarly interest in dynamic capabilities, Teece et al.’s (1997) publication was the most cited paper in economics and business for the decade 1995-2005 according to Science Watch (Thompson Scientific Essential Science Indicators).
14 There has been significant discussion in the literature over the definition of dynamic capabilities, which is expected given that the concept is still relatively young. However, for purposes of this dissertation, I use the definition posited by Teece et al. and explicitly note otherwise. For a comprehensive review of definitions and critiques, see reviews by Wang & Ahmed (2007), Ambrosini & Bowman (2009), or Barreto (2010).
15 Long-term competitive advantage, again, lies in the competencies of the firm, which is constructed from the firm’s resources and capabilities.

The nature of dynamic capabilities has often been characterized as complicated but well-known learning routines that emerge from path-dependent processes such as repeated practice and mistakes (Eisenhardt & Martin, 2000; Teece, et al., 1997; Winter, 2003; Zollo & Winter, 2002). Examples of dynamic capabilities include adaptive capacity, innovation capacity, and absorptive capacity (cf., Ambrosini & Bowman, 2009; Eisenhardt & Martin, 2000; Wang & Ahmed, 2007), topics on which there is much existing research. A boundary condition exists though in the learning process, where dynamic capabilities vary with market dynamism—a divide that is similar to that characterized by innovation’s paradox. As Eisenhardt and Martin (2000) describe, periods of moderately dynamic markets require “complicated, detailed, analytic processes that rely extensively on existing knowledge and linear execution,” while in high-velocity markets, the duration of advantage is “unpredictable” and dynamic capabilities “are themselves unstable [and iterative] processes” (Eisenhardt & Martin, 2000, p. 1106).

The majority of studies and discussions posit that agency for directing and governing dynamic capabilities rests with the executive or senior team. This explanation draws heavily from Schumpeter’s (1942) concept of the entrepreneur who is thought to be the catalyst for innovation or what Schumpeter famously referred to as the ‘gale of creative destruction.’18 In turn, the

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16 These authors represent areas of evolutionary economics, behavioral economics, and transaction cost (theory) economics.

17 In the post-industrial society, economic theories have played a heavy hand in describing the nature of the firm and sources of competitive advantage. Porter (1979, 1980, 1985) was one of the first to employ an economic analysis to the field of strategy and competitive advantage. His “five forces” model, which drew on the structure-conduct-performance paradigm of industrial organizational economics (Bain, 1959; Mason, 1949), postulated that for a firm to avoid the zero-profit condition it must pick an attractive industry (e.g., growing) to enter and where it can then build barriers to entry against competitors. However, the model is based on the positions of privilege and favors evaluation on the product-market side, which does little to conceptualize the firm, nor how firms differentiate with an industry. Dynamic capabilities was developed with explicit intent to address these limitations by drawing on evolutionary and behavioral economics versus industrial organization economics, opening up the “black box” of the firm, and bringing attention to the agency of management in economic theory and firm performance.

18 Schumpeter (1934) is often credited as one of the first to discuss the firm from an evolutionary perspective. He also brought attention to the importance of innovation in explaining economic dynamics, including the role of the entrepreneur in instigating the “gale of creative destruction” whereby innovation and technological change replace the status quo and bring forth new competitive advantages and economic growth (Schumpeter, 1942). Schumpeter’s
microfoundations of dynamic capabilities revolve extensively around the actions of senior management.

### 2.2.3. Microfoundations

The wide array of literature on strategy and innovation, coupled with the newer studies on dynamic capabilities, provides a host of organizational activities that could inform the microfoundations of dynamic capabilities. Teece (2007) provides one of the more compelling views, which he also posits as an umbrella from which to integrate the plethora of literature. The view consists of three underlying capabilities: (1) sensing opportunities and threats, (2) seizing opportunities, and (3) transforming the firm’s resources and assets (see Figure 2.1).

![Figure 2.1. Microfoundations of dynamic capabilities in the firm (Teece, 2007).](image_url)

Sensing new opportunities and threats is about scanning the environment, learning, and treating the firm as an interpretive systems (Daft & Weick, 1984). Because the firm’s competencies often revolve around its core business, and less along the periphery, the entrepreneurial manager must constantly scan and search technology and markets, both ‘local’ and ‘distant’. This includes

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(1942) definition of an entrepreneur was a person who could turn an idea or invention into a commercial innovation. He also saw large firms as the engine of economic growth because they had the resources to invest in the research and development necessary for innovation. Moving through cycles, the large firm could create in essence a profit monopoly until whittled away by rivals and imitators, which at that point, the large firm could introduce a new innovation and regain their competitive position and so on and so forth.

Scanning is designated as a cognitive and creative activity of the ‘right brain’ individual (2007, p. 1323). Teece (2007) suggests a decentralized organizing structure enables greater autonomy and is less likely to be blindsided by changing ‘local’ environment conditions. Or, senior managers literally ‘walk about’ the firm as a way to scan the lower levels of the firm. Search activities include examining the business ecosystem, particularly ‘distant’ technologies and markets that may not be visible to the ‘local’ proximities. Search should also be around both core
investment in R&D and probing of customers, as well as understanding latent demand and the structural evolution of markets.

Seizing is the investment in a recognized opportunity, which includes resource allocation procedures and designing of the new business model (e.g., firm structures, procedures, designs, and incentives). Key elements in designing the business model include delineating the customer solution (e.g., revenue architecture, target customers, etc.), setting firm boundaries (e.g., calibrating asset specificity), selecting decision-making protocols, and building loyalty and commitment (e.g., leadership, communication, value and culture factors) – all of which are necessary for complementing the emergence of a new organizing structure for the new investment space. Collectively, these activities often revolve around understanding the timing and identification of a dominant design (Abernathy & Utterback, 1978; Suarez & Utterback, 1995), as well as maintaining and improving competencies to complement new investment spaces.

Transforming is about the redesign of routines and reorchestration of assets into new core competencies. It requires a significant degree of decentralization and decomposition of parts and then redeployment and reconfiguration of those parts into new wholes – wholes which are rebuilt around the new investment opportunity and business model. It also means managing the strategic fit between asset combinations and the environment to ensure they are value enhancing. Governance of incentives, agency issues, and rent dissipation are also important in order to maintain the change momentum. Lastly, knowledge management is also central to ensure that learning, knowledge transfer, and know-how, as well as intellectual property protection, are integrated and leveraged in the reorganization of firm competencies.

and periphery activities of the firm. Searching both customers and suppliers for emerging opportunities or threats is also proposed, as well as practicing open innovation (Chesbrough, 2003) to leverage both ends of the ecosystem. As the ecosystem becomes a more and more important point of innovation, a strategic framework for integrating the firm and ecosystem will also be important.

Teece spends a significant amount of space outlining the cognitive biases, errors, and barriers that the decision maker is prone to during the investment processes and across the various micro-processes. Given the hierarchical and bureaucratic nature of most firms, senior management does have significant influence of the allocation of resources and the ability to astutely invest financing around new opportunities is critical to firm performance (e.g., Chandler, 1990). It requires strong leaders to overcome the ‘program persistence bias’ and risk averse activities of the firm. The investment decision making of the entrepreneurial manager is also different from the general investor because of cospecialization (Teece, 1986) and irreversibility (Teece, 2007). I make note of this here because this approach to cognition is also a noted criticism and limitation of the current perspective on dynamic capabilities.
Teece (2007) notes that these three capabilities are intertwined but generally treats them as independent capabilities. Collectively, dynamic capabilities act as a meta-competence that sits above the routine operating competencies of the firm. Again, without dynamic capabilities, firms may be able to gain competitive advantage and profitability in the short-term. However, with innovation’s paradox such success is always fleeting. In conclusion, Teece argues that maintaining dynamic capabilities rests on the entrepreneurial manager and the senior team, and in turn, so too does the firm’s ability to survive over time.

2.2.3. Criticisms

The concept of dynamic capabilities is not without its critics. For example, it has been argued to be

- Tautological in its relation to firm performance (Williamson, 1999; Winter, 2003),
- Abstract and conceptual with weak theoretical foundations (Arend & Bromiley, 2009; Barreto, 2010; Kraatz & Zajac, 2001),
- Resistant to observation and measurement or short on empirical study (Arend & Bromiley, 2009; Barreto, 2010; Easterby-Smith, Lyles, & Peteraf, 2009; Kraatz & Zajac, 2001), and
- An overly simplified view on the dynamics of organizational change (Arend & Bromiley, 2009).21

Some scholars (e.g., Arend & Bromiley, 2009) go as far as to suggest that researchers should think of moving away from the dynamic capabilities in favor of other, more mature areas of study (e.g., absorptive capacity, organizational learning, change management). The concept is also susceptible to the criticisms of its economic foundations, particularly as an extension to and reformulation of the resource-based view (e.g., Kraaijenbrink, Spender, & Groen, 2010; Priem & Butler, 2001a, 2001b).

21 A more complete review on the criticisms of dynamic capabilities can be found in (Arend & Bromiley, 2009).
Many of these criticisms may be necessary but unwarranted though because the concept of
dynamic capabilities is still a fledgling area of inquiry. We should also remember that “as one of
the most central and difficult questions within the strategy domain, this [dynamic capabilities]might well be characterized as the Holy Grail of strategic management” (Helfat & Peteraf, 2009,
p. 91). Innovation’s paradox covers a broad and complex set of fields and issues, and criticisms
and concerns over possible solutions should be seen as part of a natural and healthy progression
of scholarship.

In reviewing these criticisms, I argue that they are only symptoms of a deeper seeded issue.
Specifically, the progress of dynamic capabilities is constrained not by its soft definition and
limited empirical study but in its defining nature as a conversation in economics. Historically,
such conversations invoke an ontology of separateness in measurement and causality and a path
dependence in explaining agency and change. These two assumptions have led to an
inappropriately narrow understanding of human activity and particularly overlook the way
people interpret and act in and as part of the world. I posit that these concerns must be addressed
before further progress can be made in our understanding of dynamic capabilities. The remainder
of this section discusses these assumptions and their constraints, how they explain each of the
above criticisms, and their implications on the microfoundations of dynamic capabilities. In
conclusion, I pose a reexamination of dynamic capabilities from a perspective rooted in the
alternate conversation of social practice theory.

The ontology of separateness is pervasive in most economic theory and results in deductive
logic, reductionist reasoning, and object independence. Suggesting that entities possess inherent
qualities, the sum of the whole is equal to its parts. However, such an argument does not account
for interactions between parts or the emergence of higher-order behavior. In the case of dynamic
capabilities, this separateness has led to the ever-popular Cartesian dualisms such as mind vs.
body, and in the management literature, cognition vs. behavior, individual vs. the firm, and
humans vs. technology.22 Deductive methodologies have also led to an overly simplified

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22 Examples of dualisms include mind and body, cognition and behavior, objective and subjective, structure and
agency, individual and institution, and determinism and free will (Reckwitz, 2002).
examination of the firm that fails to capture the non-linear, emergent, and distributed nature of innovation (Van de Ven, et al., 1999) and its paradox in un-ordered states. It also overlooks the imbrication between technology and administrative innovations (Leonardi, 2011b), as well as the interactions and co-evolution between innovation, strategy, and organizational design (Dougherty, 1992b; Rindova & Kotha, 2001; Van de Ven, et al., 1999). While modern scientific methods are built on the assumptions of separateness, the result is a narrowed scope in scholarly exploration and explanation.

Path dependence suggests that history matters, where repeated practice (i.e., learning mechanisms) encodes unique histories into distinct routines (Nelson & Winter, 1982; Teece, et al., 1997; Zollo & Winter, 2002). These self-renewing and self-reinforcing routines are what provide economic efficiency during periods of order, but also what lead to actors or firms becoming ‘locked in’ to paths whose direction is determined by ‘contingent’ or chance events (i.e., exogenous shocks). In dynamic capabilities, Schumpeter’s (1942) entrepreneur is viewed as the source of these exogenous shocks (i.e., ‘gale of creative destruction’). Furthermore, the concept of dynamic capabilities bestows the role of entrepreneur on senior management or what has come to be known as entrepreneurial management. It assumes unrealistically though that the entrepreneurial manager possesses (1) the wherewithal to accurately sense opportunities and threats, (2) a valid mental map of the future on how resources should allocated and new business models designed, and (3) a deterministic-like ability to transform a firm’s competencies, as if resources and assets are the equivalent to parts in an engine. This view also removes any kind of agency from other actors within the firm (e.g., bottom-up innovation), oversimplifies the nature of organizing to that of a mechanistic metaphor, and ignores any sense of temporality, context, and distinction between what is endogenous and what is exogenous.

Together, ontology of separateness and path dependence ignore the social entanglement between interpretation and organizing. For example, cognition is often treated as a variable to be reduced such as a bias, barrier, or error. While the importance of socio-cognitive considerations has been on the rise in recent years, it continues to be relegated as a secondary factor. This is quite odd given how many scholars have highlighted the importance of cognition in decision making, and the importance of ‘cognitive reorientation’ in strategic change (Adner & Levinthal, 2008; Gavetti
The collection of the two economic assumptions also ignores the situated, interactive, and distributed nature of cognition (Hutchins, 1995; Suchman, 1987), which plays a significant role in how people’s interpretations shape their actions and how the material environment mediates the interpretation process.

The impact of these assumptions on the microfoundations of dynamic capabilities has been significant. For example, the separateness assumption has led to a divide-and-conquer mentality, where labor is segregated into specialists and then reintegrated as a whole. While synergy is the goal, overlooking the interdependencies between laborers often leads to a whole that is less than its sum of parts. Furthermore, solutions are often structural in nature to the detriment of cognitive and cultural factors. Sensing is also a top-down activity which does not account for the many serendipitous pathways of innovation.

From a solutions standpoint, resulting strategies for enacting dynamic capabilities focus predominantly on resource allocation and organizational structure. For example, Christensen and Bower (1996) observed that firm’s “lock in” to a pattern of sensing-seizing-transforming because resources are allocated toward existing customers and based on financial metrics that assume a level of order and predictability to the world. To overcome the cycle, Christensen (1997) suggests firms must structurally separate the resources, processes and values of the new business from the existing business. Simply acquiring and merging new businesses into the old or hiring new employs is also not enough to overcome the inertia of the existing business. They must be structurally separate. O’Reilly and Tushman (2004, 2011) introduce this structural separation as the ambidextrous organization – “where breakthrough efforts were organized as structurally independent units, each having its own processes, structures, and cultures but integrated into the existing senior management hierarchy (2004, p. 74).

These structurally-oriented, top-down strategies are limited because they do not account for the embedded nature of core competencies (Henderson, 2006), the social factors that drive organizing, or the multiple pathways of innovation. Nor do they leverage the existing business, leaving the question of what advantage, if any, does an established firm have in promoting
disruptive innovation? Innovation is objectified, yet this overlooks firm member’s interpretations of innovation and the relationship between interpretation and organization. For example, through socialization and interaction departments develop their own “thought worlds” that can act as barriers to successful product innovation (Dougherty, 1992a). Furthermore, existing organizing routines separate rather than coordinate those thought worlds. Innovation requires not only a new organizing structure but also a new image of organizing (Dougherty, 2001). Yet these socio-cognitive factors are mostly ignored in current conversations of dynamic capabilities and innovation’s paradox.

Structural approaches also rely on senior management to have the clear ability to sense, seize, and transform the firm to meet the challenges of a rapidly changing environment. Even if managers had such capabilities, this strategy does not account for the fact that most novel ideas emerge from within the basement of the firm and require extensive expert learning coupled with trial-and-error, perseverance, and timing (Van de Ven, et al., 1999), which are often not the activities of the manager.

Another limiting behavior of the structural approach can be observed during a crisis. In haste to address the crisis, a firm is often willing to release its resource rigidity (i.e., resource allocation plans) in order to develop new competencies. However, firms often fail to release their routine rigidity (i.e., organizational processes that use those resources), which in essence leaves a new group employing organizing routines from the old business (Gilbert, 2005). The structural approach fails to address the cognitive reorientation that is necessary during strategic change initiatives (Gioia & Chittipeddi, 1991).

In its current form, the concept of dynamic capabilities is constrained by its supposition of economic assumptions. To progress the concept and adequately address innovation’s paradox, an alternative view is needed – a view that can reexamine dynamic capabilities at the level of practice in the everyday, giving agency to humans and the influences of the material environment, and highlighting the importance of interpretation and the link between sensing, seizing, and transforming. Social practice theory offers such a perspective and is the topic of the next section.
Much can be gained if a plurality of research perspectives is offered on the nature of the firm and its underlying microfoundations. Contrasting views are useful in addressing and complementing the limits and constraints of the other. In this case, social practice theory is used to reexamine the microfoundations of dynamic capabilities in order to address existing constraints. Specifically, resting on a relational ontology, I review the three central principles of social practice theory and discuss the resulting implications – five fundamental shifts in the way we view dynamic capabilities. Collectively, these principles provide the foundation for a sociomaterial entanglement view of the firm.

Based on the entanglement view, I then present the L’oer Model - a new strategic model for addressing innovation’s paradox. The model highlights three innovation pathways for creating new competencies alongside existing ones. The model also proposes an inherent link between interpretation and organizing, where the effective enactment of these strategies rests on firm members’ abilities to effectively reflect on their own (and those of the firm) assumptions, knowledge, and expectations, or what I term, innovation frames. The concept of frames is discussed at length in Section 2.4.

2.3.1 The Nature and Principles of Social Practice Theory

*No man ever steps in the same river twice.*

- Heraclitus

In the management and organization literature, there is growing sentiment around a relational ontology of the world, which supposes that the relations between entities are ontologically more fundamental than the entities themselves. This is in contrast to the ontology of separateness presented above and which dominates modern scholarly conversations. The relational ontology initially emerged primarily in science and technology studies (e.g., Barad, 2003) and those that question the boundaries between technology and organizing (e.g., Barley, 1986; Leonardi &
Barley, 2008; Orlikowski, 1992, 2007, 2010; Orlikowski & Scott, 2008). The relational ontology redefines the boundaries between social and material, not as separate entities but rather, as an entanglement that occurs throughout people’s everyday practices.  

To observe the emergent, ongoing, and everyday production that is sociomaterial life, researchers must take an epistemological position that enables the study of organizational at the level of practice. Such a lens has been applied to studies of organizational routines (Feldman, 2000; Feldman & Pentland, 2003; Feldman & Rafaeli, 2002), strategy (Fenton & Langley, 2011; Whittington, 2006), organizational renewal and product development (Dougherty, 1992b; Orlikowski, 2002; Salvato, 2003, 2009), communities of practice (Brown & Duguid, 1991; Østerlund & Carlile, 2005), organizational knowledge (Brown & Duguid, 2001), technology (Orlikowski, 2000, 2007, 2010), team mental models, (Marshall, 2007), and other areas.

Collectively, these areas have come to formulate social practice theory (Feldman & Orlikowski, 2011; Reckwitz, 2002) – a perspective that implies a considerable shift in the demarcations between body, mind, things, knowledge, discourse, and the agent. Social practice theory stands on three basic principles: (1) that social life is recursively produced in everyday action, (2) that dualisms are rejected (e.g., cognition and behavior), and (3) that the relationship between elements is mutually constituting (Feldman & Orlikowski, 2011). The first of these principles returns human agency, as well as the role played by nonhumans or influences of materiality (e.g., Barley, 1986; Orlikowski, 2000; Orlikowski, 2005; Suchman, 1987) to the foreground of social order and in the production and reproduction of the structures that constrain and enable activity (Bourdieu, 1990; Giddens, 1984; Latour, 1987; Pickering, 1995). The second principle recognizes the inherent relationship between elements, which stands in opposition to the artificial divide created under Cartesian’s dualisms and deductive logic. Lastly, the third principle suggests that no phenomena is independent from another, where agency and structure  

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reconstitute the other; an actor cannot be removed from the place of his or her actions because they make up the very system of which they are each an element.\textsuperscript{24}

\subsection*{2.3.2 A Reexamination of Dynamic Capabilities from Social Practice Theory}

Social practice theory implies five critical shifts in the reexamination of dynamic capabilities:

1. Action becomes the unit of analysis and interpretation as the broader phenomena under study. From Teece’s (2007) dynamic capabilities model, this view emphasizes the relationship between microfoundations sensing, seizing, and transforming, rather than focusing on the individual acts.

2. Agency is distributed across space, time and the various agents of the firm, which means individuals and the competencies of the firm become intertwined. This also implies that agency is not relegated to the entrepreneurial manager (i.e., senior team) and instead, is viewed as distributed throughout the many actors within the firm, as well as to exogenous forces.

3. Entities act in a circular fashion, which is a shift from Teece’s (2007) linear view (see Figure 2.2). The circularity suggests for example that sensing does not occur in isolation from the prior activity of transforming, i.e., organizational form shapes the sensing activities of the firm. The implication on strategy is that structural solutions would focus on failures in sensing as a failure in the cognition of the senior team. On the other hand, the circular influence of one activity on another suggests that organizational change can come from many sources. It also draws attention to and explains why Henderson’s (2006) idea of embedded organizational competence (i.e., distribution of agency throughout the individuals of the firm) makes innovation’s paradox is so difficult for established firms. That is, during periods of stability, this circularity represents the self-renewing, self-

\textsuperscript{24} Mutual constitution does not imply equal power. In fact, the asymmetry of relations is central to understanding practice (Østerlund & Carlile, 2005)
reinforcing mechanisms that gain a firm its incumbency, while during periods of un-order, the circularity appears as a rigidity.

4. The circular model coupled with the distribution of agency can now account for three distinct pathways of innovation. The first is the relation between transforming and sensing, which is most often the agency of top-down innovation strategies driven by senior management (e.g., mergers & acquisitions). The second is the relation between sensing and seizing, which is more in line with bottom-up innovation strategies initiated from individuals or groups within the firm - those “on the front lines.” And the third is the relation between seizing and transformation, which is most often associated with threat response and crisis management. This is where in haste, many firms forget how sensing influences their reactions and leads only to the amplification of existing routines (i.e., an easing of resource rigidity but a tightening of routine rigidity).

5. As a meta-competency (Ambrosini & Bowman, 2009; Teece, 2007), dynamic capabilities become a reflexive practice whereby actors recognize how their current conditions of organizing shape the relations between sensing, seizing, and transforming. Such awareness enables their ability to restructure those organizing routines in new and innovative ways. Understanding the relations between sensing, seizing, and transforming becomes the central mechanism for change and the microfoundations of dynamic capabilities – mechanisms that rest on the broader relation between interpretation and organizing. Therefore, reflexivity and awareness of self and the firm is moved to the forefront of strategic conversation and is achieved through a questioning of the underlying assumptions, expectations, and knowledge that guides organizational action. This does not always need to be deliberate or conscious, but revolves around second-order or double-loop learning (Argyris & Schon, 1978) – learning about the deeper relationships between entities, not simply learning through imitation or trial-and-error.

In summary, humans and nonhumans (e.g., technology) can redirect the relationship between interpretation and organizing. This is the foundation of dynamic capabilities and what enables a firm “to create, integrate, reconfigure, and transform competencies in order to address rapidly
changing environments” (Teece et al.’s, 1997 original definition of dynamic capabilities). This comes through awareness, an open and safe climate for conversation, challenging counterparts who can question and critique, and new knowledge.

2.3.3 A Sociomaterial Entanglement View of the Firm

The tenants of social practice theory inherently imply a reconceptualization of the firm as a sociomaterial entanglement. Questions on the nature of the firm revolve around how one firm gains a competitive advantage over another. Porter’s (1985) “five forces” model suggests that competitive advantage is gained through positions of privilege that are based on the structure of an industry. On the other hand, the resource-based view suggests competitive advantage is sourced through the possession of VRIN resources (Barney, 1991; Penrose, 1959; Wernerfelt, 1984), with the dynamic capabilities view adding to this position with the suggestion that advantage is further gained with the ability to reconfigure resources depending on the state of the domain (Eisenhardt & Martin, 2000; Helfat, et al., 2007; Teece, 2007; Teece, et al., 1997). The notion of separateness is pervasive in all three views. The entanglement view therefore proposes a relational view of the firm, where the core competencies that provide a firm’s competitive advantage are entanglements of social and material forces. The boundaries between firm and environment are also inherently intertwined and temporally situated.

2.3.4 The L’oer Model

The entanglement view provides a very high level conceptualization of the firm, but it is not easily operationalized in practice. Therefore, I propose a dynamic organizational model that draws on the practical microfoundations of dynamic capabilities which I reconceptualize from a sociomaterial entanglement view of the firm. I refer to this paradigmatic reconceptualization as the L’oer Model (pronounced “lure” model), with an illustration presented in Figure 2.2.
Figure 2.2: The L’oer Model – A reconceptualization of firm-level dynamic capabilities from a view of the firm as a sociomaterial entanglement.

In this model, three key relationships (arrows) and their resulting strategies (i.e., top-down, bottom-up, crisis management) are identified. Each strategy relates to a different primary source of change. Recognizing that the firm is an entanglement, this model illustrates this interlocking between interpretation (frames) and action (sensing, seizing, transforming) as they are bound up in the broader activity of organizing. Frames guide action, which in turn shapes frames.25

The term “L’oer” is derived from the idea that an entanglement is based on this reciprocal relationship between interpretation and action, or what could also be thought of as learning and doing. The ability of an individual to reflect and become aware of this link enables the potential for agency. In practice, the term L’oer therefore refers to the learner and the doer, or L’oer – the individual who at a meta-level is capable of reflecting on and understanding the assumptions, expectations, and knowledge of his or her interpretations through specific acts of doing. Recognizing this link through reflexivity enables the individual to change trajectories.

The learner-doer ability is similar to that of double-loop learning, where goals can be modified in the light of experience or possibly even rejected, i.e., double-loop learning (Argyris, 2002; Argyris & Schon, 1978). At the same time, learning occurs through experience, i.e., by doing.

25 The remainder of this section describes the L’oer Model in more detail, but discussion on the role of frames with the L’oer Model is reserved for Section 2.4, as well as in the syntheses of Chapter 5.
The concept of doing as a form of inquiry is best articulated in the concepts of action research (Argyris, Putnam, & Smith, 1985; Lewin, 1946; Polanyi, 1958; Senge, 1990), where learning is achieved through action and for action. In other terms, the L’oer Model connotes a sense of inseparability between reflexivity and the potential for agency.

At the firm level, organizing is an entanglement of many individuals. Therefore, it is critical to understand the relationship between individuals and the firm. This relationship is in part the empirical focus of Chapters 3 and 4. I return to the importance and further explanation of the individual-firm entanglement within the L’oer Model in Chapter 5. The following subsections address the three innovation pathways identified within the L’oer Model.

1. **Top-Down Innovation Strategies**: Managing the relation between transforming and sensing is best understood as a top-town innovation strategy. Driven by senior management, the firm recognizes how its current organizing form shapes its sensing capabilities. In an ordered state, this is innovation as usual. Resources are allocated to expand R&D capabilities and acquisitions made to extend core competencies. In contrast, during un-order, management often misses opportunities and threats because the existing organizational form constrains their sensing ability and that of the firm. For example, the Smartphone began to take hold in the early 2000s but few thought to look at a computer firm (i.e., Apple) as a potential threat.

On the other hand, senior management may initially seek to create new disruptive innovations. In this case, as their intention is to incite un-order, they can recognize boundaries and assumptions of their existing organizing structures and seize new investments in order to enable new organizational forms that might instigate un-order and enable the sensing of new disruptive opportunities. This most often comes in the form of major acquisitions, or on the other end of the spectrum, strategic venture capital investments or in-house skunkworks projects. An example is Intel’s venture with Mattel and the creation of the Toy Lab in 1998. Andy Grove, Intel’s CEO at the time, met with Mattel’s CEO, Jill Barad, and the two saw that they each had a competency that the other did not but that combining the two might lead to new opportunities in “smart toys.” They then decided to create the Toy Lab venture, which for a while went on to have one of the
best selling robots in the market.  

By recognizing how each firm’s competencies lead to the sensing and creation of particular products, the two CEO’s shifted their allocation of resources (i.e., seizing) to invest in a new organizing form that could in turn sense and seize new opportunities.

For such ventures to succeed, senior management will need to make many small investments in order to allow for both opportunities to learn and opportunities to fail. The aim is that the firm, particularly senior management, learns from these many micro-moves so that larger, more certain opportunities may be sensed and seized. Management should also view these learning engagements as ways to create new routines and capabilities that if seized correctly could grow into core competencies. While creating structurally separate organizations is important, so too is reforming the socio-cognitive orientation of those doing the organizing.

(2) Bottom-up Innovation Strategies: “Let a thousand flowers bloom” is the motto of the bottom-up innovation strategy and in fact is where many innovations originate. Crafted by the everyday entrepreneur who is embedded within the routine workings of the firm, this individual or collection of individuals stand resilient and persevere in the face of adversity and failure, all in the name of creating the next great opportunity. However, to change the course of a firm means changing the way it seizing opportunities, which also means how it senses those opportunities. Untangling the commitments and active inertia of a firm is the long uphill battle facing the any entrepreneur.

Key to this battle is the “socialization” of an idea through presentations, prototypes, and other illustrations that outline the business opportunity and technical requirements. It means

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26 While this example may appear to follow the traditional economic view of dynamic capabilities, it began with CEO Andy Grove constantly questioning his own assumptions. He realized that Intel’s current organizational form was not sensing opportunities in the toy retail space. While the incident may seem serendipitous that Grove and Barad had the chance to interact, it can also be explained that the dynamic capabilities of each firm lead them to such chance. As they say, fortune favors the prepared.

27 The everyday entrepreneur and is different than the entrepreneurial manager espoused under the dynamic capabilities view. Within the latter, the agency for innovation and creation of new competencies is relegated to senior management. In contrast, the bottom-up strategy of the L’oer Model supposes that the agency for change resides in those individual who are embedded and entangled within the firm. They are “everyday” people who through learning and doing are provided the opportunity to be entrepreneurial. This does not mean that every person within a firm will be entrepreneurial; rather, that every person has the potential.
transforming the organization in a way that will enable the firm’s senior team to sense the
opportunity and allocate the necessary resources to grow the idea. Thus, while the everyday
entrepreneur may believe that what he/she/group is doing is bringing attention to opportunities,
what is really happening is the entrepreneur has become a teacher – reshaping not only what
others see but how they see it. As Adner and Levinthal (2008, p. 43) state, “the most powerful
form of entrepreneurship may be the initiation of the cognitive shifts that offer a different
typology of the competitive landscape.”

Firms set up multiple beds in which these flowers can bloom. They host “ideation” competitions,
create skunkworks teams, invest in R&D, establish new partnerships with suppliers and
customers and so on and so forth. One mistake though that many firms make is failing to see an
idea from end-to-end. Many of these creative endeavors simply turn into “throwing ideas over
the wall.” The result is a “valley of death” between idea and implementation (Martinelli &
Galluzzo, personal communication, 24 Feb., 2011). Often the result of emphasizing technology
transfer over other critical factors such as the surrounding assumptions, expectations, and
contextual knowledge, they call it a valley of death for a reason; most ideas and initiatives do not
survive. To bridge this valley, firms can maintain a core team that remains together from concept
to launch (Ma, Chen, & Thimm, 2008; Prasad, 1996). This enables the transfer of the
assumptions and contextual knowledge, not just the technology.

For the everyday entrepreneur, though, the choice of a core team is not always available, nor
does it address the need for creating new pathways that both leverage and separate from the
existing business. In some cases, new ideas and opportunities fit into a firm’s existing product
development pathways. However, senior management often fails to capitalize on many ideas
because the cognitive inertia of management either cannot sense the opportunity or resources are
already tied up in other commitments. Unless management is able to free themselves from the
existing organizing inertia of the firm, it is typically too late to act on the emerging opportunity
once it does become more apparent. New research explaining how management can untangle the
firm from active inertia in ways that allow for new pathways is needed. Or in alternate, how does
the everyday entrepreneur actively help management reconstruct the way opportunities are
sensed and seized?
(3) *Innovation Strategies in Crisis:* Third, the relation between seizing and transforming revolves around how firms respond to threats and crises, and is one of the more visible streams of research in the literature, particularly on the topic of technological discontinuity. A crisis can result from a broader shift in the marketplace, changes in state or national policies, or a socioeconomic or political event (e.g., war, changing demographics). It may also be the result of a new disruptive innovation. For example, Proctor & Gamble lost over 30% of their market capitalization in a single day in 2000 because of a failed merger attempt, higher raw material costs, and the volatility of being in the early stages of a major six-year reorganization (Matthews, 2000). Meanwhile, General Motors saw an ever-steady rise in internal costs coupled with increasing competition that came to a halt in the 2007 economic recession. Intel, Microsoft, and most of the PC manufacturers were left unprepared when Apple launched the iPad in 2010.

The response to crisis is almost always the same though. In the haste to respond, firms release their grip on resource rigidity but tend to amplify their routine rigidity (Gilbert, 2005). The result is an increase in a firm’s active inertia, to its misfortune. Because process resources extend from the core business, firm members continue to think like the old business while trying to build the new one – the same behavior that most likely lead to the initial crisis in the first place and that only perpetuates the problems. For a firm in crisis, survival is possible but it requires a dramatic cognitive reorientation, not simply a structural change (Gioia & Chittipeddi, 1991; Gioia, *et al.*, 1994; Thomas, Clark, & Gioia, 1993).

It is in the case of crisis where firms fail because they focus solely on structural changes to the way business is conducted. While innovation almost always begins with some kind of a crisis (Van de Ven, *et al.*, 1999), in un-ordered states the new organizing form must be learned, and new norms, processes, and values must be developed in place of the old. This is truly what Schumpeter (1942) meant by the gale of creative destruction, where new developments arise out of the destruction of some previous order. Such creative destruction requires both a reorganization of the cognitive, as well as the structural and material – one does not exist without the other, and they work not as individual parts but as a complex whole where much of the new
form come from the interactions between parts, not simply the parts themselves. Such phenomena may best described as a paradigmatic shift in the *modus operandi* (Kuhn, 1996).

It is here that the idea of separateness is most exposed. Strategy, innovation, and organizing are inextricably linked, yet during crisis these activities are believed separate, done in haste, one without the other. This is not purely the result of unskilled management, but the way humans respond to uncertainty. While individuals become more aware of their sensemaking during periods of crisis (Weick, *et al.*, 2005), they tend to not question the way they go about this process. As Kurtz and Snowden (2003) discuss in the Cynefin Model, people who are thrust into periods of chaos will do almost anything to regain some semblance of order. People also tend to think short-term and see the world as a zero-sum game. If these tendencies go unrecognized, they result in poor outcomes for the firm.

On the other hand, crisis also brings with it the potential for a paradigm change. Innovation can be had if crisis events can be viewed as opportunities instead of threats (Petrick & Martinelli, 2012). In essence, in the face of threats and crises, firms must return to how they sense the world and make sense of organizing. Innovation in crisis requires hastened learning for the firm. How such activities occur in what appears to be a zero-sum game with an immediate winner-take-all outcome remains an open and important area of research.

2.3.5 *The Link between Interpretation and Action: Calling Out Frames*

The L’oer Model suggests that the firm is anything but monolithic. Firms are comprised of multiple “thought worlds” – ways of making sense of the future and uncertainty (Dougherty, 1992a). Conceptualizing the firm and the reconfiguration of core competencies as anything less would be incomplete and inaccurate. While Figure 2.2 illustrates the L’oer Model at the firm level, the various activities between sensing, seizing, and transforming occur simultaneously, on multiple fronts, and across time, space, and actors. For example, established firms often house multiple divisions. Each division’s senior team may be addressing the first link, while multiple groups within the firm may be attempting to influence the second link, and in the face of crisis, all may be dealing with such an event, some seeing it as a threat and others an opportunity.
While firms tend not to question their assumptions during periods of order, understanding those assumptions and their implication for organizing are critical to surviving un-ordered states. Understanding the relationship between the many worlds of a firm and how it is organized into multiple competencies is critical, particularly as scholars and managers seek to address innovation’s paradox and the reconfiguration and reorientation of existing and new competencies. Opportunities, not firms, go through life cycles (Pralahad & Hamel, 1990), and the aim of the L’oer Model is to manage core competencies in order to address changing opportunities. This means delving into the organizational abyss – the inner workings of the firm – in order to address these differences and not simply reconfiguring them as if they are mechanical parts.

Therefore, I call out the role of frames within the L’oer Model as the key link between interpretation and action and position frames as the central concern for the remainder of this chapter, as well as the primary focus of Chapters 3 and 4. Particularly important is understanding how frames link the individual and the firm. Through reflexivity and an understanding of the relation between the individual and firm, the everyday entrepreneur can untangle the entanglement of a firm’s core competencies and develop new innovation pathways, all necessary for overcoming innovation’s paradox. Before discussing the role of frames in the L’oer Model, I first provide further comparison of the L’oer to other models of strategy and innovation.

2.3.6 Comparing the L’oer Model to Others

Alternate models of strategy, innovation, and the firm exist. Dynamic capabilities was one such model, which as noted, was an evolution of economic theories and the resource-based view of the firm. Porter’s “five force” model (1979, 1980, 1985) is another. Built on assumptions of industrial organizational economics (Bain, 1959; Mason, 1949), Porter’s model examines five structural aspects of an industry – (1) threat of new competition, (2) threat of substitute products, (3) bargaining power of customers, (4) bargaining power of suppliers, and (5) intensity of competitive rivalry – and suggests that a firm can gain competitive advantage through its positioning in the industry. The model makes a number of assumptions though. First, that a zero-
profit condition can exist. Second, that a firm can easily pick and choose where it competes. Unlike the L’oer Model, these assumptions are based on notions of rationalism, ignore privilege, and favor evaulation on the product-market side, and “black box” the role of management and the internal dynamics of the firm. A major question regarding Porter’s model is the role of management, and how a firm can differentiate within an industry. On the other hand, while the L’oer Model does not address industry structure, it’s central consideration are the internal workings of the firm and to bring agency to those individuals within a firm.

Cooper’s (2001) StageGate Model is another popular model of innovation that follows a phase-gate process. Phases (e.g., discovery, scoping, building business case, development, testing & validation, and launch) are separated by gates, which are decision reviews (i.e., go or no-go) typically conducted by a manager or committee. Cooper and others’ stage-gate models fall into Van de Van and Poole’s (1995) classification of a life cycle model, which means there is a single unit of analysis (a product or service) and it follows a set of prescribed and linear phases.

To contrast the L’oer Model and Cooper’s (2001) StageGate Model, the L’oer is a meta-level model focused on the interactions of the firm in relation to strategy, innovation, and the reformation of core competencies, whereas the StageGate focuses solely on the innovation process. The implication is that the L’oer is applicable across a wider range of situations (i.e., order and un-order), but is not as prescriptive as the StageGate. The L’oer is also focused on the firm as a whole, whereas the StageGate is bound to the development of a single product or service. The StageGate also does not consider a firm’s development of new competencies, how firm behavior changes in periods of order versus un-order, nor how to manage multiple product iterations or the tension between sustaining and disruptive products. Most importantly, the advantage provided by the L’oer Model is its consideration of people’s frames and mindful deviation (path creation) as the linchpin for change, whereas the StageGate could lead to a firm becoming locked-in to its history (path dependence).

Porter’s five forces model and Cooper’s StageGate model are both valuable in strategic conversations. The L’oer Model, though, provides a new complement in strategic considerations not previously recognized in these two models, particularly how the management of a firm’s
internal dynamics and capabilities are a source of competitive advantage during periods of both order and un-order. Again, the StageGate is a very useful during periods of order and should be considered as a sub-model within the L’oer, but in addressing the question of “what is innovation”, the limitations of the StageGate need be recognized and deference given to the L’oer under such circumstances. And the five forces model complements certain aspects of the L’oer, but its structural approach is bound to ordered states and it limits agency to an industry level, ignoring the power of managers and the everyday entrepreneurs that exist within a firm.

2.4 ROLE OF FRAMES IN THE L’OER MODEL

The proposed L’oer Model creates a clear need to understand the relationship between interpretation and organizing – a relationship which is governed by an individual’s frame. In this section, I review the concept of frames, including how frames are shared. I then propose the concept of innovation frames, which are the way individuals interpret innovation. I further propose that by understanding innovation frames, we can better understand the link between interpretation and organizing and relation between individuals and the firm. I then suggest that innovation frames are a way for actors to explicitly manage the invisible obvious and instigate their own dynamic capabilities, and in turn, the dynamic capabilities of the firm.

2.4.1 Concept of Frames

Collectively, the principles of social practice theory suggests that there is an inseparable and mutually constituting agency between the way people interpret the world and the way they organize and act in and on that world and vice versa. Agency does not run wild though; rather, it is a construct of a person’s experiences and interactions within various sociomaterial entanglements over time. In aggregation these are often referred to as an individual’s frames of reference (Gioia, 1986; Weick, 1979a) – a repertoire of assumptions, expectations, and knowledge that is used as a guide to make sense of and enact meaning on the world. Rooted in
socio-cognitive research (Neisser, 1976), frames are expressed in language, technology, images, actions, and ideas.²⁸

Frames in practice involve a messy bipolarity between abstracted accounts and situated demands (Brown & Duguid, 1991). Individuals evoke different frames depending on the context, and at times frames can incur their own paradoxes and contradictions. Frames often work in silence though, operating in the background unless explicitly addressed or pushed to the forefront of consciousness by contradictions in the environment. Frames are held within the individual but are mediated by the environment as well. Technology mediates cognition and acts as a memory or lens into the world (Hutchins, 1995). Cultural practices and institutional policies also reinforce which frames individuals rely on at different times and in different situations. Complex webs of meaning, frames are flexible in structure but tend to endure once formed.

In summary, frames help guide individuals to make sense of organizational phenomena. They are helpful by reducing uncertainty in changing situations, filling in knowledge gaps, and coordinating action (Gioia, 1986). They can also act as “psychic prisons” when they reinforce outdated assumptions, expectations, and knowledge and inhibit learning (Bolman & Deal, 1991). Further uncovering the dynamics of frames is a central purpose of this dissertation.

### 2.4.2 Shared Frames

Social practice theory and the entanglement view suggest that while members of a firm have individual interpretations, they also share a set of common assumptions, expectations, and knowledge about how to organize and act in different situations. For example, frames shape views on how work should be divided, levels of autonomy, and incentives. Similar education, professional training, and socialization are some of the ways groups of people come to share similar frames, particularly for new members. Group or departmental membership is shown

²⁸ Use of the term “frames” overlaps with a number of others terms that have been used to demonstrate the idea of cognitive structures, including “mental models” (Senge, 1990), “cognitive maps” (Eden, 1992; Reger & Palmer, 1996), “interpretive schemas” (Dougherty, 1992a; Fleck, 1979; Giddens, 1984), “schemas” (Neisser, 1976), “scripts” (Gioia & Poole, 1984), “paradigms” (Burrell & Morgan, 1979; Kuhn, 1996; Morgan, 1980), and “thought worlds” (Dougherty, 1992a).
throughout the literature to have a strong impact on individuals’ frames (e.g., Dougherty, 1992a; Kaplan, 2008b), which emphasizes those individuals who have a close working relation will develop and negotiate shared frames over time. A shared frame can take on different forms, which often revolves around the local dimensions of a group’s work, workers, and workplace.

Firms can also develop shared frames, or what Prahalad & Bettis (1986) term the “dominant logic.” Expressed as a learned problem-solving by the dominant coalition, managers negotiate shared frames on the way they interpret the business and make resource allocation decisions. The dominant logic will keep a firm on track but can also act as a “blinder” to its periphery (Prahalad, 2004). This is particularly true if management becomes too far removed from the daily workings or frontline of the firm. It also occurs because the metrics of a firm are often set by senior technologists (i.e., experts) and it is a matter of changing the metrics in order to change what the technologists see.29 This is not an easy feat given that senior technologists often act as gatekeepers to new inventions and to the metrics that govern a firm.

While the dominant logic is thought to reside in senior management, frames develop through socialization, interaction, and negotiation, suggesting that in large firms there most likely exist more than one frame, if not many. This may lead to incongruence between groups such as the oft talked about battles between R&D and product groups on technology trajectories or between technologists and marketers on product features. For example, Orlikowski & Gash (1994) showed that technologists and users held significantly different assumptions, expectations, and knowledge about a technology, which lead to difficulties and conflict in its development and use and variances in expected outcomes. Even within technology groups, “innovation blindness” can result if two groups do not share the same technology frame (Leonardi, 2011a); technologists often jump to discussing features with the belief that they are addressing a shared problem, but differences in frames imply different interpretations of the problem.

29 This is particularly relevant in the new frontier of experience innovation, where the past decade’s technology metrics are no longer sufficient to define “experience” and consumer capitalism (Martin, 2010; Prahalad, 2004; Prahalad & Ramaswamy, 2003).
2.4.3 Innovation Frames

To the extent that innovation sits at the core of a firm’s activity, innovation is an element of its members’ frames. Thus, I apply the concept of frames to the context of innovation and introduce the term *innovation frames* to identify that subset of firm members’ interpretations used to make sense of innovation. This includes not only a person’s abstractions of innovation but also the particular situational demands of organizing for innovation. Furthermore, innovation frames act as the link between the strategies of the L’oer Model and the organization of the firm’s core competencies.

While there is a plethora of literature on innovation, most studies are not conducted at the level of practice; so, there is little empirical research on people’s interpretation of innovation within a firm. The ones that do predominantly focus on technology development and less on the relation to strategy and organizing (e.g., Dougherty, 1992a, 1992b; Kaplan & Tripsas, 2008; Leonardi, 2011a; Van de Ven, *et al.*, 1999). However, these studies are useful in articulating an initial understanding of individuals and the firm as they relate to innovation frames.

Drawing on studies on frames and technology as examples (e.g., Bijker, Hughes, & Pinch, 1989; Davidson, 2002; Orlikowski & Gash, 1994), interpretations are shaped and constrained by the purpose, power, knowledge, and ecological context of the particular social group. For example, Orlikowski and Gash (1994) show how managers, developers, and users hold different interpretations of technology that shape the development of a new enterprise technology system. They also show that the greatest difference between technology frames exists between developers and users.

Orlikowski and Gash’s organizing conventions fall into a functional grouping of firm members’ interpretations. Conventional labels of R&D, marketing, sales, and manufacturing are only one level of shared frames though. Dougherty (1992a) showed how different departments can also develop their own “world views.” Effective innovation requires a reclustering of these knowledge specialties, where people in multiple departments and senior management can interact openly (Dougherty, 1992b). Instrumental rationalism and structural strategies of
organizing can limit such interactions. Multiple “logics” may exist within a firm, particularly in larger firms that have multiple decentralized business groups. In such cases, the dominant logic may reflect only senior management because they interact as a department and world view unto itself. The incongruence of frames may be visible both across the development cycle, as well as between departments, as they conflict over development decisions or compete for resources from senior management. Understanding the different means by which innovation frames are themed remains an open yet central question to the concern of this dissertation.

At the strategic level, contesting frames is a way to gain influence and challenge existing power structures (Kaplan, 2008b), particularly in un-ordered states. Consistent with research in path creation (Garud & Karnøe, 2001), actors should be able to “mindfully” direct their actions that affect the evolution of both their frames and innovation. While history matters, path dependence is more of an outcome than a deterministic driver (Kaplan & Tripsas, 2008). Making innovation frames more explicit – managing the invisible obvious – is central to governing the strategy and organizing of a firm.

The link between the individual and firm becomes of central concern as the L’oer Model proposes that agency resides within individuals, while it is the actions of the collective that reshape a firm’s competencies. While shared frames are the result of socialization and interaction, the dimensions around which individual and firm-level frames are grounded remains relatively unknown, particularly in relation to innovation frames. Shared structures should exist though, albeit they may be context specific. Given the general similarities in organizing structures across firms such as the matrixed organization though, it would seem plausible that there exists a set of social and material dimensions around which individual interpretations are grounded and shared frames developed.

In summary, the role of innovation frames within the L’oer Model brings up two main concerns: (1) what are the structures and dynamics of individual innovation frames and (2) how are those frames linked to a firm’s competencies? I explore these two concerns in Chapters 3 and 4, and return to a synthesis of the findings in Chapter 5.
CHAPTER 3

INTERPRETATIONS OF INNOVATION

Chapter 3 reviews an empirical study on the nature of innovation frames – firm members’ interpretations of innovation that are based on their encoding of past experiences, current context, and future expectations. The data presented here were part of the larger multimethod study aimed at understanding innovation’s paradox and how meaning and novelty emerge in the early stages of innovation. From day-one of the larger study, I repeatedly observed a great deal of variance in firm members’ descriptions of “innovation” – no two people seemed to use the term in the same way. It also seemed that these descriptions were closely aligned with members’ perceptions of the firm, i.e., Intel – another topic that every person I encountered had an opinion on and as the “new researcher” was constantly being told (although often in private, one-on-one settings) – with similar results. It was also unclear if firm members knew how different each of their interpretations of innovation and Intel actually were. At first, there appeared to be little homogeneity across descriptions.

Thus, it was immediately clear that frames mattered in the context of innovation and organizing, but how and why remained less certain. Beginning with this “hunch” (Miles & Huberman, 1984), I seeded a more rigorous qualitative study aimed at exploring the question: How do people in practice interpret innovation?

I carried out this exploration over the remainder of my immersion with Intel. For twelve months between February 2010 and January 2011, I conducted numerous interviews, collected thousands of archival materials, and participated in and observed the daily activities and routines of the firm. While preliminary insights were developed during that twelve-month period, I spent an additional year post-immersion sorting, organizing, coding, and making sense of the extensive data set. In conclusion, I found that firm members did hold individual innovation frames. These frames were often organized around three framing themes: (1) job function and professional training, (2) position in the hierarchy, and (3) position in the product life cycle (PLC). The functional framing was the most dominant, though, and three predominant firm-level innovation frames also emerged from the data: (1) technologic, (2) economic, and (3) humanistic. Individual
and firm-level innovation frames both revolved around and were linked by nine unique dimensions, i.e., framing structures.

I also made other interesting observations about the framing dynamics – how individual and firm-level frames were constructed and changed over time. An interesting yet unexpected finding was firm members’ use of linguistic binaries (e.g., incremental vs. radical) in describing and situating their role and position in the firm from others. Members used these binaries as tools for both sensemaking and sensegiving. An individual’s innovation frames also appeared necessarily incomplete. Individuals also moved back and forth between facts and assumptions, where facts appeared as commitments that could not be changed, while assumptions were seen as open to questioning and change.

The remainder of this chapter tells this story in more detail with the supporting rigor. Organized as follows, Section 3.1 reviews the specific research methods. Section 3.2 (and subsections) reviews the findings of the research, including the three predominant innovation frames, nine framing structures, and the other framing dynamics. Section 3.3 provides a discussion on the theoretical and practical implications in relation to innovation frames. A more extensive discussion of the findings in relation to dynamic capabilities, innovation’s paradox, and the invisible obvious is reserved for Chapter 5.

3.1 RESEARCH METHODS

Given that firm members’ interpretations of innovation (i.e., innovation frames) are expressed symbolically through language, images, stories, technology, and other ecological affordances, a naturalistic and interpretive mode of inquiry was most appropriate for studying and theorizing about the proposed research questions (Lincoln & Guba, 1985; Miles & Huberman, 1984). Primary data collection occurred over twelve months of field work between January 2010 and February 2011. Data sources consisted of interviews, archival materials, and participant-observations. Table 3.1 summarizes these data sources. Sections 3.1.1 and 3.1.2 review the specific data collection and data analysis procedures, respectively.
In addition to my role as the primary researcher I recruited two researchers from within the firm to serve as knowledgeable, independent reviewers of the data and any interpretations of the data as they (data and interpretations) unfolded. These two persons acted as neither a direct researcher nor informant; rather, what Gioia and Chittipeddi (1991) term a “hold-out” informant, who helped identify informants and analyzed the emergent findings of the primary researcher for accuracy and credibility – agreeing or disagreeing with the researcher to validate findings, as well as suggesting alternative avenues for consideration.

3.1.1 Data Collection

*Interviews*

The primary data analysis was drawn from 56 formal interviews conducted with members of the participating firm. Each interview lasted roughly one hour in length. Informant recruitment was
purposive (Mason, 2002) and directed by knowledgeable insiders, where those persons most experienced in areas of innovation were identified and recruited. To ensure a representative sample of the organization, recruitment spanned the multiple hierarchical layers and also included informants from each of the major business units. Informant job titles were also recorded and organized under three major descriptors: engineer, manager and research scientist. Table 3.2 summarizes informant demographics.

During each interview, I asked the informant to provide a brief description on his or her work background (i.e., skills). Then, I asked an open-ended question about his or her idea of innovation, and would follow-on with additional probing questions in order to gain a deeper understanding of the informant’s concepts, skills, theories and stories related to innovation. I took detailed notes and audio recorded each session. Following each interview, I summarized and transcribed the interview notes and returned my summarized notes to the respective informant who was then asked to ensure the validity and completeness of his or her key points and descriptions.

Table 3.2: Summary of informant demographics (Job Title vs. Position in Hierarchy).

<table>
<thead>
<tr>
<th></th>
<th>General</th>
<th>Mid-Level</th>
<th>Executive</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineer</td>
<td>8</td>
<td>9</td>
<td>4</td>
<td>21</td>
</tr>
<tr>
<td>Manager</td>
<td>5</td>
<td>13</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td>Social Scientist</td>
<td>8</td>
<td>5</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>TOTAL</td>
<td>21</td>
<td>27</td>
<td>8</td>
<td>56</td>
</tr>
</tbody>
</table>

Archival Materials

Over the course of the twelve months, I collected and reviewed hundreds of archival materials, including organizational charts, organizational charters (e.g., company values, history), project & strategy reports, internally published case studies, internal communications (e.g., reorganization announcements, vision & strategy statements), and external communications (e.g., website, company prospectus, press releases). I also collected public documents, including industry reports and news articles. These materials were used to validate and expand the interview data, to
establish the historical context of the research site, to create a timeline of key changes in the firm’s history, and to familiarize myself with the general workings of the firm as a participant-observer.

*Participant-Observations*

As a part of the larger study, I held a formal position within the participating firm as a researcher working within a business group that addressed key strategic initiatives.\(^30\) The position exposed me to a multitude of daily workings and key activities across the firm. In general, this allowed me to participate in new employee orientation and other training programs, to experience first-hand the role of technology in work routines, participate in various processes and routines of the firm (e.g., “badging in”, travel procedures, meeting scheduling), to have a deep exposure to the corporate culture, to observe different work spaces (e.g., cubes, meeting rooms, cafeteria), and to generally experience the daily working routines similar to the informants I was studying. My role also enabled me to observe numerous strategic planning sessions, advanced concept workshops, and to conduct extensive informal interviews (in complement with the formal) with key members from across the firm. Collectively, this source of data provided insights that would not have otherwise been available solely through interviews or archival data. To capture this data, I maintained a reflexive diary on both my observations and experiences. I used this data to guide the interview process by identifying key informants and business groups, to validate and expand findings from the interviews, and to examine anecdotally how frames played out in practice. Time onsite also provided an ongoing opportunity to review and analyze the data with the support of the two hold-out informants.

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\(^{30}\) Over the year-long period, I was tasked with conducting an internal assessment on various firm competencies and to identify best or new practices to address any weaknesses or gaps in such competencies. The activities and findings of this project are not included as a part of this dissertation. While such a role positioned me more as an *actor* than a *participant* (Gioia, *et al.*, 1994), in this dissertation I report primarily on my experiences as a participant. I also recognize that distinguishing between the two is not always practically possible. However, because the methods as presented within this chapter are based primarily on interviews, archival documents, and non-intrusive observations, my impact is considered minimal in the context of the results presented in this chapter.
3.1.2 Data Analysis

Data analyses occurred over a two-year period and fell into five broad and overlapping stages (see Figure 3.1). Stage 1 lasted approximately one year and consisted of the informal analyses conducted while in the field. Stages 2 through 5 collectively occurred across the second of the two-year period and consisted of the formal post-immersion analyses.

![Figure 3.1: Overview of data analysis.](image)

**Stage 1:** The emergent and iterative nature of fieldwork always makes it hard to say where data collection stops and data analysis starts. While in the field, I was constantly trying to make sense of the data as I was exposed to it. My approach during this phase was to begin with the handwritten notes collected during each interview session and use them to guide repeated conversations with the two hold-out informants. As the primary researcher, this enabled me to adjust and (re)direct the data collection process (e.g., interview questions) and gave me an initial understanding and organization of the data. I also used initial archival documents and my participant-observations to contextually situate my initial insights, to familiarize myself with the context and practices I was studying, and to develop a broader historical narrative of the firm.

**Stage 2:** My formal analysis began post-immersion and fell into four stages. In the first stage, I turned to the roughly 700 pages of digitized transcripts and notes from the formal interviews,
which I used to gain a more granular and systematic analysis of the data. Following an inductive, approach, I used NVivo 9.0, a qualitative data analysis software package, to repeatedly review, code, compare, and organize the data until patterns emerged (Gioia, et al., 1994). Requiring roughly four months of iterating between data and higher-level themes, I first developed a set of first-order codes; terms used by the informants (Van Maanen, 1979). These are shown on the far left of Figure 3.2. I then assimilated these codes into summary analytic codes (i.e., labels produced by the researcher but which were still recognizable by the informants). These are shown in the middle column of Figure 3.2. Lastly, I aggregated the analytic codes into second-order themes, which I show on the right side of Figure 3.2. Nine tentative dimensions emerged within the broader construct of what I term framing structures – those dimensions around which individuals make sense of and construct their understandings of innovation, and around which those understandings are shared and collectively constructed with others.

Stage 3: With the nine framing structured identified, I then separated the data by the three framing themes initially identified in the field: functional (i.e., job title and professional training: e.g., manager, engineer, social science researcher), organizational hierarchy (i.e., senior management, mid-level, general), and position across the PLC (i.e., early-stage, late-stage). I again iteratively recoded the transcripts according to the framing structures and looked for similarities and differences across the three framing themes. In doing so, the functional grouping (e.g., job title) was the most salient, which is in line with prior literature (e.g., Orlikowski & Gash, 1994). Within the functional theme, three innovation frames emerged: technologic, economic, and humanistic (see Table 3.3). I also identified noticeable but less salient differences in the other two framing themes, which I describe in Section 3.2.5.

Stage 4: After analyzing the transcripts, I returned to my field notes and the archival documents I had collected. Triangulating my field observations with those identified in the transcripts, I validated the tentative findings and also made a number of anecdotal characterizations of the governing dynamics of innovation frames, e.g., how individuals made sense of innovation for him or herself (sensemaking) and how an individual articulated those perspective to others (sensegiving) in the sharing and co-construction of frames (described in Section 3.2.6).
Figure 3.2: Summary of "framing structures" coding scheme.
Stage 5: Lastly, I reviewed the final set of findings with key informants and the two hold-out informants. This was done to fill in any gaps in the data, to ensure accuracy and completeness of the analysis (validation and triangulation), and to establish practical implications of the theoretical points.

3.2 RESEARCH FINDINGS

Identified across informants’ interpretations of innovation were nine framing structures. Like a picture frame, these pieces hold together and form the picture but also shape how the picture is shared with others. In other terms, framing structures acted to ground individual interpretations (making up the parts within the whole), while simultaneously acting as the common dimensions around which those interpretations were shared and collectively constructed. By grounding, I do not imply an absolute permanence; rather, a temporal and situational stability from the perspective of sensemaking and sensegiving. The following is a description of the nine framing structures:

(i) **Skills** – refer to the individual competencies (e.g., knowledge, skills, and abilities) required for innovation.

(ii) **Material** – refers to the substance or substances (i.e., material) of innovation in its various forms and spaces.

(iii) **Seed** – refers to the origin of an innovation. It is partially defined by whether the origin was internal or external to the organization, and whether the origin is associated with a single individual or a collective.

(iv) **Incentive** – refers to a motivating influence or stimulus that incites action or greater effort. It is most closely associated with a firm’s reward structure. It also incorporates the firm’s values.

(v) **Learning** – refers to the acquisition of new or modification of existing knowledge, behavior, skills, values or procedures.

(vi) **Vision** – refers to an envisioned future state of what an innovation is expected to be or do.
(vii) **Organizational Network** – refers to internal resources and processes of a firm that in collection make up the activities for developing an innovation. It includes both formal and informal tasks.

(viii) **Ecosystem** – refers to a set of organizations that collectively enable the development of an innovation. It is comparable to the concept of the “value chain” (e.g., Porter, 1985).

(ix) **Environment** – refers to the broader systems (e.g., infrastructure, competitors, policies & regulations) that make up the marketplace and the context of use.

Almost all of these framing structures have been discussed in the literature in one way or another, yet they are often studied in isolation from each other – the parts are studied in separation from the whole. For example, vision and incentives are important, yet their impact on skills or learning is not examined, nor the reciprocal and mutually constituting relationships that bind them together. These framing structures can only be fully understood as a whole or “complex” (Kuhn, 1996) or what I refer to as innovation frames.

In comparing the framing structures in relation to functional grouping (e.g., manager), three predominant innovation frames emerged. These existed both at the individual and firm-level, with the firm-level tending toward a predominant innovation frame or “dominant logic” of the firm (Pralahad & Bettis, 1986).

(i) **Technologic** – refers to the functionality, feasibility, and capability of the innovation. It strongly associates innovation as an objective, decontextualized and measurable entity that can be engineered.

(ii) **Economic** – refers to the production efficiency and monetary qualities of innovation. It includes return on investment, cost, resource allocation, and risk.

(iii) **Humanistic** – refers to human values and concerns of innovation. Its scope spans from individual to societal levels.

The technologic frame was the most prevalent within Intel, which was not surprising given their history as a semiconductor engineering and manufacturing company. While not as dominant, the economic frame was also quite apparent. However, the humanistic frame was much less so.
Although, multiple informants noted that the humanistic frame had risen in prominence over the past decade, which also aligned with the general industry trend. Capabilities revolving around “user experience” (UX) appeared to be used with greater frequency and skill in executive decision-making and product development, which can be contrasted with more technical performance or feature-driven development (Martin, 2010; Prahalad & Ramaswamy, 2003).\textsuperscript{31, 32} Figure 3.3 illustrates the three predominant innovation frames and their relative influence within the research site. Within Intel, the technological frame was by far the dominant mode of interpretation.

\textbf{Figure 3.3: Illustration of (a) three predominant innovation frames with overlapping framing structures (decontextualized – any context) and (b) the relative influence of the technological frame in comparison to the economic and humanistic frames contextualized within Intel.}

While the functional grouping was the by far the dominant framing theme, the three firm-level predominant innovation frames did not hold a one-to-one relationship with the innovation frames of the individual. This discrepancy can be explained in that firm-level frames are a representation of shared and collectively negotiated experiences, while individual frames are particular to the

\textsuperscript{31} Currently, Apple, Inc. is the most well known example of a firm that follows a strong UX-oriented strategy.
\textsuperscript{32} For Intel, the rise in the humanistic frame is represented in part by their establishment of the People and Practices Research (PAPR) group (a world renowned social computing research laboratory), the large batch hiring of human factors engineers in the mid-2000s, the 2011 formation of the Interaction & Experience Research (IXR) group (an internal group aimed at promoting and creating UX-driven strategies and products for the firm and its business groups), and an increasing dialogue and language around UX throughout the firm, especially by its senior leaders.
individual's unique composition and integration of experiences. Another explanation is that two other framing themes were identified: (1) organizational hierarchy and (2) position in PLC. Each acted like a new axis around which the framing structures were organized and could account for some of the variance between individual and firm-level frames. Furthermore, individuals may hold multiple frames, which are reciprocally shaped by the social and ecological affordances of the situation, other ongoing commitments, and broader cultural patterns. While some researchers have found differences across frames in relation to functional groupings, others have shown frames or “thought worlds” to revolve around departments (Dougherty, 1992a). The findings herein begin to tease apart these different framing themes and how each can be useful for understanding an individual’s innovation frames and the predominant historically thinking and active inertia of the firm.

Table 3.3 summarizes firm-level interpretations of innovation according to the framing structures and the three predominant frames. By examining across each predominant frame, key differences in how individuals interpret each framing structure can be seen. Further description of each predominant innovation frame is reviewed below. I also review the way innovation frames varied around the other two framing themes: organizational hierarchies and position in the PLC. Lastly, I provide a review of my anecdotes that further describe the dynamics and nature of innovation frames.
Table 3.3: Summary of predominant innovation frames and framing structures within Intel.\textsuperscript{33}

<table>
<thead>
<tr>
<th></th>
<th>TECHNOLOGIC</th>
<th>ECONOMIC</th>
<th>HUMANISTIC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Skills</strong></td>
<td>Engineering, physical sciences</td>
<td>Management, finance</td>
<td>Social sciences, ethnography, human factors engineering</td>
</tr>
<tr>
<td><strong>Material</strong></td>
<td>Decontextualized technology artifact defined by a set of features and functionality; Primary focus is on hardware (i.e., CPU)</td>
<td>Decontextualized technology artifact defined by its current cost, level of risk, and market opportunity</td>
<td>Contextualized technology artifact defined by the affordance and meaning of those people using the material</td>
</tr>
<tr>
<td><strong>Seed</strong></td>
<td>Individual inventor who is internal to the firm</td>
<td>External opportunities to gain in market share or internal opportunities for cost reduction and efficiency improvements</td>
<td>Research that identifies user needs, which can be found internally or externally to the firm, but which consists primarily of individual inventor's first-hand, anecdotal experiences</td>
</tr>
<tr>
<td><strong>Incentive</strong></td>
<td>Patents; Publicity &amp; recognition; Status (i.e., promotion up the technical tenure track); Member of two-in-a-box leadership</td>
<td>Status (i.e., promotion up the management tenure track); Broader responsibility (e.g., increased number of employees, increased budget, head of newer initiatives); Member of two-in-a-box leadership</td>
<td>Status (i.e., promotion up the technical or management tenure track); Recognition for researcher and insights into consumers</td>
</tr>
<tr>
<td><strong>Learning</strong></td>
<td>Internal focus around technical problem solving</td>
<td>Internal focus on process improvement (e.g., Copy Exact!, retrospectives); External focus on market analysis</td>
<td>External focus on gaining knowledge on UX and influencing factors</td>
</tr>
<tr>
<td><strong>Vision</strong></td>
<td>Technology invention that is adopted into the marketplace; Continuation of Moore’s Law</td>
<td>A new high margin business or a significant increase in market share; Continuation of Moore’s Law</td>
<td>Overall improvement in the quality of life across the world – education, health, and other social benefits</td>
</tr>
<tr>
<td><strong>Organizational Network</strong></td>
<td>Technology development processes (i.e., concept, planning, development, manufacturing)</td>
<td>Risk management (i.e., PLC, TRP, Tick-Tock) and business development.</td>
<td>Idea socialization; Role of social networks; Gatekeepers; Internal competition</td>
</tr>
<tr>
<td><strong>Ecosystem</strong></td>
<td>Technology solutions created by the value chain</td>
<td>Firms in the value chain</td>
<td>Role of societal values and ethics in selection and behavior of value chain partners</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td>Technology infrastructure; Competing technologies; Technology cycles and impacts</td>
<td>Competition; Defined and emerging markets; Government policies, regulations, and tax systems</td>
<td>Socioeconomic, cultural, and political systems; Context of use</td>
</tr>
</tbody>
</table>

\textsuperscript{33} The terms presented in Table 3.3 are defined in the Glossary of Terms or are discussed in the following sections.
3.2.1 Technologic Frame of Innovation

Intel’s technologic frame focuses on improvements in the features and functions of computer processing technology. Given Intel’s long history and image as a semiconductor engineering and manufacturing firm, it is not surprising that the technologic frame was the most salient and dominant of the three frames. Most of Intel’s language and knowledge are associated with technology design and manufacturing, which is expected given that Intel considers the engineer to be its cardinal employee. The majority of its founders also held PhD’s in engineering. Furthermore, as the primary instigator of Moore’s Law, Intel both drives and follows notions of technology determinism.

Materially, Intel’s technologic frame pushes to the forefront a decontextualized view of a technology artifact that is defined by its features and functionality. Such an interpretation is quite visible in the form of Intel’s core product, the microprocessor or central processing unit (CPU). Also developing other aspects of computing hardware, Intel is most often described, both internally and externally, as an “ingredients” supplier, where Intel provides many of the individual components that go into making up a PC, server, or other element of the computing device, particularly as it relates to the processor.

Skills in this frame are most often associated with engineering and the physical sciences. Skills were also often associated with education level (e.g., bachelors degree, PhD). Educational distinction played a boundary role between Intel Labs (advanced research & development) and the exploration groups embedded within the product groups. Intel Labs housed a large number of PhD’s, while the product development groups had markedly less. As one individual noted, he classified himself as an “entrepreneur” within different product development groups, often working on his own or in a very small skunkworks teams. However, he did not have a PhD and felt that his interactions with members from Intel Labs were immediately constrained because of his title (or lack thereof). This also plays heavily into interpreted seeds of innovation.
The predominant technologic-oriented seed of innovation is from the individual inventor within the firm and most commonly, a senior engineer.\textsuperscript{34} Strongly associated with the incentives, these inventors rise to become Intel’s senior engineering fellows, the highest rank along the technical promotion track.\textsuperscript{35} As one senior fellow mentioned, his promotions paralleled each of his inventions. The invention-orientation and individual focus is also visible in Intel’s strong valuation of patents, which is visible in the firm’s extensive patent portfolio, high profile litigation and enforcement of those patents, and the licensing of patents. For individuals, patents are incentivized both in financial rewards and public recognition – the latter of which is a metric for promotion, particularly for higher ranking positions that require both internal and external recognition from peers as an expert in the field. Intel’s emphasis on the individual inventor is also visible in the firm’s external-facing marketing campaigns such as “Intel Rock Stars.” These satirical commercials pose an Intel senior fellow as a rock star, surrounded by other Intel employees gawking in admiration, and the catch line, “Our rock stars are not like your rock stars.” A slick public relations campaign, the promotion is displayed throughout internally, including on Circuit (Intel’s intranet news communications platform) and posters on the many hallways, cubbies, and by elevators. This is an internal push as much as an external campaign.

Intel also promotes the “two-in-a-box” leadership method. This means each major business group is run by a senior engineer and a senior manager. Together, the two oversee the development of new technologies. Because the culture of the company was founded on applied research engineers, there is strong practice to default to the engineering side of the two-in-a-box whenever there is a split decision. For those technologic interpreters of innovation, gaining such a position is seen as a significant incentive.

Furthering this internal focus on technology-driven invention, learning within the technologic frame at Intel consists of technical problem solving – a problem solving that revolves around a vision of technology invention. Even more so, the grandest achievement that is envisioned by

\textsuperscript{34} Invention, in this case, should be distinguished from innovation. Invention refers to the initial idea and creation of a technology, while innovation includes invention as well as commercialization. Not all inventions are commercialized.

\textsuperscript{35} A senior engineering fellow is equivalent to a vice president and is the highest rank within the technical promotion track.
any Intel engineer is to invent the next great technology that reinvents Intel. Captured in any conversation with one of many long-tenured Intel employees, Intel’s storied transition from memory to microprocessors in the mid-1980s (e.g., Burgelman, 2002) has spurred dreams of repeating a similar feat – something that not all agree is even possible.

Intel’s organizational network follows a staged life cycle of technology development that follows five major stages: exploration, planning, development, manufacturing, and refresh. Each stage address a level of technical readiness related to the technical feasibility of a new idea. The title of each stage stresses the primary task within. For example, exploration focuses on conducting research and developing concepts, while manufacturing refers to the physical production of the concepts. Intel hosts multiple business units, each with its own product lines and respective organizational networks nested within. The multiple product lines within a business unit are often aggregated into a platform – ‘a set of interdependent ingredients associated with a unique processor, chipset, or processor chipset combination, all qualified to launch at the same time’ (Galluzzo & Bolton, 2011, p. 68). The ingredients within the platform include components that may or may not be manufactured by Intel but which are required for launch.

One of the key elements behind Intel’s organizational networks is timing, i.e., Moore’s Law. This long-time driver of Intel’s predictable and repeatable production of microprocessor innovation is considered both a deterministic driver and self-fulfilling prophecy. The majority of Intel’s organizational networks run in relative synchronicity to Moore’s Law with the primary shared reference being the launch date.

Intel, and the computing industry, has long interpreted the ecosystem as a “technology stack” – each layer refers to a component in the computing device, which is then stacked together to create a consumable technology solution (see Figure 3.4). Intel has primarily positioned itself as a “horizontal” (i.e., hardware) firm in the stack, which it then delivers across multiple technology solutions. In comparison, Apple is a vertically integrated company, where its strategy is to

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36 Moore’s Law is not only a model of technology, but of economic development, and thus, of equal importance to the economic frame, but due to its strong notion of technology, its first association is with the technologic frame.
deliver all the components in a stack but in doing so it trades off the ability to deliver the same components across multiple solutions. Each must be developed independently. The competitive value of each strategy varies depending on the ecosystem power structure and the environmental drivers. With “Wintel” (a portmanteau of Microsoft’s Windows and Intel), the compatible integration between Intel’s x86 architecture and Microsoft’s Windows operating system in the personal computer (PC) market created a strong barrier to entry against competing firms.

Because firms often focus mainly on the requirements of their direct and existing customers (Christensen & Bower, 1996), Intel has tended to focus on meeting the needs of those firms whose job it is to integrate the many layers of the stack into a consumer ready solution, i.e., the original equipment manufacturers (OEMs). This has lent Intel the ability to hyper-focus its technologic resources on innovating within their respective horizontal (versus being a more vertically integrated firm).

![Technology Stack for a PC](image)

**Figure 3.4: Technology Stack for a PC.**

In relation to the environment, Intel’s technologic frame grew out of its focus on individual users in the enterprise market. More recently, the emphasis has shifted to the general consumer, but still primarily revolves around the individual. Products were also assumed to have a deterministic
influence on people’s work and life, and the underlying driving assumption behind technology development at Intel has been that the users can improve productivity through increases in performance and expansion in functionality. The environment also includes all of the existing technology infrastructures, competing technologies, and technology development cycles that shape the broader context of technology use.

### 3.2.2 Economic Frame of Innovation

The economic frame is a resource-based interpretation of innovation, which is rooted in assumptions of finance, operations, and business planning. Described in terms of cost, efficiency, return on investment (ROI), and resource allocation, the main assumptions underlying the economic frame are efficiency, control and predictability. Tensions within the frame arise as a result of resource scarcity and attention is given to the production of goods and services, where resources are allocated in order to minimize a cost-benefit ratio. The economic frame, while not as prolific as the technologic frame, is tightly intertwined with Intel’s core culture. For example, Moore’s Law, while often portrayed as a technology model, is a business model that balances technology gains against production costs. Also historical competition (fostered by Andy Grove since Intel did not have external competition early the PC era) pits one group against another. Skills under this frame are often interpreted as being those of the manager.

*Materially,* an innovation perceived through the economic frame is interpreted and described as an objectified technology artifact that is defined by its financial feasibility and associated risk. The materiality of an innovation within Intel’s economic frame evolves as it progresses down a path of risk reduction. This path closely aligns with the pathways created at the level of the organizational network. Using an instantiation of Cooper’s (1975, 1990) StageGate Model, Intel developed its own PLC model. Figure 3.5 is an illustration of Intel’s PLC. Its funnel-like shape represents the intent of the risk reduction that occurs across a product’s development life cycle.

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37 For an extensive review on the history and structure of Intel’s PLC, see Galluzzo & Bolton (2011).
For the individual enacting an economic frame, the seed of innovation is viewed in terms of strategies for gaining market share or increasing margins through reducing cost or time-to-production within the PLC. Intel’s general management has long measured the firm and the status of business groups according to market share. For example, in the mid-2000s, Intel lost significant market share to one of its competitors in the PC market, and as a result, the firm undertook a corporate-wide cost reduction audit and refocused its resources on the core microprocessor business (much to the detriment of its periphery businesses). Opportunities are also measured by the size of market opportunities and the margin level. For example, across numerous strategic planning sessions members were explicitly observed stating margins below a certain level would simply not constitute an acceptable opportunity. There was also the running joke that a $100 million market was too small. Too small?!

The central incentives under this frame include a rise in title, expansion in responsibility (both in headcount and budget), and status of the program (i.e., managing CPU development vs. the chipset holds greater status – decision making power). Incentives under the economic frame are heavily influenced by Intel’s data-driven, results-oriented corporate values and culture. Similar

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38 Intel impresses six values on its employees: customer orientation, discipline, quality, risk taking, great place to work, and results orientation (http://www.intel.com/lifeatintel/values/).
to technologic interpretations of incentives, the economic frame again focuses primarily on the individual inventor or manager. In contrast to the technologic frame though, the economic frame is just as much about risk reduction as it about opportunity creation. The consequences for not achieving results are much more catastrophic for a career, particularly at higher levels of the firm. Thus, there is a strong incentive to only do what can be clearly measured and to create predictable innovative ventures. Much of this may also be related to the heavy capital investment required in the development of a “fab” (a semiconductor fabrication plant).

The vision of most Intel general managers aligns with the noted incentives of the economic frame, which is to enter into a new high margin business or to increase market share within an existing market. At the same time, there is an avoidance of riskier market opportunities because of the potential ramifications of failing, as well as the fact that many of Intel’s competencies do not enable exploration into highly ambiguous and emerging opportunities. For example, in speaking with a manager within Intel Labs (advanced research & development division), he could not dedicate resources to tasks that were not clearly defined. Thus, many firm members stated that this left Intel often reacting (violently) to market changes versus identifying those opportunities first-hand. Many of Intel’s managers also either avoided or did not see more radical forms of innovation because of the way the economic frame shaped risks. A number of informants even went as far to say that “disruptive innovation” was beyond the capability of most Intel groups because of these interpretations. If an innovation opportunity could not be measured in economic terms a priori, then it is not attempted. Such logic goes against the very nature of a disruptive innovation (Christensen, 1997). Managers also often focused on shorter-term wins because they carried less risk and were more predictable. Historically, many of Intel’s moves into new markets were done via acquisitions. This was particularly true during the “Barrett” era (Intel CEO, 1998 – 2005) when Intel was looking to diversify beyond the PC market (Burgelman, 2002).

Learning within the economic frame takes the form of retrospectives on management and other process improvements. Within Intel’s fabs and the Technology & Manufacturing Group (TMG),

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39 Intel still owns most of its own fabs. In breaking down the technology stack between chip development and chip manufacturing, some firms are “fabless” and only do chip design and development. AMD is an example.
learning has long played a central role in creating silicon manufacturing and engineering as one of Intel’s core competencies. These best in class competencies revolve around quality, another one of Intel’s six corporate values. These practices include extensive process learning and revolve around a deep tribal-like knowledge within the group. In part, this is a result of Intel’s recognition and investment in its people. For example, whenever a particular product line is discontinued, instead of laying off employees as many companies are known to do, Intel reorganizes them and in turn retains the knowledge and learning that spans decades. Intel has one of the highest retention rates in the industry because of this investment in people.

Another classic and often referenced learning technique employed by TMG is the “Copy Exact!” method – matching the manufacturing site to the development site. Matching occurs at all levels of physical inputs and outputs using cross-site audits, process control systems, and joint teams. In other terms, from equipment configurations and chemical purities to the paint used on the walls, each new fab is an exact copy of all the best manufacturing knowledge and practices learned from its predecessor fab. While this may appear to be technologically driven (and the methods for improvement are), this is an economic philosophy as it enables one of Intel’s biggest competitive advantages in the market, a best in class semiconductor manufacturing competency and Intel’s industry trademark for quality, reliability, and high volume. For example, walk into any Best Buy and ask an associate the difference between an Intel process and the competition. The answer is typically, “Intel is of much better quality and reliability. With the other guys you don’t know what you’re getting. It’s a crap shoot.”

Learning practices are also used in the product development groups. For example, since 1999 Intel has been using Norman Kerth’s “retrospectives” to identify root problems and lessons learned, empower the product development teams, develop action plans, and create early applications of learnings (Kerth, 2001). Started in 2007, the program had over 150 members and had trained 25 facilitators. In 2011, the program was graduated to the Corporate Quality Network, where the capabilities will be expended to help cover many of Intel’s 82,500 employees.

40 For an extensive overview on Copy Exact!, see http://www.intel.com/design/quality/mq_ce.htm.
The organizational network is probably the most explicit and heavily emphasized within the economic frame. While each business unit acts in relative independence, each follows some semblance of the PLC to organize their internal production network and to coordinate with external suppliers and customers. As Intel’s business model has become more vertically integrated, the integration of technology components into a holistic solution has pushed Intel to create a Platform Life Cycle model as well, which is a more complicated and complex version of the PLC. It is also in the division between business groups that the “valley of death” – the transition of ideas from one group to another – is most prominent. This is particularly true between Intel Labs (Intel’s advanced research and development group) and the product groups. To address the issue of technology readiness and associated risk level, Intel developed a “technology readiness process” (TRP) to support the transition of new technologies between the more uncertain exploration stage with the later planning processes.

The ecosystem viewed through the economic frame is most publicly visible in the “Wintel” relationship between Microsoft and Intel. Again, viewing the “stack” from the economic frame consists of the supply chain and partners that enable the innovation’s path to market. The notion of risk reduction and efficiency is also seen in the path to market, where Intel sells primarily to the larger original equipment manufacturers (OEMs; e.g., Dell). Volume and standardization are central dimensions that enabled the Wintel relationship and subsequent success for both companies. The OEMs then sell direct (e.g., Dell) or through retailers (e.g., Best Buy). Determining influence across the ecosystem from an economic standpoint is often defined in terms of what percentage of the sale to the end user does each “link” (i.e., firm) obtain and at what margin. Historically, shifts in Intel’s value chain networks have been relatively stable, but in recent times those chains have become more unstable (e.g., exit of IBM as PC OEM), as well as points for shifting influence (e.g., Apple’s success following a vertical integration strategy). In summary, interpretations of the ecosystems consist of understanding the power structures and dynamics within and between value chains (e.g., suppliers, OEMs, application developers, distributors, consumers).
The environment under the economic frame consists of the various competitors, partners (e.g., research institutions, suppliers, OEMs, retailers), and existing and emerging markets. There is also a strong focus on government policies, standards, and regulations – those elements at the ecosystem level that might act as barriers against the entry of new competition. The national and international tax system is also a major factor and consideration. Intel’s significant investment in standards bodies, tax lobbying, and other regulations are illustration of this aspect of the economic frame. And most significantly, interpretations of the environment include the markets and consumer traits that may influence markets. Such examinations of the environment often consist of financial reports or high-level demographic and market trends reports.

3.2.3 Humanistic Frame of Innovation

The humanistic frame revolves around understanding human values and concerns. At Intel, the language of such most often revolves around the terms of “usage” and “UX.” Historically, this frame and underlying knowledge has been relegated to the social scientists (e.g., ethnographers), human factors engineers, and others researchers who are organized primarily around earlier stage tasks within the product development life cycle. Intel emphasizes the frame primarily on understanding how computing devices are used by end users, both in the enterprise and in the general consumer goods space. The frame is the strongest in addressing the environment; although, historically, Intel’s has long assumed performance as the predominant user need and market driver.

The skills often associated with a humanistic frame are those of Intel’s social scientists, ethnographers, and human factors engineers. These resources are positioned primarily at either end of the PLC. Specifically, ethnographers and social scientists are staged in the exploration stage, where they are tasked with identifying new user needs and defining experiences. Human factors engineers tend to be on the tail end, where they conduct usability and validation tests.

41 At the time of data collection in 2010, Intel was transforming its capabilities in UX with actions such as the creation of a formal Intel Labs group Interactions and Experience Research Lab (IXR), a shifting language by senior executives around UX, and product examples such as WiDi.
The humanistic vision for Intel focuses primarily on the external environment – the socioeconomic, cultural, and political structures and dynamics that make up the context of activity, or what a technology affords a user. Broadly, Intel’s advertising campaigns focus heavily on how the firm is innovating in ways that change the world. While the underlying driver of this change is from an assumption of technological determinism, nonetheless, Intel’s humanistic interpretation of the vision for its innovations is to improve the quality of life across the world – education, health, and other social benefits – through advancing computer technologies. More recently, Intel has begun to invest in delivering improved user experiences as part of their strategy in seeding new technologies.

The humanistic seed of innovation is interpreted as originating both internally and externally. Internal seeds are most often associated with Intel’s predominant theme of the individual inventors. Many of the principle engineers and senior fellows discussed how the seed of their ideas originated with personal experiences, and less on formal research and data. For example, one of the inventors of the USB said that he thought of the idea of universal serial bus (USB) as a means for transferring information. He found the task difficult and thought that it must be even harder for the average person (given his relative level of technical expertise). At the time of data collection in 2010, Intel was in the process of develop its UX capabilities, which it part it achieved with the establishment of the Interactions and Experience Research Lab (IXR) with Intel Labs. Senior executives also began to emphasis UX-focused features in product launches and in internal strategy communications. Other groups such as the Digital Health Group (DHeG) were founded on ethnographic research and continued to use practice such as empathetic design with engineers as ways to understand the human concerns and values associated with new products.

Externally seeded, innovation opportunities are interpreted as resulting from extensive social science research studies. Intel is the largest employer of ethnographic researchers in the industry. It has also long invested in social science research groups aimed at identifying emerging market opportunities (e.g., PAPR, IXR). External research seeds are also used such as private research firms (e.g., Applied Minds), academic university researchers, and other larger market and consumer trend firms (e.g., Gartner, Forester Research). The framing structure of learning
revolved around similar activities – understanding human experience and the study of technology
devices in the context of use. This lent mainly to an external focus of learning as a search for
new knowledge and analyses of the environment and the “end user”.

Historically, Intel has provided limited incentive for the humanistic frame. This imbalance is
illustrated in the three circle diagram of Figure 3.3b, where the circle representing the humanistic
frame is much smaller in proportion to the technologic and economic. This may be due in part to
the relative stability and predictability of Moore’s Law and its influence on markets, and the
firm’s resulting emphasis on technology-push versus market-pull model of operations. The
humanistic frame was not valued nearly at the same level as the technologic or economic and in
turn, was not provided the same level of investment and incentives.

Over the past decade, the shift in the technology market from an enterprise- to consumer-focus
has pushed Intel to rethink the role of the humanistic frame, and as a result, the firm has
increased its incentive and prioritization of the humanistic frame. Many of these changes were
observed during the period of this study as Intel reacted to significant consumer-focused events
in the market, such as Apple’s launch of new versions of the iPhone and the initial launch of the
iPad. The relative influence of the humanistic frame still remained well below that of the
technologic. This is particularly visible in how engineers vs. non-engineers are treated within the
firm. Non-engineers (e.g., social science researchers) are also often viewed as second class
citizens in comparison to the engineer. For example, in an advanced concept workshop that was
addressing issues of a consumer’s “ease of use” with a new concept, a social science researcher
made the statement that she was “not an engineer.” In response, an engineer (by job title) turned
to her and said, “Then why are you here?”

The organizational network viewed through the humanistic frame highlights the political and
social discourse involved in the development of an innovation. The structures of such discourse
are linked in part to both formal and informal organizational forms of the PLC. Informally, the
humanistic frame is at work across the entire organizational network in the form of social
networks, political dynamics, and internal competition, particularly as it relates to the
“gatekeepers” of product development – those senior engineering fellows and executives who are
guardian to product portfolios and whose support legitimizes new inventions both in reputation
and in financial resources. Gatekeepers exist across the PLC and are positioned in many formal processes, but acting on the gatekeepers is much more informal. For example, transitioning a concept from an early stage exploration to strategic planning often requires individual champions to socialize his or her ideas with the key gatekeepers prior to any formal decision events. At Intel, this is most often done by having 1:1 meetings with a key stakeholder prior to setting up any formal meeting in which a decision on the topic will be made, or by meeting with those persons who can exert a strong influence on the gatekeeper or decision maker. Intel promotes a strong culture for “constructive confrontation” to ensure any and all ideas are thoroughly understood and reviewed – the result is that any new idea, particularly if it is to be added to a product roadmap, undergoes significant vetting. Without prior buy-in, an idea often has little chance of passing these formal reviews.

Intel has a culture of internal competition, particularly between business units. The organizational form is mostly decentralized, with each business unit acting independently and as its own profit & loss responsibilities (P&L) but cash flow and the annual investment cycle are managed at the corporate level. This leaves the business units competing with one another for resources on an annual basis. Figure 3.6 shows the annual planning process each P&L center and their comprised business groups go through. The process is just as much about the competition between P&L’s as it is about competing against external competitors. For example, competition even exists within P&L’s – A financial analyst, who supported multiple product line teams within a P&L, came into a working meeting with a team who was developing its Q3 product line business plan (PLBP). Upon entry, she mentioned that she had just come from another team’s PLBP development session, and in immediate response, the executive leading the meeting jokingly remarked, “what is their [competing product line team] plan?” While laughter ensued and the question rhetorical, the executive’s comment illustrates the competition culture that existed even within P&L’s, and more importantly, highlights the ongoing enactment of the

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42 Intel’s Technology Strategic Long Range Planning (TSLRP) is an example of where the gatekeeper plays a significant role. As part of the program, new initiatives from any employee are allowed to be submitted, reviewed, and if appropriate, funded for further development. The process allows new ideas to “bubble up” from within the firm. However, the TSLRP and review processes are managed and overseen by a council of Intel senior fellows. These fellows are gatekeepers because they have the power to approve or reject any new idea. The same is true for Intel’s TRP that is positioned between exploration and planning stages of the PLC.

43 Intel’s only centralized functions is information technology (IT). While Intel does hold separate marketing, finance and venture capital groups, those functions are still found within each business unit.
humanistic frame (e.g., political and competitive climate) that underlies the political and competitive dynamics that govern the activities for developing an innovation. Behind its association with understanding the ecosystem, Intel’s humanistic frame may be most apparent in the social and political context that connects the activities and flow across the PLC.

**Figure 3.6: Overview of Intel’s annual planning cycle.**

Humanistic interpretations of the ecosystem are similar to those of the organizational network but focused on Intel’s relationship to its external partners (i.e., other layers in the stack). In specific, it consists of understanding the influence of societal values and ethics on the practices of value chain partners and influences within and between chains. For example, Intel has a code of conduct that outlines its position on key ethical and legal business, environment, human rights, and labor practices that apply worldwide and include specific statements on issues of child and forced labor, workplace safety and environmental quality, and diversity and non-discrimination.\(^4\) Intel’s statements are meant to influence the behavior of its suppliers and undoubtedly influence Intel’s selection of partners.

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3.2.4 Comparing the Predominant Innovation Frames

The most interesting findings emerged when comparing differences across the three predominant innovation frames. For example, scholars have long recognized the importance of creating and aligning a vision. In comparing interpretations of vision, there appears to be collective agreement that this is a goal-oriented activity (e.g., invent a new technology). However, the underlying activity and goal differ significantly across the three frames (see Table 3.4). This does not immediately imply that these are in conflict; rather, they are simply different interpretations of what could be the same outcome. These differences held true across most of the framing structures (see Table 3.3 for further comparisons).

Table 3.4: Comparison of vision across the three predominant innovation frames.

<table>
<thead>
<tr>
<th></th>
<th>TECHNOLOGIC</th>
<th>ECONOMIC</th>
<th>HUMANISTIC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vision</strong></td>
<td>Technology invention</td>
<td>New high margin business or an increase in market share; Continuation of Moore’s Law</td>
<td>Overall improvement in the quality of life across the world – education, health, and other social benefits</td>
</tr>
</tbody>
</table>

3.2.5 Innovation Frames According to Organizational Hierarchy and Position within the PLC

The predominant innovation frames were identified primarily through the functional groupings. However, these groupings did not always consistently align with these groupings (i.e., job title). Two other framing themes were identified: organizational hierarchy and position within the PLC. In relation to organizational hierarchy, differences were seen between executives (e.g., vice presidents, senior fellows), mid-level (e.g., general managers, principle engineers), and other more general employees (e.g., project-level managers and engineers) of the hierarchy. Executives often interpreted organizational activities at the business group or firm level. Mid-level employees interpreted things at the program level. And general level employees often interpreted activities around their local projects.

Position within the PLC (e.g., concept, planning, development, and manufacturing) appeared to impact an individuals’ interpretation of time. Those in the earlier stages often held a long-term
time horizon. They also describe their position within the PLC as having more “slack” or flex
time along the critical development path. On the other hand, individuals in later stages such as
manufacturing held a short-term time horizon. There were also numerous references to increased
time pressures and a “no timeout” mentality and production environment. These latter two issues
appeared largely in part to Intel’s development cadence associated with Moore’s Law. Intel
placed a high emphasis on meeting launch dates, and planning for each new cycle of technology
development was done years in advance. Thus, a subsequent cycle would start just soon as (or
even prior to) the last one finished. In short, time mattered in people’s interpretation of
innovation. The specific impacts of time are explored in Chapter 4 and discussed at length in
Chapter 5.

3.2.6 Anecdotes on the Dynamics and Nature of Innovation Frames

While some studies take either a firm- or individual-level of analysis, or they follow specific
projects, the breadth of interviews from across the levels and many business groups, coupled
with my experience as a participant-observer, allowed me to gain unique insight into some of the
dynamics and nature of innovation frames. From these anecdotal accounts, three main insights
emerged: (1) binaries and the language of innovation, (2) the (in)completeness of frames, and (3)
the temporal nature of frames.

Binaries and the Language of Innovation

In reviewing how informants both made sense of and articulated that sensemaking (i.e.,
sensegiving), I recognized a strong use of linguistic binaries. In returning to the interview data, I
identified over 30 different binary terms (see Table 3.5).

Intel’s senior management had developed some of these terms over time to differentiate
boundaries in different strategic initiatives (Burgelman, 2002). For example, in the late 1990s,
Intel created the terms “blue” and “green” to help differentiate between its core and periphery
businesses. Blue represented the existing core business, while green the “green field” initiatives,
exploration, and disruptive or un-ordered innovations. In other instances, firm members adopted
terms from well-known academic theorists such as Christensen’s (1997) sustaining vs. disruptive innovation. The terms were used throughout both the interviews and daily activities of the firm. Even when individuals would explicitly state that innovation occurred on a continuum, he or she would still use various binaries to make sense of and describe the varying activities of the firm.

Table 3.5: Summary of linguistic binaries used in sensemaking and sensegiving of innovation.

<table>
<thead>
<tr>
<th>Incremental vs. Radical</th>
<th>Component vs. Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evolutionary vs. Revolutionary</td>
<td>Idea vs. Implementation</td>
</tr>
<tr>
<td>Sustaining vs. Disruptive</td>
<td>Tick vs. Tock</td>
</tr>
<tr>
<td>Core vs. Peripheral</td>
<td>Strategic vs. Tactical</td>
</tr>
<tr>
<td>Blue vs. Green</td>
<td>Formal vs. Informal</td>
</tr>
<tr>
<td>Hands on vs. Hands off</td>
<td>Innovative People vs. Non-Innovative People</td>
</tr>
<tr>
<td>Ingredients vs. Platform</td>
<td>Individual v. Collective</td>
</tr>
<tr>
<td>Inside the Box vs. Outside the Box</td>
<td>Hardware vs. Software</td>
</tr>
<tr>
<td>Invention vs. Innovation</td>
<td>On Roadmap vs. Off Roadmap</td>
</tr>
<tr>
<td>Research vs. Development</td>
<td>Product vs. Process</td>
</tr>
<tr>
<td>Research vs. Execution</td>
<td>Reactive vs. Proactive</td>
</tr>
<tr>
<td>Creativity vs. Innovation</td>
<td>Linear vs. Emergent</td>
</tr>
<tr>
<td>Top-down vs. Bottom-up</td>
<td>Social Science vs. Engineering Science</td>
</tr>
<tr>
<td>Truth Seeking vs. Success Seeking</td>
<td>Development vs. Manufacturing</td>
</tr>
</tbody>
</table>

One last point on binaries is that there existed no Cartesian axis – no absolute point around which each individual could equally or objectively compare and contrast his or her position to others or to the firm. Instead, individuals used multiple binaries to help situate him or herself in relation to others. In conversation with others, conventions or agreements would be created around which action was then coordinated or explained. This orienting often occurred around the particular framing structures, acting both as tools for sensemaking and sensegiving, and appeared to be a central means for co-constructing and sharing frames, establishing commitments, coordinating action, and initiating and sustaining inertia.
Necessarily Incompleteness of Frames

During my interviews and observations, I quickly recognized that each firm member held a different depth and breadth of knowledge about innovation and about the firm, not simply different interpretations. After coding for the identified framing structures and predominant innovation frames, I reexamined individual informant’s responses from the interviews to assess these variances in the depth and breadth of frames. While a more complete assessment may be necessary to gain strict percentiles, anecdotally it was evident that no single individual held a complete innovation frame – members held only partial frames and had varying degrees of depth and breadth within each framing structure.

An interesting contrast appeared when examining the (in)completeness of frames between individuals. During observation of strategic planning sessions, individuals often posed their statements as facts, not assumptions (or opinion). A “fact” would become more or less a fact when others agreed or disagreed with the statements.45 However, to some outsiders the “facts” appeared more like firm-level conventions and were used to guide individual action toward a sustained path for the firm. For example, strategic planners would often reference profit margins as a conventional benchmark for determining whether a new product should be implemented or to measure the success of past products. However, the actual level of the profit margin was always used as a “fact” – “we cannot make a product below X% profit margin.” Similarly, market size was another deterministic factor – “A 100 million dollar market is too small for Intel.”

Interestingly, it appeared difficult to challenge or disruptive these “facts” despite there often being no clear answer or truth to the fact. Some facts often seemed as if they were immovable and were often treated or described as such. For example, there was a constant discussion within the firm about whether Intel should own its fabs or follow the trend toward being a fabless chipmaker. In the early 1990s, T.J. Rodgers, head of Cypress Semiconductor, said "Real men have fabs," and this phrase was taken up by others, including Motorola, Advanced Micro

45 The mechanics behind the acceptance or rejection of facts is beyond the scope of this dissertation.
Devices and Intel. The discussion continues to persist into today and to a degree has polarized many within the firm, with no definitive answer yet to emerge, if such is even possible.

*Temporality of Frames*

Drawing from informants’ stories about innovation, reviewed archival materials, and participant-observations, it was clear that individual innovation frames and the predominant innovation frames of the firm were changing over time. Table 3.6 summarizes some of the identified changes.
Table 3.6: Changes that have occurred within and between Intel’s predominant innovation frames.

<table>
<thead>
<tr>
<th>TECHNOLOGIC</th>
<th>ECONOMIC</th>
<th>HUMANISTIC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Skills</strong></td>
<td>Shift in abilities as a specialist to a generalist (e.g., systems thinker)</td>
<td>Increasing awareness and priority for social science researchers, interaction designers, human factors engineers</td>
</tr>
<tr>
<td>Increasing headcount and prioritization of software engineering</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Material</strong></td>
<td>Diversification of hardware ingredients both across the horizontal and up the vertical</td>
<td>Expanding contexts of use from enterprise to consumer market segments</td>
</tr>
<tr>
<td>Increasing prioritization of software as a core component of technology solution</td>
<td>Increasing complexity as product segments diversify and product solutions become more integrated</td>
<td>Shifting user priorities from performance-driven to power management, security, connectivity, and others</td>
</tr>
<tr>
<td>Increasing complexity in silicon manufacturing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New materials being used (e.g., introduction of the copper gate)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Seed</strong></td>
<td>Creation of new revenue streams outside of core business</td>
<td>Seed identification shifting from anecdotal experiences to formalized social science research methods and more rigorous analysis of user needs</td>
</tr>
<tr>
<td>Shift from invention of new hardware to invention of new technology solutions</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Incentive</strong></td>
<td>Continued incentive for individual executives to gain in market share, reduce risk and improve operational efficiency, and to bring to market new inventions</td>
<td>Increased incentive for new inventions to have UX data supporting its overarching value</td>
</tr>
<tr>
<td>Continued investment in individual inventor (e.g., Intel Rock Stars, Sponsors of Tomorrow)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Learning</strong></td>
<td>Increased rigor in product development processes (e.g., institutionalization of PLC)</td>
<td>Increasing investment in UX resources (e.g., establishment of IXR and CMR)</td>
</tr>
<tr>
<td>Continued focus on technical problem solving, albeit at the system level (vs. component)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development of internal retrospectives capabilities and formal program</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vision</strong></td>
<td>Diversification of strategic portfolio to cover the “compute continuum”</td>
<td>“Inspired innovation that’s changing the world”</td>
</tr>
<tr>
<td>Continued technology invention but includes devices beyond the PC (e.g., servers, Netbooks, mobile phones, tablets, etc.) with increased importance on software &amp; services bundle</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Organizational Network</strong></td>
<td>Increasing technical complexity due to system integration requirements and diversifying product segmentation (e.g., transition toward platform model of production)</td>
<td>Increasing risk and complexity due to system integration requirements and diversifying product segmentation (e.g., transition toward platform model of production)</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Increased controls and standardization in technology development process (e.g., PLC, TRP)</td>
<td>Increasing standardization and formalization of product development processes (e.g., PLC, TRP, TSLRP, World Map)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Ecosystem</strong></th>
<th>Shift toward mobile devices and any time anywhere connectivity</th>
<th>Rise of Apple’s vertically integrated business model</th>
<th>Shift in the influence of power to those firms with the greatest knowledge of the consumer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Changing partnerships (e.g., decline of “Wintel,” Apple-Intel partnership in 2005)</td>
<td>Increasing importance of internet service providers (ISPs), content providers, and independent software vendors (ISVs)</td>
<td>Silicon no longer drives the market. The market drives silicon.</td>
</tr>
<tr>
<td></td>
<td>Increasing role of internet service providers (ISPs), content providers, and independent software vendors (ISVs)</td>
<td>Silicon no longer drives the market. The market drives silicon.</td>
<td>Silicon no longer drives the market. The market drives silicon.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Environment</strong></th>
<th>Proliferation of mobile computing devices (e.g., phones, Netbooks, tablets, music players, embedded devices)</th>
<th>Software becoming the high growth/margin area over hardware</th>
<th>Shift in the dominant user from enterprise- to consumer-centric</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Increasing Internet connectivity and rise in cloud computing</td>
<td>Declining growth in traditional PC market; growth in servers and mobile computing</td>
<td>Shifting user priorities toward mobility, power management, security, and connectivity</td>
</tr>
<tr>
<td></td>
<td>Shift in purchasing decisions from enterprise- to consumer-driven</td>
<td>Shifts in global economic growth due to recessions (e.g., 2001 technology bubble and 2007/08 global financial crisis)</td>
<td>Shifts in global economic growth due to recessions (e.g., 2001 technology bubble and 2007/08 global financial crisis)</td>
</tr>
</tbody>
</table>

The relative status between the three predominant innovation frames was shifting, particularly around a rise in the humanistic frame. This was especially salient during the period of my immersion and data collection. The firm not only established a large (100+ headcount) group to formally address many of the UX practices, but the CEO and other senior executives began incorporating language that would suggest a more humanistic frame. For example, the CEO
made state in 2011 that “… we learned that the best chip is necessary, but not sufficient, providing a terrific user experience is critical to win…” (Paul Otellini, President & CEO, ISMC 2011). Another senior executive made a similar statement in a keynote speech, when comparing two different SmartPhones (one of which was the iPhone). In comparing the two, she stated that “consumers are more interested in their experience than technology alone.” (Renee James, SVP & GM, SWPC 2010). The WiDi Case (see Chapter 4) is another example that was highly touted as a successful UX-driven innovation. While still not an equal, the humanistic frame’s rise in influence demonstrates that the predominant frame of a firm can and does change over time. Although, the humanist frame continues to be challenged in its growth by the culture, business model and strategy, product development processes, human resources, and infrastructure that were established and routinized by the technologic and economic frames. It is too early to know the impact that the humanistic frame will have on firm performance, nor is it clear whether the frame will sustain itself or submit to the other two if significant crisis occurs.

3. 3 DISCUSSION

As I engaged in this larger study on innovation’s paradox, I quickly learned that firm members held different interpretations of innovation and that these interpretations were influencing their actions, and subsequently, those of the firm. Formal analysis led me to identify nine framing structures that individuals used to ground and share their interpretations of innovation. Second, I identified three predominant innovation frames according to member’s functional groupings, as well as two additional framing themes: organizational hierarchy and position in PLC. Third, I identified three anecdotal insights on the framing dynamics of innovation frames: (1) the role of linguistic binaries, (2) the necessary incompleteness of frames, and (3) the temporality of frames. I briefly discuss the theoretical and practical implications of each below, as well as limitations to the study and future work.

**Framing Structures & Predominant Innovation Frames**

I believe that the concept of framing structures extends earlier work on both cognitive structures and organizational structures by focusing on the relationship between the two in the context of
innovation. Framing structures act as the foundation around which the individual makes sense of innovation and can benchmark his or her change in interpretation over time. In collection, the framing structures constitute the individual’s innovation frame. Equally so, framing structures are the central dimensions around which innovation frames become socially constructed and shared in relation to others and the firm. These two levels of sensemaking and sensegiving occur simultaneously and reciprocally.

Framing structures should not and cannot be understood in isolation though, which highlights the value of the innovation frame as a complex. The concept of the innovation frame, particularly the predominant innovation frame of the firm or dominant logic (Prahalad & Bettis, 1986), acts as a guiding mechanism for actors within the firm to share interpretations of past, present, and future actions. More importantly, innovation frames enable a shared sense of organizing and coordination of action along a particular trajectory.

At a broader theoretical level, the notion that multiple innovation frames exist goes to addressing a central question in the innovation literature – what do you “mean” by innovation? The answer is that no single definition suffices. Rather, innovation is a pluralistic phenomenon that is more akin to an argument or negotiation around the social and material relationships than a strict input-process-output model of production. This is a key point because the oft-cited need for a single definition is to avoid incongruence. However, incongruence will exist across the PLC if such a process is broken into different functional groups because each group will develop their own unique predominant innovation frame. One approach to mitigating such incongruence would be to employ a core team that remains intact from concept to launch.

This argument of innovation frames and incongruence may also extend to explaining the faults of structural inertia in periods of crisis. As discussed in earlier parts of this dissertation, firms develop a structural inertia and rigidity as they make efficiency gains. Gilbert (2005) showed that during periods of crises established firms will release their resource rigidity (i.e., investment patterns) but not routine rigidities (i.e., organizational processes that use those resources). What is occurring in these situations is that firm executives simply reallocate existing resources (i.e., people) and create a new project team or business group that is tasked with addressing the crisis.
While this crisis group is given a new task, its member still maintains its old means of interpretation and organizing. It’s like putting old wine in a new bottle and expecting it to taste different.

On the other hand, the incongruence between innovation frames may not always be a disadvantage. The predominant innovation frame of a product group or firm may act as a protective filter between new ideas and the exploitation of existing competencies. If every idea made its way into production, resources would become spread thinly and the ability to execute diffused and could become ineffective. This also is a central point to consider because the tension between exploitation and exploration is over resources, but are resources the cause of this tension? I would argue they are not; rather, the tension is between innovation frames. Thus, resources are simply the end goal, not the means.

This social practice perspective begins to explain the agency between individuals and the firm, and allows us to ask a new set of questions that would not previously have been available under existing views of the firm: How do framing structures influence each other as part of an individual and/or the firm’s innovation frame? When and how are certain framing structures more or less influential in guiding interpretation and organizing? How do shared framing structures become embedded in organizational culture, technology design, and other work routines? Are certain framing structures more prone to stability or to change?

Practically, framing structures may be a particularly useful tool for understanding key differences across predominant innovation frames. In particular, innovation frames are very complex, with individuals often holding multiple frames. Framing structures provide an analytic tool to dissect the various dimensions of a person or firm’s innovation frame. There also exists a plethora of research surrounding many of the identified framing structures (e.g., incentives, vision). Framing structures provide a coat rack-like foundation for hanging these various pieces of research and practice.

The concept of the innovation frame may also be useful in explaining barriers to developing disruptive technologies. As most firms are not able to employ a core team from concept to
launch, groups may often feel as though they are simply “tossing things over the wall” when transferring technology. The innovation frame highlights the incongruence that might occur and practically, will push the need to consider technology transfer as more than simply technology transfer or even knowledge transfer but the transfer of interpretation. This may also be why the closer research groups are with product groups, the easier the transfer and the more likely the product group will adopt new ideas.

Lastly, during data collection and in reviews with the hold-out informants, the data initially appeared to suggest that frames were aligned with job title. This suggestion in turn led to the later organization and analysis of the data by the three primary functional groupings. However, after coding the data inductively and in cross-comparing the groups, the alignment between predominant innovation frame and job title was not a clear case, at least not in a one-to-one relation. Two reasons may account for this. First, job title is mainly a representation of a person’s role and responsibility, which does not always equate with how those roles and responsibilities are performed or prioritized. For example, the economic frame could easily be associated with the position of manager because it is often the role and responsibility of the manager to account for productivity, costs, etc. However, at Intel, most managers had progressed from within the company, often starting in an engineering position before working his or her way up the management promotion track. The same goes for equating a marketing position with the humanistic frame; many marketing managers were at one point engineers and were professionally trained in an engineering discipline, which is more closely associated with the technologic frame. Thus, I suggest that formal education and training may play a stronger role than job title in determining a person’s frame. Second, for some informants, their statements fell into more than one frame. Thus, while job title might express the predominant frame of an individual, it surely did not denote the only frame. People hold multiple frames which are called on by their relationship to the situation.

In places where diversity matters, innovation frames may play a significant role. For example, concurrent engineering is an approach to product development that brings together multiple functions to work in parallel – a systems approach towards optimizing engineering design cycles. The aim is to bring multiple considerations to early design stages and have them work together...
concurrently. By addressing the plurality of issues early, the team can avoid costly errors that would otherwise not have been recognized until later stages. The concern is that team members are often selected by job title or functional group, which may not be an accurate representation of the individual’s innovation frame. Thus, the innovation frame may provide resource managers with a more accurate means for identifying and selecting team members.

The same issue may hold true for brainstorming sessions. With the intent of gaining a plethora of ideas and the recombination and integration of diverse ideas into new ones, measuring group diversity may be more accurately represented using the innovation frame. Innovation frames may also explain why in brainstorming or strategy sessions that individuals and the firm fail to see new ideas – their innovation frame precludes them from seeing the new opportunity. Or, in cases where new opportunities are identified in brainstorming sessions, again, innovation frames may demonstrate why it is so difficult to implement those new ideas. In both cases, addressing innovation frames as a central element in such sessions may be critical to success. Methods for exposing different innovation frames and as prediction tools for barriers to implementation are fruitful areas for future research and practice.

Framing Themes

The observation of three framing themes – functional grouping, level in the hierarchy, and position in PLC – demonstrates the multifaceted nature of innovation frames and how people interpret innovation. Collectively, these themes may make up what Dougherty (1992a) observed as the “world views” that differ across departments within a firm. These different views beg the question of the impact of innovation frames on structural changes within a firm, and vice versa. For example, Intel reorganized multiple business groups that included thousands of employees. In terms of organizational learning, innovation frames might suggest that no single organizational structure is ideal (e.g., matrix, functional, project); rather, the continuous redesign and reorganization of people would enable the greatest amount of cross-pollination and awareness of different interpretations. On the other hand, too much reorganization may hinder the development of shared frames, which could impact the effectiveness and efficiency of the group. A balance between stability and change would be most ideal. An excellent question for
future research is to ask how long a group takes to establish a predominant innovation frame? Another would be to ask how individual frames change as the result of a reorganization?

From the position of senior management, the concept of the innovation frame is similar to that of the dominant logic proposed by Pralahad & Bettis (1986). Given that organizational hierarchy is a main framing theme, the senior team could in fact develop its own “world view” or predominant innovation frame just like a department or business group might. In firms where daily corporate activities are separate from those of the business units (e.g., structurally, geographically), this would seem a likely outcome. The concept of innovation frames explains why Teece’s (2007) call for senior management to interact and socialize with business groups and front line employees on a regular basis is so important.

In contrast, innovation frames may further explain why theories of disruptive innovation (Christensen & Overdorf, 2000) and the ambidextrous organization (O'Reilly III & Tushman, 2011) suggest separating new business ventures from the core business. While separating the two seems a structural issue, the purpose may be equally related to separating and untangling innovation frames so that new entanglements, not founded in the assumptions of the core business, can be created. Viewing organizational separation solely as a structural matter leads to a firm’s difficulty in releasing routine rigidities (Gilbert, 2005). For employees who repurposed into new groups, they carry with them their old understandings of how to organize and old innovation frames. Any reorganization requires equal consideration between resource allocation and the influence of innovation frames as an entanglement.

**Linguistic Binaries of Innovation**

The linguistic binaries of innovation were an interesting yet unexpected finding. Although, it probably should not have been too surprising given the overwhelming number of binaries used in the innovation and organizational literature such as incremental vs. radical (Ettlie, Bridges, & O'Keefe, 1984), sustaining vs. disruptive (Christensen, 1997), micro- vs. macro-level (Kanter, 1988), exploration vs. exploitation (March, 1991), creativity vs. innovation (West, 2002b; West
& Farr, 1990), idea development vs. implementation (Van de Ven, 1986; West, 2002a), and so on and so forth.

For purposes of this discussion, it is not the existence of the binary that is noteworthy, but the way individuals use the binaries to describe their roles and position in relation to others. Even when informants would explicitly state that they knew innovation was a continuum, they would still use various contrasting binaries in their descriptions. The juxtaposition of two extremes appeared to enable individuals as tools both for sensemaking and sensegiving (Gioia & Chittipeddi, 1991; Hill & Levenhagen, 1995; Weick, 1995). At their simplest form, binaries helped individuals make the invisible obvious by contrasting the assumptions, expectations, and knowledge of others in relation to their own.

The relationship between binaries and conventions was also of interest given that the use of binaries appeared to be a central mechanism in how individuals created and oriented shared innovation frames. Practically, the binary phenomenon may be useful in explaining why alternative scenarios are so important in strategic planning and early stage concept development tasks – because they help define emergent boundaries through contrast. For individual skill development, an individual may benefit substantially by engaging in bipolar or opposing experiences (e.g., research vs. manufacturing) in order to gain a clearer and more holistic perspective on the activities and nature of the firm.

The firm also appeared to possess its own binary tensions. For example, Burgelman (2002) noted that Intel has had a number of central tensions over its history including specialized vs. commodity products (‘80s and ‘90s), core vs. new business (‘90s and ‘00s), and diversification vs. integration (‘00s). Explaining how these tensions are managed and shaped by individuals and how they change over time would be of both practical and theoretical interest. Binaries may also be of use making visible outdated assumptions and untangling the commitments that drive active inertia. Exploring both would also be of value and should be pursued in future research studies.
Necessary Incompleteness of Frames

The fact that no single individual held a complete picture of the firm and of innovation is not surprising and simply reinforces the ongoing literature about the illegitimacy of rational models of organizing. Even for the executive, there is no bird’s-eye view, only a different angle for viewing the firm. A more interesting question is how individuals manage relationships with others who have complementary, opposing, or like-frames, and how managing such either actively or passively shapes organizing and firm performance. An individual who does not recognize the limitations of his or her frame may not make the necessary connections or may make decisions based on incomplete or inaccurate assumptions and knowledge. This finding also suggests why it is so important for top-level management to stay connected to front-line workers. Without such connectivity across the firm, groups can become isolated and disconnected from changing interpretations and organizing patterns – management can become prisoners of their own interpretations because organizationally they are disconnected from new seeds and visions, nor can they best know how to enact top-down strategies that will align with the framing structures of those on the front lines.

Practically, techniques that enable an individual and/or firm to become aware of what they do not know may be just as useful as to those that identify core knowledge and competencies. This may be particularly important in addressing the “fact vs. assumption” phenomena associated with how individuals state information. Enabling individuals to recognize how they use a statement – a fact for justification or a convention used to enable commitments – would also be of use. Exploring the framing dynamics that rest behind this phenomenon is a valuable next step and natural extension of this dissertation.

Lastly, what may be most interesting about the necessary incompleteness of frames is what is known but not recognized. In firm members’ attempts to make sense of who they are and how they fit into the firm, they often focused on constructing similarities within framing structures to coordinate action; however, this ignores the unique assumptions, expectations, and knowledge an individual might hold. Perhaps this is where the mentality of the entrepreneur comes in – the person who actively explores his or her ideas without constraint from others and the firm. While
recent years have seen a push away from the “lone inventor,” perhaps there was some truth to such grandeur. Firms should not stop asking how they might be constraining the frame of the individual. Firms often put many policies and practices in place in order to control the production of its employees, but time may be better spent removing those barriers than worrying about what might happen once the individual is freed. The balance between convergence and divergence sits at the heart of innovation’s paradox. Perhaps the answer rests not with the either/or approach but in the movement between the two.

*Temporality of Frames*

The findings of this study suggest that innovation frames change, i.e., the content and matter within each framing structure changes over time. The relationship between predominant innovation frames of the firm also change, e.g., rise of the humanistic frame. How and why these changes occur remains a question for future research, but this study sets a foundation for that exploration by providing the dimensions along which we can recognize such change.

The recognition that individual and firm-level innovation frames are both stable and change over time allows us to ask a number of interesting questions: How are individual innovation frames formed? How is it that some people hold multiple frames while others are strongly wed to a single frame? How is it that some people are able to continuously update and adapt their frames, while others remain more static? What is the impact of frame flexibility and adaptation on individual and firm performance? What ignites change within individual and firm-level innovation frames? Are the mechanisms for changing individual frames the same as those of the firm? How do frames react under different periods of uncertainty (i.e., order vs. un-order)? A few of these questions are explored in Chapter 4 – the WiDi Case and the (re)emergence of the UX Competency. Further discussion on the temporality of frames is also provided in Chapter 5.

*Limitations & Conclusions*

The normal limitations of naturalistic and interpretive research apply here. More importantly, the data took place in a single research site with a small sample size. While this is not a limit on the
validity of the findings, it is simply a note on how much more there is to be explored in this space. For example, a broader sample size within the research site would have enabled greater comparison of innovation frames across business groups and greater distinction between the framing themes of hierarchy and position in PLC. The analyses of the study are also limited by the complicated sources of data. By not positioning myself as the researcher at one level of analysis or another and by not following a single group, the temporal dimension of the data was more difficult to capture and integrate into a narrative. This may have provided a more cohesive understanding of the data. However, by positioning myself as such, I also gained insights not visible in studying a phenomenon at a single level or across a single project.

The methodology also left innovation frames appearing more static in nature than they are in practice. To address this limitation, I developed a case study, which I present as the body of Chapter 4. Methods such as process research and other narrative forms of inquiry could also be used in future research. Capturing the framing dynamics of interpretation are critical in this case if we wish to apply these findings to innovation’s paradox. During the period of my observations, Intel was undergoing a period of significant reorganization and change due to rapidly changing conditions in the market environment. Without understanding the dynamics of innovation frames during these periods of turbulence, we may be left wondering whether Intel and other firms are simply changing the arrangement of chairs on the Titanic.
Chapter 4 expands upon the concept of innovation frames by introducing temporality and agency and examines the framing dynamics that underlie how individuals within an established firm actively manipulate the sensing, seizing, and transforming of the firm in order to develop both a novel technology and new competency. The research is based on an in-depth, ethnographic and historically-based case study of Intel® Wireless Display (WiDi) technology – an emerging technology for wirelessly linking a personal computer (PC) with a television (TV). Figure 4.1 illustrates a commercial version from Toshiba.

Selection of the WiDi case is of significance for a few reasons. First, it required the WiDi team to construct a novel innovation frame and enacting capabilities, none of which existed prior to this within Intel. This act, along with the later proliferation of both the technology and capabilities throughout the firm, demonstrates how dynamic capabilities are entangled in the activities of a firm’s entrepreneurs. It also demonstrates how those entrepreneurs often drive change from the bottom-up (see Figure 4.2).

Second, WiDi was developed within one of Intel’s longest-standing and strongest core businesses, the PC Client Group (PCCG). That disruptive capabilities and technologies can be developed within an established group goes against existing wisdom and highlights the important role frames play in connecting old and new. In doing so, special attention must be given to the various roles of time both in separating the new technology, while simultaneously maintaining key connections with the existing trajectories of the core business – all as a means for gaining traction and stability for WiDi. Two strategies, the minimum viable product and incremental disruption, are identified for addressing the issue of a firm’s absorptive capacity. Third and lastly, the emergence of WiDi came about while Intel and the broader industry were undergoing...
a fundamental shift from a techno-centric to a consumer-centric model. For PCCG and Intel, the WiDi technology became a key talking point for formalizing and communicating the firm’s transition during this turbulent period – a transition that saw a shift in the relationship between Intel’s predominant innovation frames (i.e., a rise in the humanistic frame). Collectively, these three points depict multiple levels of change in firm competencies, i.e., the WiDi team, PCCG and Intel, and the industry as a whole.

![Diagram of L'oeur Model](image)

**Figure 4.2: Entanglement and strategies of the L’oeur Model as presented in Chapter 2 (see Figure 2.2).**

The remainder of this chapter presents the WiDi case study and is organized as follows. Section 4.1 reviews the specific research methods used to develop the case. Section 4.2 presents the WiDi Case and is broken into four parts: (1) history and context of Intel and the technology industry; (2) the inner workings of Intel and PCCG; (3) WiDi the technology; and (4) WiDi the story, from preamble to launch. Section 4.3 analyzes the implications of the case at the individual (i.e., WiDi team), firm (i.e., rise of the humanistic frame), and interaction levels in relation to the concepts of innovation frames and framing structures presented in Chapter 3. In particular, it discusses the role of time and agency as key elements in reflexivity and the link between interpretation and organizing. A more extensive discussion of the findings in relation to dynamic capabilities, innovation’s paradox, and the invisible obvious is reserved for Chapter 5.
4.1 RESEARCH METHODS

This research is based on an in-depth, ethnographic- and historically-based case study on the emergence and establishment of Intel® Wireless Display (WiDi) technology. Since the focus of the research was to examine the changing interpretations and organizing between individuals and the firm and across the creation of a novel technology, the narrative approach of the case study best suited to capture the rich and complex dynamics of these activities and most useful for developing explanatory theory (Glaser & Strauss, 1967; Miles & Huberman, 1984; Yin, 2009). As such, the unit of analysis is activity, observable at multiple levels of analysis, not simply a single person, team, or product. This method also provides the flexibility to tell a rich story and to make salient key actors and actions that might otherwise be lost in a strictly quantitative or hypothesis-driven approach. At the same time, the case method was selected over pure ethnographic methods because it overcomes the scope and time limitations of such an approach and allows for a wider range and longer duration of activity to come under examination. Lastly, the case method was selected to provide the researcher with the flexibility to integrate the widest range of necessary data for exploring such a complex and emergent phenomena, and it is conducive to contributing to and expanding theory (Eisenhardt, 1989). Primary data collection occurred while I was embedded in the research site during a year-long period between January 2010 and February 2011, as well as follow-up interviews conducted in the spring of 2012. Data sources consisted of firm archives, publically available data, interviews, and ethnographic observations.

Firm archives consisted of project documents, charters, internal communications (e.g., memos, emails, presentations, and news releases), organizational charters, design documents, and technical papers. These were used to create a timeline of WiDi’s development. General historical documents on the business group (i.e., PCCG) and firm were also collected, including organizational charts, business charters, internal communications, and technical reports in order to recreate the broader organizational context. Publically available data supplemented firm archives, and also captured the broader history and state of the industry. This included business press articles on WiDi, the firm’s financial reports, materials published on the firm’s website (e.g., Intel’s history, Intel museum, and other corporate overview information), and other
business press articles on Intel and the semiconductor and information technology industries. I was also significantly aided in developing Intel’s organizational history (pre-WiDi) by Burgelman’s (2002) extensive work on Intel’s corporate strategy.

To complement the archival data and create a richer narrative, over 5 hours were spent interviewing informants who working directly on, or who oversaw in some form, the development of WiDi. An addition, 50+ hours of interviews were conducted with informants from across the firm in order to capture the broader context and workings of the firm. To further capture the dynamics between the WiDi team and the firm, as well as situate the archival and interview data, ethnographic observations were collected throughout the year-long period, which coincided with the original public release and commercialization of WiDi. A full draft of the case was reviewed for accuracy and completeness by two WiDi team members, as well as two non-WiDi Intel employees who held a broader perspective of the firm.

4.2 THE WiDi CASE

![Intel WiDi Wireless Display](image)

*Best Seat in the House... Stop crowding around a laptop screen! Intel® Wireless Display lets you view and share content from your hard disk, home network or anywhere a browser can take you on the biggest screen in your home.*

-Tagline for Intel® Wireless Display

While at a family gathering, a senior engineer noticed that people were crowding around a small laptop display while his large screen TV sat blank. Frustrated but also interested by this event, he took the idea to work. At the same time... An Intel manager had watched “device to device wireless attach” continually pop up in consumer market research. A business group was looking to extend its wireless leadership as a strategy to protect and extend its real estate in the Netbook and PC markets. A firm knew the living room had become the next technology battleground, and an industry was undergoing a dramatic shift from a vision of technology as an enterprise tool and technically-driven to a consumer-driven model that revolved around user experience (UX).
These were a few of the many events that emerged and interlocked with others over the course of three-plus years and eventually led to the development and launch of WiDi technology at the 2010 Consumer Electronics Show (CES). With this information at hand, some might say the writing was on the wall, but very few, if any, knew all the pieces to this puzzle – time played a major role. Others might suggest serendipity or that fortune favored the prepared. However, most people do not know that the idea was rejected at first, and in fact the current version is only a partial instantiation of the original idea. The idea also emerged in a firm and business group that for decades had stifled most everything that did not directly advance and promote the core business, i.e., the advancement of the central processing unit (CPU). Often compared to a creosote bush (Burgelman, 2002), the roots of the core business sucked up most of the surrounding resources and released a poison so no other seeds could plant roots.46

This story has another explanation – an explanation rooted in how the entrepreneurs of a firm, seemingly regular people, actively manipulated the cycle between sensing, seizing, and transforming by reflexively studying and becoming aware of their own innovation frames and the predominant frames of the firm in which they were embedded. In doing so, the many forms of time became critical comparative moments for reflection, as well as moments of agency, that the team used to create what collectively has come to be known both within the firm and the market environment as WiDi.

The remainder of the case focuses on a three-year period between 2007 and 2010. It begins though with an overview on the background and history of Intel and the computing industry before turning to central period of study.

**4.2.1 Intel and the Computing Industry: History, Context, and Current State**

Intel Corporation was founded in 1968 and focused on developing and manufacturing computer memory products such as static random access memory (SRAM) and dynamic random access

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46 Intel is most well known for its x86 series of microprocessors, the processor found in most PCs. Its dominance in this space left it strategically under-diversified, yet pitting the exploration for new growth opportunities against its core microprocessor business is a constant challenge, but prime opportunity for studying those that have survived.
memory (DRAM). Between 1968 and 1985 the firm pioneered many technological innovations, including the microprocessor. In 1985, with the advent of the PC, Intel made the strategic decision to refocus the firm around its semiconductor capabilities, with the microprocessor as the epicenter and core of the business. The decision set Intel on a path to become a central founder of the PC and internet revolution and to be one of the most valued firms and brands of modern times.

In 1999, former CEO and then chairman of the board, Andy Grove, and then current CEO, Craig Barrett, both recognized that Intel would need to transition into its third epoch. While Intel had been the microprocessor firm of the 1990s, it would have to become an Internet building block in the 2000s. This was complicated by the fact that Intel’s core business revolved around growing the PC market, and by the time of the CEO transition in 1997, there were signs of a steep slowdown in the revenue and profit projections for the PC. While Intel’s transition into the microprocessor was deliberate, its laser-like focus left it undiversified as a firm. In 2000, this hit the firm’s stock hard in the form of a 45% decline in value when the dot.com bubble burst and fears increased over slipping PC demand.

At the turn of the century, the high-tech industry also appeared to be undergoing a major transformation of its own. Growth in the corporate market segment was declining, while the consumer market segment was growing. Technology innovation was turning its attention to digital appliances such as cell phones, handheld computers, cable TV set top boxes, gaming consoles, and other personal electronic devices. Apple, Inc., both a competitor and complementor, was making a major comeback with its launch of the iPod (October 2001), iTunes music store (April 2003), iPod Shuffle (January 2005), and iPod Nano (September 2005). The diffusion of technology was changing. The 1990s typically followed the diffusion path of corporate to the consumer market, but this flow was inverting. This was becoming the frontier of experience innovation (Prahalad & Ramaswamy, 2003) and customer capitalism (Martin, 2010).

While revenues from the PC could carry Intel for another decade, the firm struggled to diversify because its resources, processes and values were so ingrained in the microprocessor that it was hard for new business opportunities to take priority. Again, then CEO Craig Barrett likened the
microprocessor to a creosote bush, a plant found in the harsh deserts of the Southwest U.S. that secretes chemicals through its roots to prevent any other plants from taking hold and allowing access to more water during the hot dry spells. In other terms, the microprocessor business was sucking up the majority of the firm’s financial resources, as well as the best engineers and sales people. Processes also revolved around developing the next generation microprocessor, and underlying corporate values were founded on an engineering and manufacturing mentality.

In response to these challenges, Intel’s senior management launched a new “Grow the Business” initiative, which taught top managers a new shared vocabulary focused on new ventures and business models. Subsequently, the core microprocessor business became known as “blue,” while new business opportunities that were “away from the core” became known as “green.” This included establishing a New Business Initiatives (NBI) group, as well as other pipelines for innovative opportunities to bubble up and gain visibility by senior management. Some of the successes of NBI included Larrabee (Intel’s push into graphic processing units; GPUs), WiMAX, Low Power Chipset Organization (LPCO) which later evolved into the chipset for the Intel Atom processor. Intel has also grown successful businesses in areas of servers, Netbooks, and other computing devices. The firm also began shifting its relationships with complementors such as its partnership with Apple (2005). During the early 2000s, Intel also used acquisitions to expand its portfolio following the dot-com bubble, but with varied and rather limited success.

Another key part of Intel’s move to diversify included expanding its competencies beyond engineering and into the social sciences. This included hiring a number of ethnographers, anthropologists, human factors engineers, designers, and other social computing researchers.47 Another act was the formation of Intel’s People and Practices Research (PAPR) group within Intel Labs, a world renowned social computing research and design lab the late 1990s. New business groups and joint ventures also emerged from these efforts, including the Smart Toy Lab, a joint venture with Mattel (1998), the Digital Health Group (DHeG), and Digital Home Group (DHG). Some of these groups were later reorganized or spunoff into new ventures such as

47 Members within Intel have been quoted as saying that Intel employs the highest number of ethnographers in the industry, which surprises many given Intel’s predominant image as a semiconductor engineering and manufacturing firm.
CareInnovations (2010), a spinout of Intel’s DHeG and General Electric (GE) Healthcare’s Home Health division.

Executives also recognized that increasing market segmentation meant a product-market strategy would better enable Intel to compete across the diversifying market spaces. Prior to this, Intel had been the hardware components or “ingredients” supplier. This horizontal strategy had allowed Intel to commoditize the surrounding footprint and maximize the value of the CPU. However, vertical strategies were showing to be more effective to address the rapidly changing and diversifying consumer segments. In 2004, Intel began turning toward a platform strategy in response and even launched the Corporate Platform Office (CPO) whose charter was to reorient and coordinate more consistent and timely planning and decision making across the different business groups for all platforms.\(^48\) This transition was also in line with Intel’s earlier moves toward vertical integration (i.e., chipsets and motherboards), particularly as its relation with original equipment manufacturers (OEMs) such as Dell, Inc. and Hewlett Packard (HP) began to change. These firms were competing on cost and over time relied more and more on Intel’s research and development (R&D) investments and validation processes to innovate and integrate components and whole solutions.

Intel took a step back, however, in the mid-2000s when they announced a number of product delays in 2004, and in 2005, steadily lost market share to their biggest rival, Advanced Micro Devices (AMD). During that two year period, Intel’s employee count had gone from 85,000 to over 100,000. During Q2 of 2006, Intel CEO Paul Otellini responded by creating a Structure and Efficiency Team (SET) who reviewed the firm from top-to-bottom with the aim to reorganize with a lower, more efficient cost structure. One result was the layoff of over 1,000 managers.\(^49\) This reset and other adjustments put a significant damper on the growth of Intel’s UX-oriented

\(^{48}\) A platform consists of a set of interdependent ingredients all set to launch at the same. A notebook (laptop) platform might include a motherboard chipset, mobile CPU, and wireless network.

\(^{49}\) Referred to as the “walk of a thousand managers,” this event was significant in the history of Intel for multiple reasons. First, Intel had long valued employee retention. For examples, whenever a business group or FAB was to be shut down, Intel would show strong support for employees to transition to new jobs within the firm. Second, Intel’s largest development site was located in Hillsboro, OR (just outside Portland), which was where most of the layoffs occurred. Given that Intel is the largest employer in the region and state, the loss was tremendous for the community. On the flip side, many people both within and outside of Intel touted the 2006 layoffs as the major reason why Intel did not have to make any layoffs during the 2007 financial crisis and resulting recession.
capabilities. Not only were a number of experienced positions lost, but business groups returned to the core business of microprocessors – a focus which left little appreciation for UX personnel or capabilities. The firm’s UX competencies took a step back as a result.

As the market environment continued to shift toward experience innovation, the broader UX movement could not be ignored, particularly in the wake of Apple’s spectacular successes in launching the iPhone (June 2007). Thus, Intel returned to creating and expanding its competencies in delivering on UX. This included promoting key UX experts to the level of Fellow (e.g., Eric Dishman, 2007; Genevieve Bell, 2008)\(^{50,51}\) and creating new groups dedicated to teaching, promoting, and developing UX strategies and competencies across the firm. The rhetoric of key executives also began to shift, particularly in 2010 and 2011, as the firm sought to compete in the Smartphone and tablet markets. For example, in 2011 CEO Paul Otellini made the statement, “…we learned that the best chip is necessary, but not sufficient; providing a terrific user experience is critical to win…”.

WiDi became a major speaking point in Intel’s transformation toward a more UX-oriented firm, a transformation that is still ongoing and whose outcomes are not fully known. While WiDi was launched in 2010 as a part of this reimaging, its genesis began in many places and at many points in time. Before turning to the specific story of WiDi, more context is provided on the inner workings of Intel and the business group that initial housed WiDi, the PC Client Group (PCCG).

\(^{50}\) Only 55 Intel Fellows in 2010. It is the highest ranking technical position in the firm, and is the equivalent of a vice president.

\(^{51}\) Eric Dishman and Genevieve Bell are both trained anthropologists and ethnographers and both started their careers with Intel in the PAPR group. Dr. Dishman created the first healthcare research lab at Intel, later helped establish DHeg, and eventually helped lead Intel’s joint venture with GE to create CareInnovations. Dr. Bell helped establish the UX group within DHG and in 2010 was named the director of Intel’s Interactions and Experience Research (IXR) group, a group positioned within Intel Labs whose charge was to develop UX-driven strategies and concepts for the firm.
4.2.2 Intel and PCCG: The Inner Workings

Tick-Tock, Tick-Tock, Tick-Tock...

Like the hands of a clock, Intel time is always moving both forward and round-and-round. In 1965, *Electronics* magazine published an article by Intel co-founder Gordon Moore that observed and subsequently predicted the pace of computing progress for the following forty-plus years. As Moore then observed, “The complexity for minimum component costs has increased at a rate of roughly a factor of two per year” (p. xx). Rewritten, the statement reads that the number of transistors per chip that yields the minimum cost per transistor has increased at a rate roughly a factor of two per year. While Moore (1975) later adjusted the pace to double every two years, his prediction describes the basic business model for the semiconductor industry. Figure 4.3 illustrates the phenomenon that has come to be known as Moore’s Law, with the relative manufacturing cost/component on the Y-axis and the number of components per integrated circuit on the X-axis. Half-truth and half self-fulfilling prophecy, Moore’s Law drove Intel’s cadence during the firm’s early years, but over time Intel came to drive Moore’s Law for the industry.

(a) Gordon Moore’s original 1965 sketch

(b) Redrawn sketch of Moore’s Law

![Figure 4.3: Illustration of Moore’s Law (Moore, 1965).](image)
Moore’s Law is fundamental to Intel’s notion(s) of time and how the firm organizes its inner workings. Intel’s planning and production cycles are modeled from it. The industry uses it to predict compute performance and to coordinate activities. The stock market uses it to measure competition and growth. Other components required for computing are also influenced where increases in computing performance require increases in hard drive memory, random access memory (RAM), bus ports, networking equipment, firmware, software, and other components. Beyond even the PC itself, the entire infrastructure that supports computing is affected such as the thousands of miles of optical fibers used to connect the world. Microprocessor manufacturing advances are also subject to Moore’s Law, where every new generation of chips requires a largely new set of equipment that must be designed and tested to produce at smaller and smaller levels but with new and greater barriers to quality and control. This affects the entire semiconductor supply chain, not simply Intel. In short, in today’s global and technology rich economies, Moore’s Law can be felt in almost every corner of the world.

Inside Intel Moore’s Law manifests itself in numerous forms, with the most obvious being Intel’s 18 to 24 month production cadence. To reliably and predictably deliver the ongoing technology innovation this demands, Intel developed its own internal clock called the “tick-tock model.”52 The “tick” is focused on developing new silicon process technology - increasing transistor density while enhancing performance and energy efficiency with a smaller version of the existing microarchitecture (i.e., die shrinking). The “tock” delivers entirely new processor microarchitecture to optimize the value of the increased number of transistors and other technology inventions that can improve computing experience. There is expected to be one tick or tock every year. Figure 4.4 illustrates the tick-tock cycle in relation to the microprocessor sizes and new architecture codenames.

52 Intel’s Tick-Tock model was implemented in 2006 as another response to the market threat of AMD and as a way to improve operating efficiency.
The tick-tock model allows for the coordination and allocation of resources and processes across the globe. Intel’s two largest design centers, one in Oregon (USA) and the other in Israel, are in constant synchronization around the tick-tock model. The predictability of the tick-tock model enables faster, more efficient coordination with vendors, drives ongoing innovation, and acts as a benchmark for technology markets and the broader stock market.

Each product cadence is organized around the multi-level Stage Gate-like model referred to as the product life cycle (PLC). A sideways funnel, the PLC consists of four general stages: (1) exploration, (2) planning, (3) development, and (4) production/end-of-life (see Figure 4.5). The PLC has been applied and extended in varying degrees since the early 1990s as a way to drive consistency and risk reduction across product development processes. As the firm expanded in the late 1990s and early 2000s, the PLC became a means for managing the growing complexity of product development. The PLC took on an even greater role when Intel shifted to a platform strategy in 2004 and formed CPO to help instituted this organizational change (see Section 4.2). At that point, there existed a platform program life cycle, core ingredients life cycle, and med/short lead-time ingredients product life cycles.

53 Although presented briefly in Chapter 3, a detailed description of the PLC process is particularly relevant to the WiDi case.
At the time of this case, Intel followed a yearly, four quarter planning cycle (see Figure 4.6). Beginning in Q1, business groups conduct an assessment of the environment or strategic long range planning (SLRP), where teams get together to look at market segment analyses (MSA) to identify key strategic requirements/ideas to include in the next generation technology. This typically consists of a range of personnel, from general managers to strategic planners to senior engineers. In Q2, SLRP is followed by the development of the Product Line Business Plan (PLBP), which is created primarily by a group’s strategic planners. In Q3, those PLBP’s are then discussed and debated across the higher levels of the firm and overarching program or project priorities are determined. A Plan of Record (POR) is then created from these priorities in Q4, which sets each business and product groups’ priorities and most importantly, resource allocation. PORs are then executed by the business groups during the following year. As far as personnel, MSA/World Map is conducted by a collection of dedicated corporate market researchers, strategic planners, architects (i.e., senior design engineers), engineers, and general

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54 Although presented briefly in Chapter 3, a detailed description of the quarterly planning process is particularly relevant to the WiDi case.
55 More recently, Intel planning refers to this as “World Map.”
managers, each working at different levels of the platform and product lines. PLBPs are often developed and driven by strategic planners, which are then reviewed and discussed by the various general managers in Q3 and approved by the executive managers in Q4.

The POR process is used to establish budgets for every project, but virtually every quarter there are new requests. Intel cannot fund every idea. Using zero-based budgeting (ZBB), the lower return on investments (ROI) projects are cut, but the larger ROI projects are almost always related to the core CPU business. Therefore, ideas for non-core businesses must be very persistent, resilient, and persuasive. As one Intel executive quoted, “In many cases they [new business ideas] were great businesses by any other metric, just not compared to the microprocessor business” (Burgelman, 2002, p. 341). One way for new ideas to gain traction is through the formal planning process.

Throughout the yearly planning cycle, groups develop Product Overview Proposals (POPs), which describe the why, what, and by when (not the implementation of how or by whom possibilities). This includes the product vision, market, capabilities, and business opportunities as
laid out in a product business plan, intended users and usage models, product description, and key features and high-level product requirements. POPs move through three major milestones (POPL1, POPL2, and POPL3) which are related to their maturity and risk level and are completed at the platform level, component subPOPs, and segment subPOPs (e.g., consumer and enterprise).\(^{56}\) POPs can be inserted into the yearly planning cycle at any time, but typically are done in sequence with quarterly planning (e.g., POPL1 in Q1, POPL2 in Q2, etc.) with the expectation that they will make it into the PLBP and eventually POR for the following year. POPs that enter into the POR late in the year (Q3 or Q4) often require a reallocation of resources, which is challenging because it requires a reprioritization and reallocation of resources. Because cash flow is controlled at the corporate level, not the business unit level, business units do not have as much slack or flexibility in resource allocation for emergent product ideas.

Organizationally, Intel’s corporate level structure follows a divisional format with seven to eight large divisions that represent the general functions observed in most firms (see Figure 4.7). Each division hosts its own business groups who operate in relative autonomy, i.e., each is its own profit & loss (P&L) center and hosts its own supporting functions (e.g., human resources, finances, marketing). This structure is relatively the same at each level of the hierarchy and enables the firm to continuously reorganize in relation to changing external market conditions. Business groups are managed using a “two-in-the-box” leadership approach that consists of splitting responsibilities between a business manager and an engineering manager.

\(^{56}\) POPL1 defines usage. POPL2 defines features, where engineers have done enough feasibility studies (e.g., land zone with 70% confidence). And POPL3 defines the plan, which means teams may have already engaged third partners.
Intel Architecture Group (AIG) is Intel’s primary product development division and accounted for 93% ($50 Billion) of Intel’s revenue in 2011. As Figure 4.7 shows, PCCG is a business group within IAG and is responsible for managing Intel’s core business product, the PC (hence the name). In 2011, PCCG was responsible for microprocessors and related chipsets designed for the notebook and desktop market segments, as well as motherboards and wireless connectivity products based on WiFi and WiMAX technologies. To the general public, PCCG is associated with the Celeron, Pentium, Core i3, Core i5, and Core i7 microprocessors. In 2011, PCCG

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57 Intel corporate organizational chart is not intended to be comprehensive. Figure is based on an integration of internal documents and Intel’s 2011 public earnings release report.

58 Financial numbers are based on Intel’s earnings release for 2011, which was reported in January 2012 and available at http://www.intc.com/results.cfm.

59 While PCCG manages the business & operations for the notebook and desktop segments, it is not directly responsible for CPU development. In relation to the CPU microarchitecture (“tock”), this is the responsibility of different engineering, architecture, and development groups within IAG (see Figure 4.6). The “tick” or die shrinking is the responsibility of TMG, which reports up through the Technology, Manufacturing & Enterprise Services (e.g., IT, finances) division. TMG is home to Intel’s core competencies in technology manufacturing (i.e., process engineering).
accounted for 70% of IAG revenue or 66% of Intel’s overall revenue ($35.4 Billion). Intel’s 2011 gross margin was roughly 63% and net income was $12.9 Billion.

While the aforementioned describes Intel’s structural orientation, its culture and corporate values play a sizable role in those practices and performance outcomes. Intel promotes six corporate values: customer orientation, discipline, quality, risk taking, great place to work, and results oriented. Other key cultural practices also drive much of employee thinking and behavior such as its promoting both bottoms-up and top-down forces. For example, Intel executives and managers encourage open and vigorous debate that is indifferent of rank and aimed at strategic truth (what is best for the company). Even given its own name, “constructive confrontation,” the practice is coupled with another called “disagree and commit,” which is where employees are allowed to voice their disagreements but once a decision is made, everyone moves to support the decision. Together, this creates clear decision-making that is well examined and supported by the entire firm.60

Divisions and business groups have also developed their own cultural practices such as TMG’s philosophy and methodology of “Copy Exact!” for reducing time delays and quality issues in technology transfer related to manufacturing. Simply put, everything which might affect the manufacturing process (both equipment and processes) is copied down to the most granular level until it is physically impossible to do or there is an overwhelming competitive benefit to introduce change. This cultural practice has become a core element in TMG’s manufacturing strategy and been adopted across other parts of Intel as well. Intel also promotes a wide range of continuous improvements from the corporate level as well. For example, sponsoring organizational health surveys on a yearly basis, executives are charged with improving activities ranging from the efficiency of meetings to the quality of cafeteria meals and employee health and wellness.

60 The term “support” does not mean the entire firm agrees that this is the right decision, but that the entire firm will act in accordance with the decision.
4.2.3 WiDi: The Technology

First available under Best Buy’s “Blue Label” promotion in 2010, Intel® Wireless Display technology or WiDi was roughly three years in the making. WiDi was a technology developed to wirelessly transfer high definition display from a laptop to a TV (see YouTube Video). With a tagline, “no more crowding around a laptop screen to share content,” the system was designed with the intent of users streaming and sharing video on high definition TVs (HDTV). The system was also designed for quick connect with standard Wi-Fi and easy to set up user interface without the use of remote controls. The system worked by connecting an adapter to the TV and then syncing the computer with the TV adapter.

Figure 4.8: Diagram of WiDi solution with NETGEAR®’s Push2TV receiver.

The block diagram shown in Figure 4.8 lays out the WiDi solution in 2010 in an advertisement with NETGEAR®’s Push2TV receiver. NETGEAR® took an early lead in developing the HDTV adapter. As part of the Blue Label promotion, Intel and Best Buy other early and exclusive partners included Sony, Toshiba, and Dell (PC OEMs) who then incorporated a “single touch” button into their WiDi-enabled laptops for easy connect.

61 http://www.youtube.com/watch?v=FJmxhZzBuVI
62 Intel® Wireless Display requires a compatible laptop, TV adapter and a TV with HDMI or composite A/V input.
4.2.3 The WiDi Story: From Preamble to Launch

Preamble

The main developments of WiDi began in 2007, but the preamble had been in motion since the turn of the century. With the broader shift toward a consumer-oriented market, the core microprocessor business continued to invest in new commodity devices and applications (e.g., webcams, online videos) to push consumer performance requirements. With the perceived slowing of the PC market (i.e., notebooks and desktops), Intel’s diversification strategy was also calling for new sources of revenue, one of which was wireless technology.

The 2002 Federal Communications Commission (FCC) Report & Order authorized the unlicensed use of ultra-wideband (UWB) and set the initial standards for short-range, high-bandwidth communications. This was in response to, and promised growth in consumer’s use of personal area networks (PANs); wireless monitors; and wireless transmission of files from camcorders, printers, and phones. For Intel, this was a new way to drive higher computing performance requirements, but it also brought opportunities to develop those technologies first-hand as an expansion of its revenue portfolio.

At the same time, growth in the consumer market segment meant an increasing consumption of online content, particularly movies, music, videos, and gaming. For the technology industry, this meant the living room (or wherever there was a TV) would be the next competitive battleground. For example, Microsoft launched the Xbox in November 2001 as its strategy to gain entry into the gaming console market and more importantly, to compete and establish itself as the dominant computing firm in the living room. The Xbox competed with Sony (e.g., PlayStation 2), Sega (e.g., Dreamcast), and Nintendo (e.g., GameCube, Wii). As these devices began to connect to the internet (e.g., Xbox Live), they began to compete to be the “home theater PC” or media center.

63 Webcams, video conferencing systems, online TV streaming, and other devices and applications were considered “commodities” because of their general low cost and easy ability to be cheaply bundled with core products or sold separately to consumers. These items were thought to push CPU performance needs because of their higher processing requirements.
In January 2006, Intel launched its own platform initiative to support the media PC concept with ViiV – a collection of computing technologies and features such as dual-core processor, advanced graphics, sound capabilities, immediate power on and off functions, and remote control operations. However, after only two years, Intel announced it had no plans to continue supporting ViiV. This did not end Intel’s strategic directive of increasing its footprint in the living room, however, and various groups within the firm continued to pursue alternative avenues.

**Concept**

During the promotion of ViiV, Intel was learning a fair amount about the consumer market segment and consumer needs in the living room. Mobile entertainment features on the notebook continued to pop up as a key usage in 2006 and early Q1.2007 strategic planning conversations within PCCG (i.e., MSA and World Map – see Figure 4.6), including high definition experience, integrated TV, longer battery life, streaming connectivity in the home, and improved broadband wireless. Enhancing wireless leadership and entertainment were also noted “pillars of innovation” in the mobile platform (as well as performance, battery life, form factor, and manageability & security).

In late 2006, Rudy Cassidy, had recently moved from the Software and Services Group (SSG) into PCCG’s mobile products group (MPG), where he would act as the strategic planner for mobile initiatives planning (i.e., laptops). In this role, as Rudy says, “Most of the people in strategic planning are literally [asking], what’s the next chip? What are the features that go on it? I was [in my role supposed to ask]…, ‘ok, we put the chip into a platform, and we look at it from the standpoint of an end user segment like the consumer, where are the gaps in the industry and where should we do ISV-enabling [internet service providers] or IHV- enabling [independent hardware vendors] or build solutions ourselves?’” Entering his first MSA/World Map in Q1.2007, Rudy noticed the “wireless display” usage need continued to pop up in planning conversations, in consumer market research reports, and consumer appeal indices.

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64 Actual employee names have been replaced with pseudonyms.
At around the same time, Steve Munson, a principle engineer, was at a family gathering when he noticed everyone crowded around a laptop viewing photos while the big screen TV on the wall went unused. Rudy and Steve’s events eventually merged, and an idea born. As the mobile initiatives planner, Rudy began to pursue the concept in greater depth through the formal planning process, asking many questions about the possible value to Intel and asking who in the ecosystem should be doing this. All the while, Steve explored the technical requirements as the lead architect such as what should the wireless solution be, where can this fit with existing/expected technologies, and which engineering group is building what. It is important to note though that working on the wireless display concept was neither their only nor first priority job. Both had other obligations, which they completed while developing the WiDi concept.

As Rudy describes this relationship, “the engineers don’t care as much about the structure or the process. They just come up with ideas and work with the planners to fit it into whatever cockamamie process we’ve [planners] set up.” This cockamamie process, though, is critical because without executive management buy-in, emerging ideas will not be incorporated into the roadmaps, nor will development teams be allocated the resources [headcount] necessary to prove the concept. Although as Rudy notes, in early concept development “sometimes they [engineers] don’t even care what the process is. They just go get five resources [engineers] and start building stuff.” These extra resources can come from people’s extra time or sometimes slack in other projects (e.g., a project has been canceled or delayed for three months so a manager has a few extra resources available). Eventually, Rudy and Steve’s relationship emerged into the “two-in-a-box” leadership style promoted by Intel.

Planning: Rejected the First Go-Around

In early 2007, the Calpella platform came out of its POPL1 with wireless display being a top usage.65 At that point, Rudy and Steve began pulling in various experts from corporate market research (CMR) and engineering to help flesh out feasibility for both the business proposition and engineering around a wireless display solution. A pre-build stage, this “architecting” phase

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65 Calpella was initially scheduled to be launched in mid-2009 as the Core i3, Core i5, and Core i7 series. Actually launch did not occur until January 2010. The delay gave the WiDi team a critical window of time that was enough to incorporate their technology into the platform a year ahead of plan.
between POPL1 and POPL3 required a longer-than-usual period of time because the concept was so “radical” and required pull-in from many different silos of the firm. Not until late 2007 was POPL3 completed and ready for review.

Development through POPL3 included two radio options for wireless transmission. Option 1 was a standard that Intel had been working on for roughly five years called UWB or Wireless USB. Intel had an NBI team that had built this radio and was looking for a way to get their technology inserted onto a product roadmap, i.e., “looking for usages.” Intel Capital had also invested in two outside firms developing in this area. Rudy and Steve “borrowed” resources from these teams (because they did not have any formal resources of their own). The informal collaborations helped a lot with market research and development of the business plan.

Option 2 was Intel’s Wi-Fi team, which was working on how to use Wi-Fi radio for PAN. PCCG management was promoting Wi-Fi as their way of extending Intel’s leadership in wireless connectivity. Blue Tooth technology could be considered a first generation Wi-Fi radio, but it has low bandwidth and high power consumption. Also, Wi-Fi already existed in most notebooks.

Both options 1 and 2 were discussed but Option 1 with a discrete encode plus UWB mini-card module was included in the final POPL3 in 2007. The longer-term product roadmap expected UWB to be integrated with an Intel Wi-Fi card and encode to be integrated into the next generation CPU.

A timing hurdle stood in their way though, but this hurdle not recognized until it was too late. Rudy was set to take a sabbatical for the summer months of 2007. During his sabbatical, a talented guy named Giorgio Rossi was brought in to cover Rudy’s role as a strategic planner in

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66 For example, if a consumer wanted to upload their iPod music library via Blue Tooth, it would take days.
67 Encode is the process of converting video for output, where the digital video is encoded to meet proper formats and specifications for recording and playback through the use of video encoder software. In the case of WiDi, encoding is how video is converted to be transferred wirelessly to a TV receiver box.
68 Intel employees earn a 2-month paid “sabbatical” for every seven years of employment.
The WiDi concept was between POPL1 and POPL2 though, which is a very ambiguous position, especially for a non-core product. Furthermore, if wireless display did not happen, nobody was going to say anything. To compare, the ecosystem and path to market for a core CPU plan is already well defined from the previous generation, but wireless display required a new construction of the ecosystem. In short, the entry of new leadership, albeit brief, put the wireless display concept on hold until Rudy’s return in Q3, and as a consequence the POPL3 review occurred late in the yearly planning cycle.

Rudy and Steve were still excited going into their POPL3 review in late 2007. They had even put together their first prototype using a laptop and Apple TV. However, PCCG management rejected the proposal citing (1) a PLBP funding gap, (2) a concern with the discrete mini-card solution, and (3) whether Intel wanted to go with open Intel Wireless UWB or Wi-Fi for Intel’s wireless personal area network (WPAN) strategy. It seemed wireless display would not be included on the Calpella platform. The rejection was disappointing and led them to a “year of aimless wander”.

The Year of Aimless Wander...

Rudy and Steve’s 2007 efforts were not a complete loss though as “wireless display came up as a Top 5 mega WOW” in the following World Map in Q1.2008 and out of POPL1 for the Huron River platform (successor to Calpella) wireless display was again included. Rudy and Steve continued to work on re-architecting the concept. However, this time they went into it with two key learnings.

First, Rudy and Steve committed to go with the Wi-Fi radio approach (vs. UWB) since it was already part of the existing product roadmap. PCCG’s management had decided on Wi-Fi as the

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69 When an Intel manager goes on sabbatical, those management responsibilities are given to another individual as an opportunity to gain experience in managing a larger group for a 2-month period. It’s like a hands-on, 2-month training experience and can lead to later promotion. This occurs at even the highest levels of the firm and is a part of the corporate culture.

70 Calpella and Huron River are the sixth- and seventh-generation Centrino platforms, which are comprised of a mobile chipset, mobile CPU, and wireless network.
PAN radio strategy for the next 3 – 5 years, and NBI’s UWB group was closed. All that needed to be decided was how WiDi would be accomplished technologically. Three options presented themselves. Option 1 was to put a video chip on the Wi-Fi mini-PCI express card that would encode and compress the data as it was being sent out over Wi-Fi. Option 2 was to develop a separate mini-PCI express card that would encode the data and route it back through the system which would then send the compressed data out over the Wi-Fi. Option 3 was to wait for encode on the next generation CPU that would go into Huron River platform. From the standpoint of the PC OEM, Option 3 was the immediate choice because it required no additional costs, while Option 1 and Option 2 might have an additional dollar cost for purchasing the functionality. It also did not require use of mini-PCI express card slots since notebooks only came with a few standard slots. These slots were often used to tailor the notebook with different geographic market demands such as 3G (e.g., Japan) or Wi-Fi (e.g., U.S.).

Second, they realized their timing issue and what they had to do as Rudy stated, “What we really needed was to get the idea sold [to management in Q3 for PLBP] and to have management understand that it was going to need 10 to 20 people to make it happen.” To provide a sense of resource challenges and headcount requirements, a CPU development team typically consists of roughly 400 people, but even in this, a manager could not fudge his/her numbers enough to fund a 10 to 20 person project. The only way a 10 to 20 person project could come about is from a “special projects bucket” whose funds are controlled by the vice president (VP) and general manager (GM) of PCCG. Tensions arise though between core business product groups and special projects. Core business groups will argue that those additional slack resources should be included in the core group budget because special projects have a 99% failure rate, while even one additional headcount in sales and marketing could close out a multimillion dollar deal for the core group. The VP/GM is then left asking whether he/she is going to give up a multimillion dollar relative certainty for something that is a big “maybe” but that could also be the “next big thing at Intel”.

It was noted that on technical merits UWB was the better radio for the WiDi solution, which is why it was the selection option in the first go-around. However, after PCCG’s decision to go with Wi-Fi as the PAN strategy, establishing a new POP that said WiDi would still go seek a partner for UWB was not good politically and would have been extremely difficult from a resource standpoint. In essence, the WiDi team’s technology options were “jailed” by the CPU and Wi-Fi.
The team began working on their second prototype using a laptop and Intel’s Wi-Fi that was on an Atom processor codenamed “Canmore” (CE3100) – a media system on a chip (SoC). They then demonstrated the system to as many groups as possible to help gain further support and buy-in. As Steve’s technical team learned, “there is nothing like a demo to convince management that this is cool.” Again, because this was still a rather informal team, Rudy and Steve had no direct headcount support. Finding help and then finding more help with groups such as My Wi-Fi, Intel’s graphics (GFX), worldwide sales teams, and platform and ecosystems scale (e.g., Ultra-Mobility Group, Digital Home Group) was essential to consensus building and helped WiDi gain commitment from all ingredients teams. With the pieces in place, the team secured PCCG commitment in early Q3 (PLBP) for a POR 2009 funding to launch with the Huron River platform and encoding on the expected Sandy Bridge CPU. The product line also got its tag name WiDi from one of the marketing specialists.

A Window that Led to a “Whabbit” Customer

While getting on the Huron River platform roadmap could be considered a big success by some, the WiDi team was not satisfied. In missing the window for the Calpella platform and a 2009 launch, WiDi would not enter the market until 2011 at the earliest. Potential competitors were mounting in the marketplace, and the WiDi team believed that the market picture would be completely different in two years time. The team also felt like WiDi’s mission had been to establish a viable way for Intel to gain long-term revenue beyond the PC. However, taking Option 3 – waiting to be built into the Sandy Bridge CPU – meant WiDi was relegated to helping Intel sell more and sell up on CPUs (i.e., if a customer wanted WiDi, they could only get it on the new high-value, high-margin CPU). In other terms, the WiDi team was “put back in the CPU penalty box”. This also would limit their tertiary objective of establishing Intel’s technology and market leadership in wireless display, as well as WPAN.

72 Intel culture is dominated by the PowerPoint method of communication, but the live demo of WiDi was so powerful that the team used it in all of their presentations, especially with management, external partners, and customers.
73 Cross-group buy-in and collaboration was necessary to ensure acceptable performance levels and compatibility both of wireless display and other platform features.
Fortunately, a window of opportunity opened when the Calpella platform was delayed until early 2010 from its previous mid-2009 launch. The WiDi team immediately focused on three questions that would need to be answered in order to get WiDi back on the Calpella platform: (1) How could WiDi be run on the Calpella platform? (2) How are we going convince management to include WiDi on Calpella this late in the game, particularly since we were just approved for Huron River? And (3) How are we going to convince the PC OEMs to make the change as well? After the difficulties of simply getting WiDi included on any product roadmap, the team knew this would be a major feat, all of which had to be done in the last quarter of 2008. Until then, all work in 2008 had been for the Huron River platform, which the team would have to continue; so, they would be on double-duty.

Question 1 was actually started with a WiDi demo development, which was prior to the announced Calpella delay. Steve’s “skunkworks” engineering team was developing a software prototype for WiDi using the existing Nehalem CPU architecture and found the performance to be well beyond expectations. This meant that the Arrondale (next generation CPU based on the die shrink of Nehalem) for the upcoming Calpella mobile platform could potentially run a soft-encode at 720p, i.e., the processor was fast enough that encoding could be done in software (instead of hardware), which could then be routed back through the system and out the Wi-Fi transmission. The WiDi team had initially spec’ed the solution at 1080p for HDTV, but they believed 720p would be acceptable. The engineering team had convinced Rudy that this was worth taking back to management when the delay in Calpella was announced. As Rudy stated,

“We thought its [720p] still HD, and the market will still accept it. No sound though, no video output protection, little 8 pt found on all of our marketing to wiggle around some feature gaps, but it works. What we said [to management] is that if you can make it easy, we don’t think the consumer cares about some of these features as much as us technologists and the technologists at our OEMs…”

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74 Soft-encode is the use of a software solution for processing a new feature versus having the process built directly into the hardware. Performance is often higher in a hardware solution, but the software solution is more malleable and does not require as long a development lead-time, which means it can be added or adjusted more easily at later stages of development.
Because when you go talk to the PC OEMs, they have their own set of architects and they are all purists. And if it were up to them nobody would ever ship anything because it never works ‘good enough,’ and just wait two years because in two years something better always comes out.”

The technical solution was there but Questions 2 and 3 were now the immediate concern. Question 2 required the team to think about Intel and PCCG’s priorities. As Rudy laid out in a set of retrospective slides on the team’s thinking at the time, Intel is (1) a processor company – this is how we get paid today, (2) a platform company – this is how we sell up, and (3) an experience company – future to be created. This led to telling the processor and platform story: “Intel WiDi = Intel CPU Media Engineer + Intel WiFi”. They also told a second story about creating a new revenue stream: “Intel WiDi = $X per unit royalty on adapters”. With these stories in hand, the WiDi team was able to establish the overall need and value for WiDi in the eyes of PCCG and Intel. They also had to figure out who within Intel would own the WiDi product group given that its development had cut across multiple groups. Working between groups was actually becoming hazardous because the WiDi team was not initially included in a few key decision-making meetings, and they also had the issue of drawing informal support from groups that already compete within Intel and now might compete over WiDi revenues. Convincing all of the different ingredient supplier groups within Intel to come on board was still going to be challenging since most had already closed their Calpella plans. The other issue was going to be convincing the PC OEMs.

Luckily, the answer to both Questions 2 and 3 came in the form of a “whabbit” customer:

“Whabbit; noun, a conjunction of whale and rabbit meaning a customer who is both big enough to influence others and passionately aligned with your agenda.”

– WiDi Team

Intel’s Whabbit customer was Best Buy. A PCCG executive working in the consumer space had informally talked about the WiDi concept to a VP at Best Buy (Q4.2008) and received a very

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75 Actual dollar number removed for proprietary reasons.
positive response. A prototype demonstration was quickly set up after which Best Buy executives immediately asked to have it added to their exclusive “Blue Label” laptop promotion, even at the 720p – a 2nd generation promotion that was aligned to launch with Intel’s Calpella platform. The electronics retail giant then exerted its influence and requested the PC OEMs to include WiDi for their Blue Label 2.0 (and Calpella) launch.

Seeing that a one year pull-in was possible on Calpella, the WiDi team redrew the plan to launch a first product with Calpella in early 2010. The team then realized that with only 720p and none of the other bells and whistles, “ease of use” would make or break the product with consumers. A human factors engineering expert was brought onboard in late 2008 to ensure the UX would be right. Further prototypes were developed and piloted with 40 consumers.

All of this was done by early 2009. At CES 2009 (January), Rudy and the team snapped a picture of a wireless billboard by WirelessHD who was a competitor (see Figure 4.9). This reiterated the team’s urgency for getting the product to market, as well as validated the general need and integrity of the idea.

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76 Best Buy’s Blue Label was an initiative to do user research and spec a special set of features. They would then commit to PC OEMs to sell those features for one year as a way to incent them to meet the spec. Blue Label would also be an exclusive with two or three OEMs (versus the ~30 that are on the shelf at any given time) and those devices would be advertised on TV and highlighted in the Best Buy stores. This is a unique program because retailers often think on the 3-4 month time horizon associated with the retail cycle (e.g., Holidays, Spring Refresh, and Back-to-School), which is not nearly long enough for Intel or PC OEMs to commit to developing new technical features or devices.

77 Developing consumer-ready prototypes and conducting user testing is not the norm for Intel. WiDi’s testing was organized by the human factors engineer, but an outside vendor was used to design and conduct the actual pilot tests.
At the end of Q1.2009, Rudy moved out of his role as a strategic planner in MPG to become the product line manager for WiDi and Steve the lead architect. An official cost center was also created and headcount for the program quickly ramped up to over twenty heads. The remainder of 2009 was mainly execution of the plan, which included another prototype, as well as extensive development of the marketing and sales team. It also meant lining up the PC OEMs and a partnership with NETGEAR® to brand the TV receiver. Figure 4.10 is a timeline overview of WiDi created by Rudy Cassidy.
Launch and Fanfare at 2010 Consumer Electronics Show

Intel launched WiDi at the Consumer Electronics Show (CES) in January 2010 with great fanfare. It won cnet’s Best of CES 2010 Award and Popular Science’s 2010 Grand Award in Computing. Anandtech said, “…Intel calls it a game changer. I call it the best thing I’ve seen at CES… The demo worked flawlessly when I saw it… It’s amazing Apple-like…” (2010, January 7). PC Magazine said “…this could very well be the hottest sleeper technology of the year” (2010, January 9). And similar accolades came from another half dozen or more computing technology and consumer electronics media outlets and reviews. During the 2010 Super Bowl – the most watched TV event of the year worldwide – Best Buy launched a commercial that highlighted WiDi as the key distinguishing feature of the Blue Label 2.0 promotion.

While the 2010 WiDi launch was a limited version, the originally planned features were later built into the Sandy Bridge CPU and launched with the Huron River platform in 2011, including support for 1080p, Blu-rayTM playback, and surround sound. Additionally, the team continued to add headcount in 2010 with over 30 direct reports and growing. They also increased the
number of computing devices that support Intel WiDi by enabling many 2nd generation Intel®
core™ processor-based laptops and select upcoming Intel® Atom-based Netbooks, as well as the
range of connectable devices (see Figure 4.11 for examples).

![Figure 4.11: Future vision for WiDi capabilities.](image)

Internally, WiDi also received significant accolades and attention from senior executives,
particularly the VP/GM of PCCG and the PCCG’s lead strategic planner. Primarily, the case
became an example of Intel’s efforts to become more UX-oriented and was touted in numerous
internal events and communications, including an internal “innovation lessons learned” forum.
Developing the UX pitch from a business standpoint would be critical for convincing the OEM
technologists, the “purists,” that this solution would sell in the market (as well to be able to sell
in the market!).

As of this writing, Rudy Cassidy noted “Intel® WiDi-based laptops have enjoyed a very rapid
adoption in the market during the past two years [since launch in early 2010], expected to pass
the 20 million mark by the end of 2011.”
4.3 ANALYSIS AND DISCUSSION

The WiDi case illustrates the concept of innovation frames in action, particularly how individuals of the WiDi team were able to actively (re)construct their own frames, construct shared frames, and influence the predominant frame of the firm. Collectively, this provided the team with the agency to create a disruptive technology and new business for Intel. The case is a first-hand example of the bottom-up strategy proposed in the L’oer Model. Analysis of the key framing dynamics and implications are discussed below, including a summary on the WiDi team’s innovation frames.

4.3.1 WiDi Team’s Innovation Frames & Those of the Core Business

The two main characters, Rudy and Steve, each possessed their own innovation frames. Through their ongoing interactions and negotiations, they created a shared frame around WiDi. At the team level this was important because awareness of individual frames was equally as important as the shared frame because through this understanding they were able to manage conflict and direct each other toward the other’s expertise. Tensions with Intel’s core business further provided points for comparison between the WiDi frame and that of the core business. Such awareness enabled the WiDi team to then manage the integration of WiDi into the core business, and in fact, leverage the inertia of the core business as an advantage over other potential competitors. Using the three predominant innovation frames and nine framing structures identified in Chapter 3, Table 4.1 captures some of the differences both within the WiDi team and in relation to the core business.  

To provide a few examples in more detail, the skills that the WiDi team deemed important varied significantly because it required an integration of multiple technologies that prior to the WiDi team existed in separate business groups or not at all. The team required the technologic know-how in relation to the CPU platforms Calpella and Huron River. They also “borrowed” expertise

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78 I chose to present Table 4.1 at the team level to demonstrate the interactions between individual WiDi members and each other, as well as their interactions with the broader firm. Illustrating each individual person’s innovation frame and changes over time would require a scale and scope that extends beyond the feasibility and space of this dissertation and data sources.
from the NBI UWB team, My Wi-Fi, chipsets, and software engineers, as well as a human factors engineer, to create the wireless capability. From an economic lens, Rudy knew he would have to keep the engineering team coordinated along the formal planning processes that CPU and platforms followed. Rudy and Steve each brought unique but overlapping perspectives of the humanistic problem: Rudy using formal MSA and World Map and Steve drawing on personal experience. Rudy’s original role in SSG and then as a strategic planner in PCCG also pushed him to have an emphasis on “usages” and a solutions-oriented focus. Rudy’s tie as a strategic planner to MPG and PCCG also provided him with experience to contrast the frames of WiDi with those of the core business.

Table 4.1: Contrasting innovation frames within the WiDi team, which are visible by comparing across the three predominant innovation frames (technologic, economic, and humanistic).

<table>
<thead>
<tr>
<th></th>
<th>TECHNOLOGIC</th>
<th>ECONOMIC</th>
<th>HUMANISTIC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Skills</strong></td>
<td>Engineering skills and knowledge in CPU design, wireless, software, systems integration</td>
<td>Required an organizing of engineering into an economic and risk management process, group and intergroup management, and business development; an increased awareness of the different players over time made this an easier task</td>
<td>Ability to recognize and validate problem</td>
</tr>
<tr>
<td></td>
<td>New skills were gained and added throughout the development process</td>
<td></td>
<td>The team later recognized their own limitations in this space and brought on a human factors engineer to validate and test their key usage: “ease of use”</td>
</tr>
<tr>
<td><strong>Material</strong></td>
<td>Debates over how to implement: CPU, PC Card, Software</td>
<td>Impacting platform roadmaps (i.e., CPU was 3-5 yrs out, Chipset was 1-3 yrs, Software was 1-2 yrs)</td>
<td>Making it easy to use, easy set-up, ready &quot;out of the box&quot;</td>
</tr>
<tr>
<td></td>
<td>Feasibility</td>
<td>Prototypes vs. ppt. in communicating the vision</td>
<td>Tradeoffs between 720p and 1080p, yes/no surround sound in experience and likelihood to purchase</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Feasibility and risk</td>
<td>Focus on how device will change the consumer’s social experiences</td>
</tr>
<tr>
<td><strong>Seed</strong></td>
<td>Problem solving and testing during prototyping</td>
<td>Market segment analysis and World Map</td>
<td>Personal experience (e.g., engineers)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Searching for new, off-roadmap initiatives and usages</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Demo of prototypes (e.g., for management)</td>
</tr>
<tr>
<td><strong>Incentive</strong></td>
<td>Recognition and promotion for inventing Intel’s next big technology</td>
<td>Recognition and promotion for creating new revenue stream, supporting Intel differentiation, and establishing market leadership</td>
<td>Satisfaction in creating a solution that enabled new consumer experiences and improved overall ease of use and anytime wireless connectivity</td>
</tr>
<tr>
<td><strong>Learning</strong></td>
<td>Technical problem solving, particularly via prototyping</td>
<td>Understanding of Intel's agenda and the ecosystem players</td>
<td>Recognizing the opportunity</td>
</tr>
<tr>
<td><strong>Vision</strong></td>
<td>A technology that will allow wireless transmission of media content from a PC to an HDTV at 720p/1080p, surround sound, video output protection</td>
<td>Establish a viable way for Intel to gain long-term revenue beyond the PC</td>
<td>Create a way for people to share &amp; enjoy media wirelessly that is easy to set-up and portable.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Support Intel’s platform differentiation (sell-up) by enabling new compelling usage models</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Establish Intel’s technology/market leadership in WD as well as WPAN</td>
<td></td>
</tr>
<tr>
<td><strong>Organizational Network</strong></td>
<td>Know where expertise exists in the organization</td>
<td>Know how to &quot;borrow&quot; resources</td>
<td>Know how to obtain the formal and informal &quot;blessings&quot; of senior management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Determine who would &quot;own&quot; WiDi (e.g., cost center) and where resources would come from</td>
<td>Leverage social networks and personal relationships (e.g., Intel executive and Best Buy VP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Understand Intel's cadence</td>
<td>Understand Intel’s agenda</td>
</tr>
<tr>
<td><strong>Ecosystem</strong></td>
<td>Identify development partners - who else do we need in order to build the solution?</td>
<td>Know how the different players in the value chain make their technology decisions</td>
<td>Know the direction of influence and what motivates the different players in the value chain (i.e., Best Buy, PC OEMs, Intel)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Identify barriers for adoption by partners (e.g., PC OEM technologists)</td>
<td></td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td>Know competing technologies and existing/supporting infrastructure</td>
<td>Know the competitive landscape and timing of market entry and maturity</td>
<td>Recognize the strategic importance of the living room and increasing prominence of digital media</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Awareness of technical standards and standard bodies (e.g., 2002 FCC Report &amp; Order on UWB)</td>
<td>Any time anywhere connectivity is a key user need, as well as ease of use</td>
</tr>
</tbody>
</table>
Material played a significant role in the development of WiDi. From a technical standpoint, the engineering team had to develop a number of alternative paths (e.g., UWB, Wi-Fi, hard encode in CPU) and spent much of their time developing prototypes to prove feasibility. In an example of conflicting frames, WiDi’s initial selection of the UWB solution (because of technical superiority) in the end was a major reason WiDi was rejected the first go-around.

Rudy’s interpretation of material was different from Steve’s as it focused on how to get WiDi on the platform roadmaps. Given the importance of timing (e.g., Intel’s Tick-Tock cadence, pressure to market), Rudy followed a minimum viable product strategy. Specifically, he knew changes to the chipset and software would not take as long as a hard encode on the CPU so he opted for a lower performance, good enough solution that could be launch sooner rather than later, but with the intent that future product generations would improve toward the original, more ideal solution.

The material played other roles such as Rudy’s recognition that prototypes were a much more effective way of communicating the team’s product vision than the typical PowerPoint presentation used in most Intel strategy discussions. From his economic-centered frame, Rudy also forced the technical side of the team to use the prototypes to ensure the feasibility of the solution.

Weaving WiDi’s new competencies and product solutions into the organizational network was another critical issue. From the technologic frame, Steve and the engineering team had to know where various experts existed across the firm. This is no small feat given Intel’s size of roughly 82,500 employees who are scattered across multiple U.S. and international locations (WiDi had team members primarily in the Hillsboro, OR design center and a software group in India). Rudy and other management had to then negotiate “borrowing” these resources given that most early stage projects are not formally funded. Even with the formal “blessing” of senior management, Rudy had to get two senior managers to “work it out” on who would cover what heads, which was apparently quite the sensitive undertaking – people’s livelihood and careers are often on the line, especially as the rank increases.
Timing played another major role in the integration of WiDi into the organizational work. One key lesson noted by Rudy was an understanding of Intel’s cadence. Rudy’s sabbatical during the first go-around left the POPL3 review behind schedule and after PCCG had already allocated most of its resources for the year.

Aligning the *ecosystem* brought forward one of WiDi’s most interesting strategies – circumventing Intel’s traditional customers (OEMs) and engaging with Best Buy, a retailer. By convincing Best Buy in the value of WiDi (from a humanistic frame, using prototypes), Best Buy was able to inversely influence the value chain by asking the OEMs and eventually Intel to make WiDi an immediate priority. WiDi’s use of the Whabbit customer provides one of the strongest examples of how knowing the innovation frames of different partners can shape organizational activity and innovation.

Interestingly, the WiDi team in essence put together three business plans: (1) one for PCCG that would allow them to up-sell the CPU; (2) a second for Intel strategy that aligned with Intel’s strategy in wireless leadership, and (3) a third that demonstrated the long-term humanistic value of WiDi that would gain them buy-in with Best Buy and consumers. The process of having multiple business plans was only manageable and even recognized because of the team’s ability to reflect on their own innovation frames and those of Intel and the ecosystem.

Lastly, the team was willing to go slow in their aim of creating disruption. They recognized that disruption was more a point of view than a specific technology and that creating such meant following what could be thought of as an incremental disruption versus a big bang theory. Not until well after the product and competencies had been established was WiDi heralded by Intel management and the market as disruptive.

### 4.3.2  The Before and After Shots: Rise of the Humanistic Frame & New Competencies

“Silicon no longer moves markets. The markets move silicon.” said a tech industry analyst during an internal conference at Intel in 2010. Intel and the technology industry have been
undergoing a transformation over the past decade or more toward a consumer-centric model, with UX being a central driver. These capabilities, enveloped in the humanistic frame, have not always existed at Intel, nor were they always a competency driven from Intel’s senior management. In fact, while senior management recognized its importance at times, it continued to prioritize the technologic and economic frame over the humanistic (e.g., 2005 reset to the core microprocessor business). WiDi was challenged on five main fronts in their promotion and use of the humanistic frame, which are summarized in Table 4.3.

Table 4.3: Summary of organizational challenges WiDi team faced, particularly in relation to the humanistic frame.

| Culture | • Intel thinks horizontally, while WiDi required vertical integration  
|         | • Associations, language and incentives revolve around technology, not the user experience  
|         | • WiDi had limited experience and conceptualization of UX; had to bring in human factors expert  
|         | • Driving new technology from a UX-orientation was not the norm for Intel |
| Strategy, Business Model, & Ecosystem | • Intel’s core business revolved around developing microprocessors (i.e., technology components), while WiDi required a complete solution orientation  
|         | • WiDi had to satisfy the existing business model of upselling the CPU and as a strategy for Intel’s leadership in wireless technology before it could consider developing its own revenue stream  
|         | • WiDi required a restructuring of the ecosystem network, creating new partnerships, and most importantly, overcoming traditional paths of influence  
|         | • Using a minimum viable product strategy that was driven from the humanistic frame was in opposition to existing practices |
| Organization of Product Development | • Little transfer and validation of UX assumptions across functional silos/PLC phases  
|         | • Incomplete, inadequate and unassigned UX tasks and resources across PLC  
|         | • Start-end points of PLC and “Intel think” are limited to Intel’s horizontal position  
|         | • Overemphasis on explicit knowledge to the detriment of tacit knowledge  
|         | • Limited metrics and measurement of UX in technology and product development  
|         | • The design and prototyping activities that significantly enabled the success of WiDi are not standing capabilities within the existing product development process and organizational network |
| Human Resources | • Design and prototyping resources were not available between POPL1 and POPL2 so WiDi had to gather and develop those informally Inadequate UX resources in business / product groups: Marginalized, continue to reduce, and diluted titles and capabilities  
|         | • Human factors engineers are not standard resources on new product development projects so the WiDi team had to request the headcount and hire an expert |
| Support Systems | • There existed limited design and prototyping infrastructures, which WiDi had to develop and outsource on its own  
|         | • All UX testing had to be outsourced because none existed internally |
The WiDi team had to overcome many of these challenges in order to institute their innovation frame in a way that would allow for the emergence of WiDi. This included thinking more vertically; adopting UX metrics (e.g., ease of use); developing a new business model for Intel and the ecosystem; reorganizing product development planning practices to revolve around UX metrics, not strictly technical requirements; and developing a skunkworks team and using rapid prototyping to illustrate the concept to management and ecosystem partners, an uncommon and unfunded practice within the planning processes at the time. In prioritizing the UX, the team also had to realize their lack of skills in the humanistic space, which led to the hiring of a human factors engineering expert.

WiDi ended up being both a data point and agent in this transformation, which is further visible both in the seed framing structures to what became WiDi’s vision around ease of use, as well as WiDi’s narrative for how new revenue streams could be created within Intel. While Intel’s core business continued to revolve around microprocessors, UX competencies were growing from WiDi and other groups in the firm. In the year following WiDi’s launch at the 2010 CES, PCCG executives began exalting WiDi as a champion of how UX could be used to develop new revenue streams for Intel. Many senior managers touted WiDi in various internal talk, and a year after launch, Rudy was invited to present an internal seminar on innovation lessons learned and the how-to behind WiDi.

WiDi’s impact on the firm demonstrates a broader shift in Intel’s priorities and a rethinking of its predominant innovation frame in relation to creating disruptive innovation. The shift may also be the result of the firm’s increased investment in the humanistic frame as a growing competency. Further work is needed to capture and examine this broader shift. Questions may still be asked though on the relation between the three predominant innovation frames and their shifting prioritization within a firm. Can a firm change its predominant frame, i.e., its dominant logic? Do each innovation frame exist within a firm but at different levels of competency? What is the causal relationship between innovation frames, the dominant logic, and the core competencies of the firm?
4.3.3 Implications and Limitations

The L’oer Model Explained through the WiDi Case

The case is an empirical example of the L’oer Model’s bottom-up strategy. The WiDi team sat in a space between sensing and seizing, where they needed to change the way the firm viewed WiDi in order to have the firm reallocate resources from an existing investment space to the emerging WiDi opportunity. This meant the WiDi team first had to transform the way the firm was organized in order for the firm to sense the new opportunity, particularly as a viable option as compared to the existing business. Both a process of learning and doing, the WiDi team characters Rudy and Steve (1) learned of the new opportunities, (2) acted on those opportunities through which their actions came into conflict and contrast with the existing CPU business, (3) learned from those conflicts and contrasts (i.e., reflected on their own innovation frames and those of the firm), and (4) acted again by reorganizing and redoing their approach in a way that integrated those learnings and that enabled the successful convincing of senior management on the viability and potential of WiDi.

While these acts of learning and doing were occurring, the WiDi team was in fact was creating a new set of competencies, along with a new technology. An integration and reconfiguration of traditionally separate people, processes, and resources within Intel (e.g., integrating wireless, CPUs, and displays), the newly formed group held not only these new competencies but a new way of viewing the world, i.e., a new group-level predominant innovation frame. In other terms, the WiDi team created a new innovation pathway for Intel that comprised of both a competency (process) and a product (output). From the entanglement view of the firm, the WiDi team untangled aspects of Intel’s existing processes-outputs and re-entangled them in a new way that will allow Intel to compete in the future as leaders both in the existing CPU business and simultaneously the new emerging business of wireless and wireless displays.

The L’oer Model is a continuous cycle though, which exposes the myth of the firm as monolithic. The WiDi case also begins to illustrate how parts of a firm change over time and how those parts interact with each other and the larger complex that makes up the firm; while the
WiDi team was developing these new competencies, it was also changing the very nature of Intel’s core competencies. By changing the way the broader firm “senses” opportunities, senior management then took ownership of such sensing and furthered the cycle on their own and separate from WiDi. Specifically, while WiDi was a catalyst for larger changes in the firm, senior management began following more of a top-down strategy, where they continued to allocate resources toward developing UX-oriented competencies. Thus, the WiDi case begins to demonstrate how the multiple strategies overlap and interact with one another over time. The WiDi team took a bottom-up strategy, which in part led to senior management initiating further top-down strategies. An interesting question would be to follow-up in time to see how the firm’s top-down strategies may instigate further bottom-up strategies, and more interestingly, the underlying catalysts to those changes and the role that innovation frames play in those activities.

Theoretical and Practice Implications of the WiDi Case

Analysis of the WiDi case leaves many implications both for theory and practice. Theoretically, the narrative of the method demonstrated the dynamics of innovation frames in practice, along with the role of predominant innovation frames and framing structures. Time in its many forms also played a heavy role in determining the pace of change, providing moments of contrast and reflexivity, and enabled strategies for absorption and coupling of WiDi into the core business.

An important theoretical implication of the L’oer Model explained through the WiDi case is that the firm is anything but monolithic. Too often researchers treat the firm as a singular entity, but the WiDi case clearly demonstrates that a firm is anything but singular. The boundaries between the firm and environment also blurred as the WiDi team leveraged their Whabbit customer to reshape the power dynamics of the ecosystem. Theoretically, the case lends credence to both the L’oer Model and entanglement view of the firm, and how innovation frames make visible the link between individual interpretations and actions in such a way that can reshape the broader organizing activities of the firm. Further discussion on the theoretical implications of the WiDi case in relation to the L’oer Model and the entanglement view are discussed in Chapter 5.
Ambiguity appeared to play a major role in how firm members negotiated their shared frames. This occurred at multiple levels as well. For example, Rudy and Steve’s management of WiDi enabled Steve the flexibility to develop a solution, while Rudy integrated it into the Intel’s formal planning processes. Rudy’s management and integration of the multiple narratives that surrounded WiDi is another example, where WiDi’s goal was to be the next great thing at Intel, while PCCG first saw it as a way to up-sell the CPU. Ambiguity was a lubricant for action during periods of uncertainty and emergent behavior, which is similar to the other new and emerging findings in new technology development (Leonardi, 2011a) and in contests of strategic negotiation (Kaplan, 2008b).

Methodologically, the WiDi case has all the inherent limitations of any case study (Yin, 2009). However, in this situation, creating the link between individual actors and the firm required a combination of many narratives. Future research may seek new ways to explore multiple narratives simultaneously. Also, there may have been other underlying and deeper structural elements at play that still remain invisible to both the actors and the researcher. In time those factors will hopefully become obvious.

As the researcher, this case began with my immersion in the workplace of Intel. However, I did not know WiDi was of such relevance until someone else brought my attention to it. In this sense, I was lucky. What would be interesting would be to examine the cases I was not turned to – perhaps those that failed or who were successful but in ways that were interpreted as “less disruptive” and thus deemed less important by those looking to insight change.

In conclusion, this chapter demonstrated how simply having a good idea is not enough to innovate. Neither is having good leadership, a strong vision, or extensive resources. Holding the assumption that innovation’s paradox can be solved simply by splitting two binaries couldn’t be farther from the truth. Rather, managers seeking to innovate within an establishment must be capable of managing the invisible obvious – seeing how people’s interpretations shape the organizing both of what they see and what they do, as well as how what they see and what they do shapes those interpretations. The WiDi case begins to show this sociomaterial entanglement,
and most importantly, draws attention to the role(s) of time in untangling those moments by providing opportunities for reflection and agency.
CHAPTER 5
MANAGING THE INVISIBLE OBVIOUS

The following chapter (1) discusses the theoretical and practice implications of the arguments and findings presented in Chapters 2, 3, and 4 (see Table 1.1 for a summary of the key arguments and findings) (2) reviews the methodological limitations and other questions related to the larger dissertation study, and (3) in conclusion, returns the final conversation of the dissertation to innovation’s paradox and managing the invisible obvious.

5.1 IMPLICATIONS FOR RESEARCH

Innovation’s Paradox

Introduction of innovation’s paradox as the central concern for strategic management is not a wholly new idea as Teece et al.’s (1997) original concern was to address how firms navigate rapidly changing environments. However, the array of fields contributing to this concern is broad. Embodying decades of research from multiple fields into a single term makes two contributions. First it acts as a melting pot and enables the cross-pollination of ideas and potential solutions from these often disparate intellectual communities. Some scholars may argue this an oversimplification of the phenomena and loss of the idiosyncrasies of individual fields, but just as in product development, innovation within the academic field comes when the most unlikely are merged and new connections and conceptualizations created. A second contribution that emerges is the clear articulation and validation of the central problem currently facing scholars and practitioners alike. Knowing the right questions to ask is just as much if not more important than finding the right answers.

Reexamining Dynamic Capabilities

I believe the reexamination of dynamic capabilities from the alternative perspective of social practice theory is a second contribution of this dissertation. Identifying the underlying suppositions of dynamic capabilities at an ontological level provides researchers with a common
An Entanglement View of the Firm

The tenants of social practice theory brought into question the very nature of the firm. In alternate to resource-based and knowledge-based views of the firm, I proposed a view of the firm as a sociomaterial entanglement – a third core contribution of the dissertation. An embodiment of this view, the L’oer Model illustrates how people (knowledge, interpretations, actions) and technology (financial and physical resources) are entangled over time as the core competencies of a firm. In turn, a firm’s competitive advantages come from these core competency entanglements. Those core competencies can also be untangled through reflexive action and rewoven along new emergent paths.

A sociomaterial entanglement view of the firm implies another key reexamination – that of resources. Economic theory and the resource-based view are rooted in particular assumptions on what a resource is, with the central assumption and criticism that resources are static entities. The dynamic capabilities view sought to overcome this criticism by suggesting a meta-like capability (Ambrosini & Bowman, 2009; Bowman & Ambrosini, 2003; Teece, 2007; Teece & Pisano, 1994; Teece, et al., 1997; Wang & Ahmed, 2007; Winter, 2003) that resides within the entrepreneurial spirit of senior management. In contrast, a sociomaterial entanglement view suggests that the VRIN attributes of resources are created in the entanglements of entities. What entangled (relational) resources look like and how they complement or provide a more durable explanation of competitive advantage remain important questions to be answered with further development of the entanglement view and L’oer Model.

The entanglement view enables scholars to re-couple another long-standing divide and dualism within the strategy and management literature. That between the firm and the environment. Specifically, Porter’s (1979, 1980, 1985, 2008) “five forces” model analyzes the environment yet black boxes the role of management and the firm. On the other hand, Teece et al.’s (1997)
dynamic capabilities vehemently argued against the five forces model in favor of highlighting the entrepreneurial manager. Both are valuable positions though, and recombining them is a necessary step for truly understanding the nature of competitive advantage and wealth creation. The entanglement view provides a new platform for exploring that re-coupling because the boundaries of the firm are situational and the firm and environment are intertwined, where they mutually shape and constitute the other.

Along these same lines, the entanglement view explains that a firm’s resources lose their VRIN status over time because the relationship between those resources and the environment changes. In fact, the very wealth that a firm creates reshapes the entanglement of the environment, which in turn reshapes the value of the firm’s resources. For example, during the 1990s Intel’s VRIN resources enabled the firm to create the platform that has become the Internet. However, growth has shifted from building the platform to building on top of that platform (e.g., software applications, mobile devices), which requires a new set of resources and core competencies. In short, Intel’s VRIN resources created its stellar growth but their entanglement kept Intel from diversifying and better handling un-ordered change.

An entanglement view of the firm opens a number of new research questions, which become more salient in application of the L’oer Model. The first is in regards to the relationship between strategy, innovation, and organizing. To date, much of the management literature explains innovation from an input-process-output (IPO) model. The implication is that firms believe innovation occurs by hiring the right people and providing them with the right resources (inputs). These people and resources are brought together (processes) to create something innovative (output). In contrast, the WiDi case showed new competencies and innovative outcomes to emerge simultaneously, not serially. A chicken-and-egg problem if viewed from the IPO model, alternative explanations are necessary if scholars and practitioners are to develop more effective practices.

The same goes for the imbrication between the multiple strategies suggested by the L’oer Model. No strategy is implemented in isolation. The WiDi case briefly demonstrated this in the overlap between different innovation strategies. The team’s bottom-up innovative capacity led to senior
management’s top-down transformations and adaptive capacity, and back and forth over time. An interesting question is, how do the different pathways interact and become entangled over time? Burgelman’s (2002) classic work on Intel from a corporate level would be an excellent case to reexamine for this problem of imbrication because it presents Intel’s many strategies over time, some of which were top-down, while others emerged from within.

The existence of multiple overlapping innovation pathways implies the need to reconsider the role of intent. Helfat et al. (2007) argue that intent is a basic requirement in the definition of dynamic capabilities. Intent implies a goal-orientation of the actor, yet with multiple overlapping pathways, there are multiple overlapping and often conflicting goals that exist simultaneously. What is the implication for how scholars think about goals, particularly as modern production environments are often distributed geographically and temporally? Strong shared goals are thought to significantly reduce incongruence, but ambiguity acts as a lubricant during periods of uncertainty and un-order (Leonardi, 2011a). Ambiguity appears to be a desired factor in certain states, not reduced. How intent and ambiguity come together over time and in different states is another key area for future research.

Similar questions arise in regards to corporate and team vision. One of the nine framing structures, a strong shared vision is often cited as a key factor in organizational success. What does a vision look like during periods of un-order though? Is a vision even appropriate or does it constrain the flexibility and adaptability of a firm and its ability to untangle itself? Multiple visions seem to exist simultaneously as well. Which is correct? Or are multiple visions the norm and in fact necessary for adaptation and flexibility?

Lastly, the entanglement of the L’oer Model suggests that truly disruptive innovations do not originate at the “fuzzy front end” of innovation, i.e., the first stage within the popular Stage Gate model (Cooper, 2001); rather, disruptive innovations can emerge at any point but they require the reformulation of the nexus between strategy, innovation, and organizing. Suggesting that disruptive ideas form in this early “fuzzy” stage, are down-selected, and funneled into product and manufacturing stages is analogous to putting old wine into new bottles and believing the wine will taste significantly different (see Figure 5.1). The funnel process is already a part of the
firm’s existing competencies, which stand in contrast and as barriers to the emergence of disruptive innovations. WiDi did not emerge at the fuzzy front end, but from people already embedded in the existing process. However, it did require not only a new technical product but a new strategy, business model, and competencies, all entangled in a new organizational form.

**Figure 5.1: Fuzzy front end within the stage gate model.**

Innovation scholars will need to rethink the term fuzzy front end, particularly in light of Kurtz and Snodwen’s (2003) distinction of order vs. un-order. The term “fuzzy” suggests that extensive analysis can bring clarity to the space, and the term “front end” assumes that firms simply need to “shift left” their attention. Neither term seems an accurate representation of the phenomenon of disruption.

The sociomaterial entanglement view of the firm presented in this dissertation is still very much an infant in its development, but with further theoretical and empirical development could be a valuable complement to other views of the firm. Given the increasing turbulence between firms and the environment, views that incorporate the fluidity of boundaries and multiple identities will be critical. The entanglement view is a promising approach.
Social Practice Theory

Social practice theory laid the foundation for reexamining dynamic capabilities and creating the L’oer Model. It also enables a fourth core argument of this dissertation, which is that interpretation should move to the forefront of scholarly conversation, particularly in the areas of strategy, innovation, and organizing. No longer should it be relegated as secondary, considered a bias, or there to fill the error term of variance models. The role of innovation frames in the L’oer Model contributes direct empirical evidence for this argument.

Social practice theory, and particularly framing structures, brings greater attention to the intricacies between the social and material. In fact, ontologically the two are inseparable as signified in the use of the term sociomaterial (Feldman & Orlikowski, 2011; Orlikowski, 2005, 2006, 2007, 2010). The role of materiality in organizing was clear in this dissertation, as represented as one of the nine framing structures. It was also evident in how the predominant technologic innovation frame of Intel was reshaping itself over time from being solely focused on hardware to that of software, and the implications of this change on the organizing assumptions and patterns of the firm. Connecting the studies of technology, where sociomateriality first emerged as a concept, to broader theories of organizing and innovation would be a fruitful path for further theorizing. This will be particularly important as the mobility and general pervasiveness of information technology continues to proliferate throughout people’s work and life. Changes in the past decade alone to the boundaries of the firm (e.g., crowdsourcing, virtual organizations) and the way people socialize and communicate (e.g., social media) are dramatic. As technology reshapes these boundaries, other questions come to light such as how will the nature of the predominant innovation frame be reshaped? How can the learnings from framing dynamics be incorporated into technology to better improve the capabilities of the firm and innovation in general? In summary, social practice theory is still in its infancy in relation to the relative impact it might have on the fields of strategy, innovation, technology, and the science of organization.
L’oer Model

Introduction of the L’oer Model’ is a fifth core contribution of this dissertation (see Figure 5.2). A paradigmatic reformulation of dynamics capabilities, the L’oer Model explains how a firm’s core competencies can be managed during both periods of order and un-order. It also visually explains the firm as an entanglement of activities and how innovation’s paradox plays out in practice. Specifically, the cyclical nature of the model depicts the relationship between the core activities of sensing, seizing, and transforming and how the relationship between activities leads to the self-renewing, self-reinforcing processes that occur as a firm increases its productivity gains. It also illustrates why it is so difficult for a firm to change course during periods of un-order – because each activity feeds into the other so that the existing organizational form in fact shapes what a firm senses. How to manage or govern this cycle then becomes the central question for the firm.

Figure 5.2: The L’oer Model.

The L’oer Model begins to explain the multiple pathways of innovation, which are not exposed in the original dynamic capabilities view because it limits agency to senior management. Three main innovation strategies are predicted around each of these paths, as well as weak points, a firm faces during periods of un-order. The (1) Top-Down Strategy suggests that senior management has the ability to innovate and change paths by reallocating resources and determining new business models (i.e., seizing). This may be most closely associated with
mergers and acquisitions or the creation of new business groups. Equally so, the top-down link suggests that senior management may be blind to un-ordered change because the existing form of the firm feeds their sensing processes. Unless senior management is able to change how they are organized and how they interpret opportunities, they will be unable to direct the necessary changes. An interesting question that arises is how can senior management reshape the interpretations of its employees when it does see a new opportunity? Studies in leadership, organizational change, and organizational culture might lend nicely to addressing this question.

The (2) Bottom-Up Strategy is associated with the everyday entrepreneur who is embedded in and entangled with the firm. This thinking is more in line with observed cases of innovation, where most novel ideas emerge from the bottom-up. It is those employees working the frontlines who are in the best position to see and match the changing problems of the world with the competencies of the firm, especially since they are part of those competencies. The WiDi Case Study (see Chapter 2) is evidence for the bottom-up strategy. For other everyday entrepreneurs, the challenge is to change the organizational form in a way that influences how senior management senses opportunities and in turn, allocates resources. Interestingly, this explanation of innovation may align more closely with Schumpeter’s (1934, 1942) idea of the entrepreneur as the “gale of creative destruction” than that in dynamic capabilities, the entrepreneurial manager. For Schumpeter, senior management’s role was to invest in R&D, while the entrepreneur was the everyday R&D employee.

The (3) Crisis Response Strategy provides a valuable explanation of a third and oft discussed pathway because it is one that tends to lead to further decline. Gilbert (2005) explains that during periods of crisis firms often release their resource rigidity but increase their routine rigidity. In short, a new business group may be created in response to a market crisis, but it carries with it the old organizational practices that are no longer appropriate for addressing the new crisis. The result is an escalation of the crisis for the firm. To address this issue, the L’oer Model suggests that firms in crisis need to change the way they make sense of the crisis (i.e., as opportunity) and to learn new organizing practices. A key to this transformation may be unlearning (Tsang & Zahra, 2008). First, though, unlearning requires an awareness of those assumptions, expectations, and knowledge – innovation frames – that drive existing practices so firms know which to
change. To learn quickly during periods of crisis (extreme un-order, i.e., chaos), firms may seek to apply the notion of fail fast and often. Integrating the L’oer Model, innovation frames, and organizational learning (Argyris & Schon, 1978; Dunford, Steane, & Guthrie, 2001; Senge, 1990) is an important avenue for future theoretical development.

The L’oer Model’s multiple strategic pathways also allows it to act as a hanger for researchers to integrate other well established studies on innovation such as adaptive capacity, innovation capacity, and absorptive capacity, all of which have been described as forms of dynamic capabilities (cf., Ambrosini & Bowman, 2009; Eisenhardt & Martin, 2000; Wang & Ahmed, 2007). An important step in advancing the L’oer Model is more closely integrating it with Kurtz and Snowden’s (2003) Cynefin Model, as well as other works on complexity theory and sciences of organizing. For example, enacting the different strategies of the L’oer Model will be highly dependent on the state of the domain, which Kurtz and Snowden discuss within some of their own strategies. Coupling the two models is a valuable next step to follow this dissertation.

Innovation Frames as a Theoretical Construct

A fifth core contribution of this dissertation, innovation frames build on and extend existing work on frames by delving into the increasingly critical area of innovation. While organizational researchers have long studied the roots of innovation, very few have approached it as a sociomaterial ensemble where interpretation plays a central role hand-in-hand with organizational structure and action. Drawing on literature in social practice theory and other areas of socio-cognitive and cognitive structures, innovation frames are defined as the underlying assumptions, expectations, and knowledge individuals hold about innovation. To the question of what is innovation, the answer is that it depends on who is looking.

While innovation frames are individually held, they are part of a broader social fabric of organizing. Through socialization and interaction, individuals link their interpretations and actions around predominant innovation frames – those negotiated assumptions, expectations, and knowledge that lead the collective activities of the firm. These links are formed around different framing structures. These concepts allow researchers to ask a number of useful questions around
the interpretations of innovation: How and at what pace do individual innovation frames change over time? How do innovation frames change in relation to the predominant frame of the firm and vice versa? What instigates such change? What is the impact when predominant innovation frames of the firm shift in relative priority? And what is the relationship between predominant innovation frames and the identity of a firm? Why do predominant innovation frames form primarily around functional groupings and less so in others?

Figure 5.3 proposes an analytic tool for further examining the question of innovation frames. Organized around three framing themes, the figure could be used to position the different predominant innovation frames of the varying business groups and how they interact to create the predominant innovation frame of the firm. To examine the (re)formation of individual innovation frames, researchers could track an individual as he or she moves across these different groups to examine bi-directional influences.

![Figure 5.3: Differences observed across the firm’s business groups.](image)

Innovation frames are particularly useful tools for analyzing incongruence across a firm’s various groups. The struggle of individual innovation frames against those of a firm’s predominant innovation frame also helps explain why firms are so challenged in overcoming innovation’s paradox. While most research on the challenge is focused on organizational
structure, innovation frames provides a new analytic lens for examining the problem and playing complement to provide more holistic and effective solutions. Human cognition and behavior is also often positioned from political, cultural, or institutional lenses. While these lenses focus on power, the innovation frame explains the issue of interpretation which these cannot. It also explains how even the brightest of individuals are biased by their own experience and to no fault of their own. Actions that may seem politically motivated and intentional may in fact be the result of varying interpretation – a harmless and less charged explanation that may help individuals and firms address and overcome the organizational defenses (Argyris, 1990, 2002) that often arise during periods of conflict and uncertainty.

In positioning innovation frames at the center of strategic conversation implies that path dependence may be more of an outcome than a determinant (Kaplan & Tripsas, 2008). While history matters, it only does so in relation to the make-up and structure of people’s innovation frames; it does not “lock-in” a firm to a particular trajectory as supposed in economic theory and dynamic capabilities. Through mindful deviation individuals and firms can change course and rewrite their paths (Garud & Karnøe, 2001). History is also written by multiple actors, and conflict plays a key role in exposing these different histories. Like a Gestalt switch, new historical narratives can emerge from spaces not previously seen. Because the past, present, and future are intertwined, theorizing on the role of narrative (re)formational in relation to innovation frames may provide a powerful means for better understanding change and organizing. New questions should also be asked such as how do individuals and firms rewrite their histories in new ways? And how do alternative histories create new futures? Most work in strategy revolves around rethinking new futures (e.g., scenario planning). How would creating new histories provide a mechanism for creating new futures?

**Framing Structures**

The sixth core contribution of this dissertation stems from the identification of framing structures, which provide not only a foundation around which innovation frames are grounded
Framing structures played a dual role, grounding individual interpretations of innovation, as well as acting as points for sharing those interpretations and the construction of predominant innovation frames. Nine of these framing structures were identified, which may not be an exhaustive list. The situated nature of innovation frames and the single-site methodology of this dissertation leave open a question on the transferability of these framing structures to other contexts. In generalizing to other framing theories, it is likely that the framing structures themselves may hold relatively stable across contexts but the make-up of those structures will vary depending on the industry and sociomaterial nature of the innovation. Further research is required though to better understand the dynamics of framing structures and their variability over different contexts. Framing structures also bring up a number of methodological issues as discussed in Section 5.4.

**Predominant Innovation Frames**

Predominant innovation frames are similar to and an extension of a firm’s “dominant logic” (Bettis & Prahalad, 1995; Prahalad, 2004; Prahalad & Bettis, 1986) – a seventh core contribution of the dissertation. The distinguishing differences it that predominant innovation frames incorporate the interpretations of the broader firm, not simply the management team. Furthermore, multiple predominant interpretations existed simultaneously within a single firm. The implication is that firms not only hold unique patterns of interpretation, but they are not monolithic in nature, nor should they be treated as such by researchers or managers. While brands and company titles may attempt to represent a sole identity, the firm is in fact changing in many ways because in reality there exist numerous individual and collective identities in parallel. Often discussed in the team literature is how to assess a team. Is it simply the sum of its parts, its only as strong as its weakest link, or is a collective and shared identity created? Perhaps it is all three, and more.

Particularly valuable is the identification of the three predominant innovation frames: technologic, economic, and humanistic (see Figure 5.4). Other researchers and practitioners have

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79 A core aim in this dissertation was to examine the entanglement of practice across levels of analysis, and framing structures are a direct result of this examination.
discussed similar ideas. Collins’ (2001) came up with the three circles of the hedgehog concept: (1) what a firm can be the best in the world at, (2) what drives a firm’s economic engine, and (3) what a firm is deeply passionate about (p. 96). While not exact, Collins’ three circles align with the three predominant innovation frames found in this dissertation (1) technologic, (2) economic, and (3) humanistic. Within Intel, there was explicit conversation of a “3 circles model” – technology, business, and UX – but the ability to operationalize the model in practice was incomplete and lacking. The value-add of the three circles presented within this dissertation is that they are rooted in the theory and practice of frames, which provides both researchers and practitioners the tools and mechanics to use the model as an analytic tool for assessing a firm’s driving assumptions, expectations, and knowledge. In short, the contributions of this dissertation ground the “3 circles model” in theory and empirical evidence, making it operational and directly applicable to practice.

**Figure 5.4: Visualization of three predominant innovation frames.**

Understanding the role and influence of the predominant innovation frames is critical to understanding and overcoming innovation’s paradox as they play a central role in directing and governing a firm’s active inertia (Sull, 2009). When firms must untangle their existing inertia, it is the assumptions and commitments of the predominant innovation frames that firms must untangle.
Framing Dynamics

Innovation frames and those of the firm were observed to change over time. While a complete explanation of the framing dynamics that drove these changes is beyond the scope of this dissertation, a number of smaller insights provide starting points for further exploration.

The role of linguistic binaries in the sensemaking and sensegiving processes of firm members was an unexpected but interesting finding. Important activities in any strategic change initiative (Gioia & Chittipeddi, 1991) and for entrepreneurial and innovative action (Hill & Levenhagen, 1995), linguistic binaries illustrate the tools firm members use to enact these processes in practice. Innovation itself could thus be considered a sensemaking and sensegiving activity. When and how such activities occur is an interesting question for future study.

An interesting element of the binary is that it provides individuals with a sharp contrast – a black & white comparison on an otherwise grey scale. Use of the linguistic binaries may be most useful in the earlier stages of concept development, where boundaries are less clear. Individuals often have an “intuition” about an idea yet articulating the idea is often difficult. Employing linguistic binaries may be a useful tool for clarifying concepts in periods of uncertainty and un-order. Binaries also allow individuals to articulate what an idea is not, which is often easier than stating what something is, particularly in ambiguous situations. They are also relational, not absolute – an extension of Weick et al.’s (2005) notion that decisions are made based on plausibility, not accuracy – giving individuals a flexibility to act during ambiguity without requiring extensive analysis and precision.

The concept of necessarily incomplete frames is another interesting finding that also plays on Weick et al.’s idea of plausibility over accuracy. This research suggests that no single, absolute, bird’s-eye view exists of innovation. A complete innovation frame is not theoretically nor practically possible, and for good reason: what does a complete frame look like in an un-ordered state? By remaining necessarily incomplete, innovation frames maintain a level of flexibility and adaptability. This stands in stark contrast to rationalist perspectives that believe an optimal point or frame exists; that there is an underlying order and predictability to the world. While this may
appear true in ordered states, un-ordered states clearly show this to be temporary. An important
and unanswered question is how individuals move back and forth between seeing things in the
world as facts versus assumptions. Understanding this phenomenon is critical to understanding
how predominant innovation frames emerge, how active inertia builds, how core rigidity is
maintained, and how firms can gain flexible during periods of un-order. In practice, methods
such as strategic roadmapping have begun to make salient these assumptions (Petrick, Ayoub, &
Prindible, in press; Petrick & Echols, 2004), but further work is necessary to promote and
understand the issue. Another strong avenue may come from integration of organizational
learning theories with the L’oer Model, as proposed earlier (Argote & Miron-Spektor, 2011;
Argyris, 2002; de Geus, 2002; Levinthal & Rerup, 2006; Senge, 1990).

Timing plays a central role in the entanglement and untangling of a firm. Firm members did not
freely manipulate their innovation frames or those of others; rather, they addressed each at
different times as situations unfolded. Time came and went in many forms as well – polymodal
temporality. At its foundation, time can be expressed simply as a recognition of change. How
that change is recognized though is a central key to reflexivity and learning, which sits at the
heart of the L’oer Model and enables the possibility for future agency.

Using Van de Ven and Poole’s (2005) four motors of change, the relationship between time and
agency becomes evident. Each motor visibly influences how the actors and groups in the WiDi
case interpreted innovation and how this reshaped their innovation frames and the organizing of
activity, and vice versa. The teleological (i.e., goal-oriented) is visible as the team changed
course from Calpella to the Huron River platforms and again between hard-encoding to soft-
encoding. Each time what WiDi was, is, and could be changed with the changing goals, which
was reflected in how the other framing structures were also reinterpreted. These conflicts with
PCCG’s goals enabled the team to become better aware of Intel’s “agenda” (i.e., as a
microprocessor firm) and to integrate the WiDi narrative to create a shared trajectory for WiDi.
From the life cycle standpoint, WiDi was vetted through Intel’s yearly planning and POP
processes, maturing and even being rejected at milestones and transition to new activities when
moving to new stage of development. When the project was rejected in its first go-around, the
team was forced to reinterpret WiDi in relation to time in a cyclical and deadline form, which
better enabled the team to see and adapt to Intel’s cadence and agenda. The evolutionary motor of change was visible in many instances as well, including the variance, selection, and retention of Wi-Fi technology over UWB and other wireless technologies. Multiple variations of wireless technology emerged during the early stages of WiDi, including UWB, which was the initial selection for WiDi. Ultimately, UWB was not retained by Intel, and Wi-Fi technology survived as the corporate WPAN strategy. The fact that Wi-Fi was already a mainstream item in the personal computer (PC) was also a major factor in the proliferation of WiDi. Thus, the evolutionary motor sheds light on the broader, macro-forces at play that the WiDi team would need to address. Lastly, the dialectical motor was visible in many instances such as the tension in PCCG’s resource allocation between core and non-core businesses, the processes and incentives of Steve’s predominant technological frame versus Rudy’s predominant economic frame, and the balance of timing between ecosystem partners. Each helped WiDi’s members, as well as the firm, recognize the opposing framing perspectives, which enabled them to manipulate and/or negotiate a shared frame.

In summary, the different motors of change act as temporally-driven agents for reflexivity. They also acted to situate agency and constraints in these different moments, which afforded the WiDi team with opportunities to act and to reshape not only their own frames but the frames of others in those temporal moments. Table 5.2 describes the four motors of change and summarizes observations from the WiDi case.
Table 5.1: Summary analysis of Van de Ven & Poole’s (1995) motors of change to explore temporally-driven reflexivity and agency

<table>
<thead>
<tr>
<th>MOTOR OF CHANGE</th>
<th>DESCRIPTION</th>
<th>WiDi CASE EXAMPLE</th>
<th>TEMPORALLY-DRIVEN REFLEXIVITY &amp; AGENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teleological</strong></td>
<td>Change is imminent, cumulative, and follows a single sequence of stages where each stage is a precursor to the next</td>
<td>Team changed goals between Calpella and Huron River platforms, and again between hard-encoding to soft-encoding</td>
<td>Changes in project goals changed other framing structures as well and enabled WiDi team to more clearly see Intel's &quot;agenda&quot; (e.g., goals)</td>
</tr>
<tr>
<td><strong>Life Cycle</strong></td>
<td>Change is the movement toward a goal or end state, where a directed purpose is the driving cause of change</td>
<td>WiDi was vetted through Intel’s yearly planning/POP processes; Rejected/maturing at milestones &amp; transition of activities at each new stage</td>
<td>When the project was rejected in the first go-around, the team was forced to reinterpret WiDi in relation to time in a cyclical and deadline form</td>
</tr>
<tr>
<td><strong>Evolutionary</strong></td>
<td>Change is driven by a continuous cycle of variation, selection and retention</td>
<td>Multiple variations of wireless technology, including UWB which was the initial selection for WiDi; Ultimately, Intel retained Wi-Fi as corporate WPAN strategy and rejected UWB; Wi-Fi as mainstream in PC was factor in WiDi proliferation</td>
<td>Shed light on the broader, macro-forces at play that the WiDi team would need to address such as Intel and PC OEM adoption and leveraging of Intel existing path-to-market for quick proliferation of WiDi into market environment</td>
</tr>
<tr>
<td><strong>Dialectical</strong></td>
<td>Change is the result of a “pluralistic world of colliding events” where two contradictory and opposing forces compete with each other for control.</td>
<td>Visible tension in PCCG’s resource allocation between non-/core business; The processes/incentives of Steve’s predominant technological frame vs. Rudy’s predominant economic frame; And balance of timing between ecosystem partners</td>
<td>Made WiDi team members and PCCG management aware of opposing frames, which enabled manipulation and/or negotiation toward a shared frame</td>
</tr>
</tbody>
</table>

Absorptive Capacity, the Minimum Viable Product, and Incremental Disruption

Time is often defined as a measure of change. How much change can occur within a given time period is equally important; the absorptive capacity of a firm is a critical determinant of change. Scholars primarily consider absorptive capacity in relation to a firm’s ability to recognize and assimilate new knowledge (Cohen & Levinthal, 1990). The WiDi case extends the concept of absorptive capacity to include the incorporation of a new competency and product. The WiDi team followed a minimum viable product strategy – just those features needed for the initial product to be deployed, and no more – for ensuring absorption of both the team’s competency and the new technology by PCCG. Had the WiDi team attempted to integrate anymore, WiDi
most likely would have been rejected. In part, this was why WiDi was rejected on the first go-around.

Considering absorptive capacity in this sense is critical if established firms aim to develop disruptive innovations without separating the emerging group from the core business. WiDi contributes an interesting case in this regard as the WiDi team resided within the boundaries of Intel’s core microprocessor business. The minimum viable product strategy enabled the WiDi product to gain inertia by leveraging the existing core business and in a way that provided the WiDi team with a competitive advantage over other wireless display products: the embedding of the WiDi technology directly into Intel’s existing product and mass distribution channel.

Interestingly, in the case of WiDi, the minimum viable product was determined by the humanistic frame. Even more so, it was done in team that was predominated by the technologic and economic frames. The minimum viable product concept was initially developed for web application development – a way to rapidly test products or features in the market (Ries, 2009, March 29). It deserves significant attention both by scholars and managers and not solely in the web applications sphere. The concept could be particularly valuable in explaining how disruptive ideas gain hold in un-ordered states, or even more interestingly, how disruptive ideas gain hold in ordered states. Further study is needed to clarify the relationship between the minimum viable product and the humanistic frame, but an initial precedence appears to be set.

Two additional implications can be drawn from WiDi’s use of the minimum viable product strategy. First, designs are never done, only due. The team knew not to leave the decision of the final product specifications in the hands of the OEMs because, as Rudy referred to the OEM engineers, they are purists who think a design must be perfect prior to launch. To this day, the WiDi team recognizes that their initial conceptualization of “WiDi” is still numerous iterations away from reaching the market. This theme was repeated numerous times by others within Intel, too, in regards to other well known technologies such as the USB and even CPUs.

Second, the minimum viable product strategy suggests that disruptive innovation is a point of view. WiDi demonstrated that disruptive change does not and cannot occur overnight. Perhaps a
more appropriate characterization would be to refer to this process as *incremental disruption*. By starting small and iterating incrementally over product generations, the WiDi team was able to establish new competencies and create a disruptive innovation within an established firm. Had it been too radical, it is likely that WiDi would have been rejected, as it was during its first go-round. The concept of minimum viable product also appears to be a strategy specific for unordered change. Comparison of the concept across ordered and unordered states is a valuable question for future study. So too is the study of disruption as a point of view, which sits very much at the heart of this dissertation: the concept of innovation frames and managing the invisible obvious.

As noted earlier, this dissertation only scratches the surface when it comes to framing dynamics. Other interesting and necessary questions include how are innovation frames initiated, stabilized, diffused, and institutionalized? How do those of the individual and/or the firm change over time? What might lead to their decline? How do innovation frames become embedded in the routines and technology of the workplace? What is the implication for shifts in the prioritization of a firm’s predominant innovation frames? Addressing these questions of framing dynamics will be invaluable as they are the key to unlocking innovation’s paradox and managing the invisible obvious.

### 5.2 IMPLICATIONS FOR PRACTICE

The practical implications of this research come in two parts: (1) explanations and (2) solutions.\(^8^0\) Much of the research presented herein provides an explanation of key organizational phenomenon. Such knowledge is useful in its own right because it provides practitioners with a better understanding of the situation in which they find themselves. Second, I propose a number of solutions to accompany the explanations. Practitioners may find these solutions useful depending on their circumstances. In both cases, practitioners may find these comments to

\(^{80}\) Some of the practical implications of this dissertation are incorporated within the discussion on theoretical implications. To avoid repetition, they are not repeated within section; so, I point readers searching for more implications on practice to review the above comments on topics such as minimum viable product and incremental disruption.
provide strong starting points for addressing some of the most challenging questions facing today’s firms.

A Shift in Strategic Conversations

At the forefront of both explanation and solution is the need to bring interpretation and the role of innovation frames to the center of strategic conversations. As this research shows, innovation frames are necessarily incomplete and assuming otherwise could be dangerous. Firm members should continuously question their assumptions, expectations, and knowledge, whether the situation is orderly or un-orderly. They should also remember that anything interpreted as a threat may in fact be an opportunity. This is the central message for practitioners, and everything that follows is focused on guiding this questioning.

Innovation Frames as Tools for Managing the Invisible Obvious

Innovation frames, particularly the three predominant innovation frames, are useful tools for examining the assumptions, expectations, and knowledge of the firm and its employees, as well as for performing competitive analyses against other firms and industries. All three frames appear necessary and complementary to one another so recognition of strengths and weaknesses in each is immediately useful. Executives looking to restructure their organizations can use these three innovation frames to guide core changes. Framing structures also provide specific dimensions of the firm around which change can be based. Managing these dynamics is managing the invisible obvious.

Innovation frames are an important consideration during organizational events that depend on diversity. For example, brainstorming is an activity where a diverse set of individuals are brought together in order to develop new ideas. The assumption is that the interaction of different ideas will enable creation of novel and meaningful ideas; however, most brainstorming sessions tend to end in one of two unsuccessful ways. Either the group (and subsequent groups) ends up with the same ideas time and time again, or a new great idea is identified, yet implementation is viewed as impractical in relation to existing products. Explained through the lens of innovation
frames, the first issue is a lack of diversity across individual innovation frames. The second is the result of the group developing its own and new predominant innovation frame that is in conflict with the existing predominant innovation frame of the firm or hosting business group. By recognizing the phenomenon of innovation frames, brainstorming groups can increase the likelihood of gaining novel ideas by using innovation frames, not job titles, to determine diversity. With regards to the second problem, firms can use the concept of predominant innovation frames and framing structures as analytic tools for assessing implementation barriers, as well as potential implementation strategies.

Diversity is also an issue for concurrent engineering and human resources (HR) management. HR practices often focus on job titles, which may or may not reflect an individual’s innovation frame – what this dissertation presents as a key underlying source of diversity. For example, Intel has a low attrition rate because it allows employees to move into many different positions over the course of an individual’s career. The firm also repurposes as many employees as possible whenever a business group or product line is discontinued. During the period of my immersion, Intel was undergoing a significant number of reorganizations, and employees were being shifted into new positions and new titles. As a strong engineering-focused firm, most employees’ held the technological frame as their predominant viewpoint. The result was employees holding titles that did not match their innovation frame. While this was not always a negative, it was identified as a barrier as the firm was attempting to grow the prominence of its humanistic frame (i.e., become more market versus technology driven). For managers selecting their team, concurrency may be limited if membership is determined primarily by job title. The same may be true for general HR practices.

Innovation frames may be useful for issues of incongruence that might arise during transfer and integration events such as mergers & acquisitions, technology transfer, and staged product development cycles. In each case, innovation frames makes clear that transfer and integration events require much more than simply a handoff of technical requirements or the repurposing of employees. It must also transfer those assumptions, expectations, and knowledge associated with other frames. For example, technology development events often transfer only the technical requirements, while assumptions and contextual knowledge are overlooked and lost (this may be
because they are primarily invisible, i.e., intangible). This is a common mistake often seen in the transition between early stage researcher and concept development to the product development stage. This is because those who initially identified an idea and who hold first-hand experience of the intended context of use often do not move with their ideas from start to launch. This is particularly true in larger established firms, where these stages of product development also act as functional buckets, with researchers at one end and engineers and developers at the other. One solution is to transfer people with their ideas. Many firms have begun to maintain “core teams” that work on a product from conception to launch, which ensures the transferability of frames, not simply the product or knowledge. Another solution is to have individuals continually engage with the context of use throughout the product development cycle, which allows all individuals to interpret first-hand the assumptions and context for which they are building.

For start-ups and venture capitalists, innovation frames may be a valuable tool for assessing exit strategies. Established firms are the target of many start-ups firms. By understanding the predominant innovation frames of an established firm, the start-up firms can more easily align their entrepreneurial businesses with potential buyers, as well as ensure the longevity of an innovation if acquired by an established firm. Established firms could also apply these same ideas in reverse. As stated in an earlier chapter, “the most powerful form of entrepreneurship may be the initiation of the cognitive shifts that offer a different typology of the competitive landscape” (Adner & Levinthal, 2008, p. 43).

Innovation frames play a significant role in employee repurposing and reorganization because it provides a means for sharing diverse frames and for creating new predominant frames for organizing. At an individual level, innovation frames may suggest advantages and disadvantages of how an individual might interpret different situations once repurposed. Understanding how innovation frames are shaped and reshaped would also be useful for enabling individuals to better fit new or conflicting positions.

On a second issue of reorganizing, particularly organizational structure, there is often an either/or mentality toward organizational forms, especially between hierarchical and project-based structures. Each posses tradeoffs and a popular response is the matrix organization (although its
effectiveness invites significant debate). An alternative view to organizational design is to manage the tension between structures by continually shifting the design (Henderson, 1994; Siggelkow & Levinthal, 2003). By continually redesigning the firm (versus selecting a single structure), innovation frames are continually shared, contested, exposed, and reconstructed with new and more adaptive designs and with the potential for new, adaptive predominant frames emerging. How much movement still remains a question, but innovation frames reinforce the notion a shift from organization design to organization designing (Siggelkow & Levinthal, 2003; Yoo, Boland, & Lyytinen, 2006).

Lastly, innovation frames could play a major role in framing contests and how senior managers strategize in uncertainty (Kaplan, 2008b). Recognizing both the predominant innovation frame of the individual and group will help eliminate existing assumptions and alternatives. Revolving conversations around specific framing structures could also accelerate learning and the development of shared innovation frames. Employing different framing dynamics such as binaries may also be useful in those contests and the construction of strategy.

*L’oer Model & Framing for Innovation*

The L’oer Model is an excellent starting point for understanding the patterns of the firm, as well as strategies for instituting change. For example, the model better explains the phenomenon of active inertia (Sull, 2009) by illustrating how the cycles that lead a firm to incumbency also lead to its core rigidity (Leonard-Barton, 1992). The WiDi case study provides key learnings about how everyday entrepreneurs can enact change for overcoming core rigidity. For example, the WiDi team used a Whabbit customer, Best Buy, to circumvent the traditional power structure and decision making process of the ecosystem. In doing so, the WiDi team was able to influence the OEMs and Intel managers in a non-obvious but highly effective manner.

The L’oer Model may be most valuable for a firm in crisis because it explains many of the likely reactions a firm may have. The first suggestion of the L’oer Model is to “slow down to speed up”, which means firm members should pause and reflect on their assumptions before hastily moving to reallocate resources. It also suggests that firm members incorporate the unlearning and
relearning that surround innovation frames as a core element in that organizational change, not simply the implementation of structural solutions.

For firm seeking to create disruptive innovations, the findings of this dissertation suggest that good ideas, strong leaders, and financial resources are not enough; rather, management must consider strategy, innovation, and organizing as an integrated activity. Disruptive innovations do not come from the fuzzy front end of a gated funnel but from the early stages of creating new competencies. The key is to enable the co-development of new competencies with the old. The central competitive advantage an established firm has over new entrants is its existing competencies. WiDi demonstrated this on many fronts. One was its ability to directly integrate the technology into the PC. Had WiDi been a separate plug-n-play device, it is uncertain that end consumers would have made the secondary purchase (i.e., PC plus PCI express card). Second, WiDi leveraged Intel’s existing distribution channel and gained significant speed and scale to market that other entrants could not access.

5.3 METHODOLOGY: LIMITATIONS AND CONTRIBUTIONS

This dissertation started with a simple question, namely, what is innovation? In studying various management and organizational literatures, what emerged was not a right or wrong answer to innovation but a set of lenses on how to see innovation. My experiences told me though that there was much more to the question than these lenses were allowing us to see. At the same time, Barley and Kunda (2001) and others called for “bringing work back in”, which was the need for management and organizational scholars to study work in practice. The implication was for researchers to hold to four methodological requirements: to study work from an approach that was (1) multimodal, (2) multilevel, (3) in situ, and (4) conducted over time. I believe by studying innovation in the wild, this dissertation achieved these four goals and met Barley and Kunda’s call.

Such methodological requirements do not act in isolation from the theories that tell us what to measure though. In this case, the use of social practice theory as a guiding lens provided a new host of insights which would not have otherwise been visible had I simply sat onsite for an
extended period of time, employing a more traditional lens. The call for studying “cognition in
the wild” (Hutchins, 1995) is not new, but social practice theory pushes the observer to
incorporate both human agency and material performativity (Orlikowski, 2005). In many
management studies, the only thing that does not seem to matter is matter, yet technology is
often deemed one of the greatest forces of change over the past century (Orlikowski & Iacono,
2001; Orlikowski & Scott, 2008). For this research, social practice theory allowed me to view the
firm as a sociomaterial entanglement – a key theoretical differentiator that made visible many of
the findings presented within this dissertation.81 In summary, theory and method are tightly
interwoven, and I believe the combination found in this research will provide scholars and
practitioners with a new and valuable way to see innovation.

Limitation Considerations

This dissertation is not without its limits. While all the inherent limitations of the various
methods apply, there are a few central issues worthy of special attention. The first is the issue of
competitive advantage. This dissertation cannot claim a clear causal link between the proposed
concepts and long-term firm performance. Because of the complexity of said concepts and the
natural un-ordered way of organizing, this may in fact never be possible. Only against theory
might scholars make such performative claims. On the other hand, I assume that any discussion
on the topic of innovation would be greatly aided if we understood the underlying foundations
between interpretation and action and their impact on organizing, which is the central
contribution of this dissertation.

A second issue is that between context and generalization. The question could be asked, how
might the findings of this dissertation differ if examined in a non-technology context or more
stable condition? In response, I would say that this dissertation primarily sought to generalize to
theory, not to a population. It is through theory that the broader findings of the dissertation are
transferrable to other contexts. This does not mean that such studies should not be undertaken. In

81 While this dissertation discusses the material only in brief, its observation made a significant impact on the
findings. It also played a crucial role as one of the nine framing structures. It is definitely a space worthy of future
consideration and plays a major role in a firm’s organizing activities.
fact, I would be the first to say that further study on innovation frames is necessary in order to ensure both the truth and utility of the concepts.

A third issue arises with the complex methods employed – many data sources, cutting across levels of analysis and business groups, being in situ for over a year, holding multiple positions of observation from participant to actor. While leading to a rich and unique narrative, the approach was exhausting. While extensive techniques were undertaken to ensure both a breadth and validity to the captured data, the process could have been greatly enhanced though the use of multiple researchers, as well as other complementary techniques. By including more primary researchers, a more complete view of the firm’s dynamics may have been possible. For example, such reflection suggests that I hold a humanistic frame. What would researchers with an economics or engineering background have seen? Would it have been different? Complementary techniques such as a survey would have been useful in assessing different personality or environment characteristics that were not visible to a single researcher.

Methodological Contributions

This research contributes to our understanding of methodology as well. First, addressing the four methodological concerns immediately illustrates the value and need for management and organizational scholars to rethink their own research frames – those assumptions, expectations, and knowledge that drive research practices, and more importantly, research findings and theory. While methodology is often viewed as stable aspect of a discipline, it is the most fragile when cutting across disciplines. A major source of intellectual progress will be had through the interdisciplinary researcher, which suggests that the means for comparing, contrasting, and integrating multiple research frames is critical and should be made more explicit. I would argue that research frames are a major barrier to innovative scholarship, and the ability to manage such frames, a valuable skill. The invisible obvious applies just as much to our methods as it does our theories.

Second, this dissertation begins to sort through the methodological issues of social practice theory and ideas of sociomateriality, both of which still lack clear principles for study and
measurement. Excellent in theory, they are difficult to operationalize in practice. For example, how is cause-effect determined in a sociomaterial entanglement? While this dissertation does not directly discuss these issues, it does contribute to our understanding of the concepts by further employing them and by giving old words new meaning such as the use of entanglement as a metaphor for understanding the firm. Clearly articulating the methodological theory and techniques of social practice theory and sociomateriality are a certain and necessary next step in this intellectual space.

Lastly, the linking of individual innovation frames with those firm-level predominant innovation frames exposes another, even more fundamental methodological question: how are we determining levels of analysis (LOA)? Traditionally, LOA is a statistically-based grouping that is bound by an assumed fixed identity, i.e., individual, team, business group, firm. However, social practice theory and the findings of this dissertation suggest individuals and the firm are part of a sociomaterial entanglement that are inseparable and mutually constituting. As previously noted, the firm is not monolithic. Business groups are reorganizing, teams are always changing, and individuals shifting through multiple identities. This dissertation suggests that LOA revolves around interactions via humans and other humans, as well as through non-humans and the environment. LOA is a temporally-based phenomenon, and innovation frames or other forms of “framing” may be useful analytic tools for uncovering the LOA dynamics. LOA as interactions also allows us to ask a number of interesting methodological questions: how can we measure LOA over time? How does LOA as a changing platform of interactions fit within variance theories (Van de Ven & Poole, 1995)? Theoretically, the issue of LOA falls in line with ideas of sociomateriality, where boundaries are temporary and entangled. How does LOA play into these theories? What new methodologies might we need to operationalize and analyze these entanglements?
5.4 A RETURN TO THE INVISIBLE OBVIOUS AND THE QUESTION OF INNOVATION

The test of a first-rate intelligence is the ability to hold two opposed ideas in mind at the same time, and still retain the ability to function.

-F. Scott Fitzgerald, 1936

What is innovation? In returning to this question, we can see that “it depends” on which umpire is making the calls. While a favorite answer to any question, the contributions of this dissertation provide us with a greater clarity on when and how and who. By introducing the concept of innovation frames and its dynamics, we can now see innovation in a new and complementary way. One that depends on the assumptions, expectations, and knowledge an individual holds about innovation, but of equal importance, how those ideas become entangled in the make-up of a firm. Those inconsistencies that were often seen as methodological or conceptual flaws of our concepts of innovation can now be seen as replicable findings (e.g., Barley, 1986; Poole & Van de Van, 1989). Alternative theories, such as those presented herein, may be proposed that assume such uncertainties and dichotomies as commonplace and a natural order of both innovation and the progressive path of science.

These ideas, their assumptions and inconsistencies, are often invisible though to those who practice them, and it is often only with contrast, crisis, or hindsight that they become obvious. Like an iceberg, the tip stands clear for all to see, but be not ignorant as a mass of titanic proportion lay hidden below the water. Collectively, I title this phenomenon the invisible obvious.

A firm is an entanglement of people and technology. Such entanglements make up the core competencies that provide a firm’s competitive advantages. Fueled by success, these entanglements grow and expand into an inertia of commitments. During periods of order, there seems no reason but to fuel such inertia and maintain such commitments. Innovation’s paradox never rests though, and un-order will eventually sweep away yet another generation of establishments. The concepts presented in this dissertation, however, provide useful tools for
making the invisible obvious and for affording the potential to overcome such path rigidity. It may even provide the ability to intentionally drive disruption toward others. While success is never guaranteed, the potential for agency and path creation is granted to the reflective practitioner.

The production environments of today are different than the production environments of yesterday. I hope I have helped further the science of organizing so we better understand why. In addressing the central question within strategic management – how can a firm achieve and sustain competitive advantage over time – I would say that the single take-away from this dissertation is that managing the invisible obvious is the key to the long-term survival of any firm. Perhaps this is why Andy Grove’s quote – “only the paranoid survive” – has lived on for so long and why Intel has been so successful and for so long.82

82 Andy Grove was a co-founder of Intel, CEO from 1987 to 1997, and chairman of the board until 2004. In 1997, CEO magazine chose him as its "CEO of the Year," and Time magazine made him "Man of the Year." During his tenure, Intel’s stock increased 2400%.
REFERENCES


PHILLIP J. AYOUB  
33 Fresh Pond Place, Cambridge, MA 02138  
pja143@psu.edu • www.phillipayoub.com

EDUCATION

**PhD**, Information Sciences & Technology, Pennsylvania State University, 2012  
**MS**, Industrial & Manufacturing Engineering, Pennsylvania State University, 2005  
**BS**, Psychology, University of Wisconsin, 2002

EXPERIENCE

**Intel Corporation**, Portland, OR  

**Perigean Technologies**, Fredericksburg, VA  

**Steelcase, Inc.**, Grand Rapids, MI  

**Boeing Company**, Everett, WA  
Nov 2005 – Feb 2007, Human Factors Engineering Intern, Payloads Concept Center

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