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Service Innovation in the Cloud: Implications for Strategy Development

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***Abstract*--Cloud enterprises have shifted from linear to networked business models through a value transformation process centered on the development of multisided service platforms. These platforms facilitate service exchange and value cocreation by enabling three essential transitions: 1. from control to orchestration of enterprise resources, 2. from internal optimization to external interactions, and 3. from customer value to ecosystem value. Innovative service transformation is most in evidence with enterprises that are native cloud companies or companies that have more rapidly and effectively adopted ecosystem-based service platforms such as Netflix, Google, Facebook, Uber, and Airbnb. Service ecosystems enable the critical processes for value cocreation that is foundational to the continuous development of innovative user experiences. However, many developers and adopters of cloud service business models fail to innovate. This is usually blamed on inappropriate business strategy and/or insufficient technological solutions. However, the root cause is often more basic; specifically, it is the lack of service thinking that is necessary for the development of cloud-based service innovation models. This paper explores the service science foundations of cloud computing and the dimensions of service thinking that inform the service transformation process for cloud-based companies. A framework for the development of cloud-based service transformation is proposed with evidence from three case examples.**

I. Introduction

With more than a decade of increasing adoption of cloud computing, most CIOs and business managers have observed that the cloud is faster, cheaper, agile, elastic, and offers improved resource allocation than legacy computing systems. The cloud has become the platform of choice for service innovations that are disrupting existing markets and defining new ones. The cloud is maturing into a platform for IT services across a wide range of business and consumer functions including marketing, advertising, finance, human resources, production, logistics, supply chain management, infrastructure, AI, autonomous vehicles, drones, 3D/4D imaging, entertainment, social media, and analytics, to name a few application areas. The most far reaching impact of cloud computing is its ability to empower not only IT innovations but its ability to drive that innovation into nearly every industry and personal endeavor in the form of digital services. The cloud is the engine for enterprise and societal transformation.

In 2003, Nicholas Carr provoked considerable debate among IT professionals, business executives and academics by asserting that IT doesn't matter [11]. After more than three decades of high growth in IT investments business executives had come to appreciate the strategic value of information as a primary driver of competitive advantage and strategic transformation through IT-enabled business models. Carr argued that IT was mostly built-out infrastructure of commoditized hardware and software services little different from commodity electricity and water services. IT investments lead to strategic parity between firms, not disruptive innovation. Therefore, there is little expectation for improving productivity or driving innovation through investment in information technology. IT strategy defaults to a defensive "me too" tactics of cost reduction, late adoption of new systems, and risk minimization.

The IT productivity paradox was first identified by Nobel Prize economist Robert Solow in 1987. "You can see the computer age everywhere but in the productivity statistics [31]." The productivity paradox appears to ebb and flow. During the 1990s, IT generated a massive investment and productivity boom, which burst with the Dot.com bubble. Since then researchers have proposed that it takes time to realize a payoff from IT investment. For any investment in hardware and software systems, firms had to invest additional funds on strategy development, process redesign, implementation, and training to begin to see productivity gains. In addition, during the mid-2000s, disruptive technologies, most notably the mobile systems and the digital services paradigm were beginning to disrupt industries and their legacy IT systems. While a case could be made in 2003 that computing power, storage, network technology and many legacy applications had attained commodity status, Carr's view was not of the future. He apparently did not anticipate the rise of cloud computing, big data, AI and the service innovation revolution.

This paper will present the concept of service thinking as a complex mindset that is essential for product-oriented IT[1] companies, their customers and suppliers to instill in their organizations as they transform themselves into cloud-based service innovators. Service thinking is especially important for organizations where the product-focused corporate DNA and culture limits, or precludes, market-creating service innovation

[1] IT as used within this paper is a broad term that refers to information communications technology as it defines an industry ecosystem of various actors that develop, market, and use computers, networking, software, storage, productivity tools, security, and other equipment and services that manage information. This also includes the industry's component suppliers and other supply chain actors such as consultants.

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opportunities. Cloud native companies such as cloud service providers, social media, games, search, online retailers, ride-hailing, and online lodging services are free to experiment with new services that can disrupt legacy product-focused organizations.

In the following sections we present the service science foundations of cloud computing and the dimensions of service thinking that inform the service transformation process of cloud-based enterprises. The paper concludes with a proposed conceptual framework for cloud-based service transformations with evidence from Intel's drone cloud, IBM's Watson Health service, and Microsoft's service innovation strategy.

II. Service Innovation

Innovators generate ideas that are transformed into new products, services and processes that can create marketplace advantage [35]. During the industrial era, productivity and economic growth were largely the result of application of technology to transform natural resources in new ways to create value. Services, if thought of at all, were a low-value afterthought. This bias continues today as some manufacturers, politicians, academicians, and new college graduates view services as incidental to real economic value and 'good' jobs that derive from the manufacturing of products.

This perception is slowly changing as technological innovations have transformed the very nature of services. First, technology, especially IT, has transformed traditional product-focused services by the adoption of modern manufacturing concepts such as customer centricity, division of labor and knowledge, product development processes, standardization, *platformization*, and coordination of production and delivery to enable new forms of value creation and consumption. This is a necessary step to begin to formalize services as independent sources of value. However, the service-as-a-product conceptualization has many of the same limitations as products when it comes to commoditization and value co-creation.

Industries such as retail, hospitality, restaurants, telecommunications, healthcare, transportation, marketing, finance, human resources, education, and the IT industry itself are undergoing a service transformation as cloud computing increasingly enables disruptive business models. IT has enabled the *servitization* of traditional manufacturers as they become providers of services [39]. Apple, the world's largest technology company, illustrates a case where a dominant product company has added cloud-based services including Apple Pay, iTunes Store, App Store, Apple Music, iCloud and Apple Care to its solutions mix. In 4th quarter 2017, the Services division sales rose to USD 8.5 billion, a 35% increase over the 3rd quarter. Services were the company's second largest source of revenue behind the iPhone [23]. In 2017 Apple services generated two times more revenue than Amazon Web Services and three times that of Netflix [36].

IT drives service innovation by enabling the separation of production and consumption in terms of space and time. This separability improves productivity, efficiency, augments social and behavioral change, and provides users with more control over the consumption experience. Furthermore, IT and other technologies broaden the evolution of the service economy through the quickening of new service development that make services more prevalent. Service innovation has become the primary driver of economic growth and dynamism [16].

Disruptive innovation is recurrent in the computing industry [17]. Initially, disruptive technologies, such as cloud services, under-perform legacy technologies in established markets. However, over time new entrants disrupt the traditional firms by redefining the established markets or creating new ones. Service innovation changes industry dynamics by reducing barriers and redefining (or ignoring) industry boundaries in term of rules, regulations, time, organizational culture, and geographic reach. Amazon disrupted the retail industry by redefining the entire retail shopping cycle, expanding geographic boundaries, and reducing transaction cost and delivery time. It disrupted the book market by enabling customers to search and find virtually any printed book and induced user behavior to prefer digital books. Apple disrupted the music industry and the phone industry and Google disrupted online search, advertising, and data-based consumer research. Netflix and other service providers are disrupting cable TV. Uber and Airbnb largely ignored rules and regulations to gain market footholds in their effort to disrupt taxi and hotel services [3].

III. Value Co-Creation

The Internet enabled people to share information on an unprecedented global scale. Highly networked people engage providers of goods and services in a collaborative manner that is fundamentally changing the dynamics of value creation. Customers share their experiences and opinions about product and services. Service providers encourage customer reviews, solicit satisfaction ratings, and utilize big data analytics to understand customer needs and to evaluate customers and employees. Customers desire relationships that impact on user experiences, customer service, product and service design, quality, pricing, corporate ethics, and sustainability, to name a few issues. Users engage with providers and other actors in the service ecosystem to validate their essential role in value co-creation.

However, too often business, government, and other organizations have failed to develop high-engagement, complementary, and collaborative relationships with customers. Such organizations lock into an internally focused goods-dominant thinking of how value should be created and delivered. Goods-dominant thinking is likely a contributing factor to the IT productivity paradox where increased adoption of technology does not produce improvements in productivity or create competitive advantage. IT and other technological innovations provide companies with the operant resources (know-ledge, skills, and technology) that are applied to operand resources (i.e. factors of production such as equipment and raw materials) and other operant resources necessary to develop products and services. However, without the ability to engage

with customers to co-create value opportunities are lost, brands lose relevance, products and services commoditize more quickly, and competitive advantage diminishes.

A. Service Transitions

Service dominant logic (SDL) is a revolutionary concept that transcends the output-based orientation of a goods-dominant logic (GDL) to recognize that service is a process of applying resources (specialized knowledge and abilities) for the benefit of themselves and other actors [53]. Economic activity consists of service-for-service exchange. This contrasts with product-oriented notions of exchange in terms of goods-for-goods or goods-for-money. It is the activities that actors (providers and users) want done for themselves that are the source of value and the purpose of service-for-service exchange [55].

SDL is foundational for understanding the value creation process. As firms shift from analog to digital-technologies the opportunity for disruptive service innovation is apparent. SDL encompasses this shift from product-dominant to service-provider business models where operant resources, especially IT innovations, are driving the rapid growth of high-value service applications. Table 1 depicts the generic characteristics of firms as they transition from GDL to SDL categorized by the four service constructs: service exchange, value creation, resource integration, and actors/service ecosystems. The fourteen characteristics for each instance of the migration from GDL to SDL are not mutually exclusive.

The perspectives of each stage of the transition process provide insight to the status of an organization as an SDL-oriented enterprise. The changes in perspective from GDL to SDL are representative of:

1. The shift of focus from manufacturing products and services as units of output to service as a networked system for co-creating value;
2. The creation of actors' experiences rather than units of output;
3. A firm's offerings are contributions to solutions rather than product features and attributes;
4. A shift from arm's-length transactions to relationships;
5. The migration from value-added to co-creation of value;
6. Service firms do not deliver value, they offer value propositions;
7. Value co-creation is context specific;
8. Service enterprises enjoy economies of *scope*, anything that can be digitized can be customized;
9. Service enterprises exist in a service ecosystem that is impacted by society and the natural environment;
10. The creation and application of operant resources that are dynamic and reusable contrasts with consumption of static operand resources (e.g. factors of production such as machinery and raw materials);
11. *Resourcing* refers to the conversion of resources into benefits as opposed to producing a specific products or services;
12. Actor-to-actor value networks are described as a system of reciprocal service provision among actors: service ecosystem providers, users, suppliers, etc.

TABLE 1: TRANSITIONING FROM GDL TO SDL. ADAPTED FROM [56]

Service Construct	#	Goods-Dominant Logic Characteristics	Hybrid Product-Service Systems	Service-Dominant Logic Characteristics
Service Exchange	1	Goods	Services	Service
	2	Products	Offerings	Experiences
	3	Features/attributes	Benefits	Solutions
	4	Transactions	Touchpoints	Relationships
Value Creation	5	Value-added	Co-production of value	Co-creation of value
	6	Embedded value/Utility	Value delivery	Value proposition
	7	Value-in-exchange	Value-in-use	Value-in-context
	8	Economies of scale: products	Economies of scale: products-services	Economies of scope
	9	Business value	Customer value	Ecosystem/societal value
Resource Integration	10	Operand resources	Operand/Operant resources	Operant resources
	11	Producing	Resource acquisition	Resourcing
Actors and Service Ecosystems	12	Value delivery sequence	Supply chain, EDI, CRM	Actor-to-actor value network
	13	Equilibrium systems	Dynamic systems	Complex adaptive systems
	14	Internal IT systems, client-server	Data centers, SOA, SaaS	Cloud, smart systems, multisided platforms

13. Service ecosystems are complex adaptive systems that are dynamic networks of interactions that can self-organize according to a change-initiating micro-event or collection of events.
14. Cloud computing, multisided platforms, and smart systems are emblematic of the IT technologies that are driving service innovation and hastening the adoption of SDL principles.

Cloud industry professionals and other IT practitioners that are considering or currently pursuing the adoption of service-oriented business models should become conversant with the fundamentals of service-dominant logic and its axioms [54].

- Axiom 1: Service is the fundamental basis of exchange. Service-for-service exchange is essential for value co-creation.
- Axiom 2: Value is co-created by multiple actors, always including the beneficiary. Value is always co-created. Value co-creation results from the actions of multiple actors that contribute to each other's wellbeing.
- Axiom 3: All social and economic actors are resource integrators. Social and economic actors within a service ecosystem are resource integrators in service-for-service exchange networks and networks of networks.
- Axiom 4: Value is always uniquely and phenomenologically determined by the beneficiary. All value is perceived by the beneficiary of that value. Value propositions (value intended) may differ from value perceived. Service exchange may be initiated if, and only if, beneficiaries accept the value proposition.
- Axiom 5: Value co-creation is coordinated through actor-generated institutions and institutional arrangements. Institutions are actor-generated rules, norms, and practices that are aids to collaboration. Institutional arrangements are interdependent associations between institutions. Together they form the basis for governance of the service ecosystem and facilitate actor collaboration for value co-creation.

Collectively, the axioms provide a foundation for SDL-based business strategies. As enterprises move beyond their traditional product-orientations to embrace an active role in creating new markets and redefining old markets they will create service ecosystems where innovative value propositions result from the integration of resources with collaborative actors for co-creating value.

B. Business Model Transformation

Prahalad and Ramaswarmy in their 2004 book *The Future of Competition* defined co-creation as "the practice of developing systems, products, or services, through collaboration with customers, managers, employees, and other company stakeholders [40]." This definition implies that companies can no longer act independently to design products and services or rely on outbound advertising and marketing communications to define customer value. Networked customers and other actors can assert their influence throughout the enterprise and the business ecosystem.

Cloud enterprises have been able to shift from linear to networked business models by developing multisided service platforms [34]. Amazon, Alphabet (Google), Microsoft, Facebook, Uber, and Alibaba became some of the most successful companies by implementing multisided platform business models that facilitate exchanges between individuals, online communities, organizations, and even machines. The platforms enable engagement beyond the provider-customer dyad to engage all actors in the value network. These actors assume roles such as platform owner, suppliers, partners, developers, advertising agencies, employees, distributors, agents, competitors, and shareholders, sometimes simultaneously [19]. Value networks are synonymous with service exchange networks, service ecosystems, or platform ecosystems. Van Alstyne, et al. observe that platforms facilitate service exchange and value co-creation by enabling three strategic shifts that affect the way value is created and enable service innovation [51]:

1. From control to orchestration of resources. "Pipeline" firms, traditional goods-dominant value-chain centric businesses, control a linear value-added process that transforms resource inputs into value-added outputs as products and services. Alternatively, platform businesses enable the exchange of resources owned and contributed by the community of ecosystem actors. These resources typically include financial resources, knowledge, skills, critical relationships, and technologies. The service ecosystem, properly orchestrated, is the core asset of the platform.
2. From internal optimization to external interaction. Traditional goods-dominant firms optimize the organization of internal resources and processes, end-to-end, to ensure the efficient production of products and services outputs at a profit. Platforms create value by facilitating external interactions, specifically the engagement and collaboration between service ecosystem actors.
3. From customer value to ecosystem value. Goods-dominant firms focus on maximizing business value by optimizing customer lifetime value (CLV) which is a measure of the future value of the firm's relationship with a customer. Platforms seek to maximize the total value of the service ecosystem.

Figure 1 shows the market capitalization per employee for several leading IT companies. We use market capitalization, which depicts the market value of a firm's outstanding shares, as a relative measure of firm size, business value generated, and business model risk. Facebook, Netflix, and Google, as pure-play cloud-native service platform enterprises, generate exemplary market capitalization per employee. Apple, a dominant product manufacturer with growing cloud services, generates considerable market cap per employee as well. Amazon generates much less market cap per employee due to its extensive warehouse and logistics footprint to support ecommerce operations. Apple, benefits from its own ecosystem

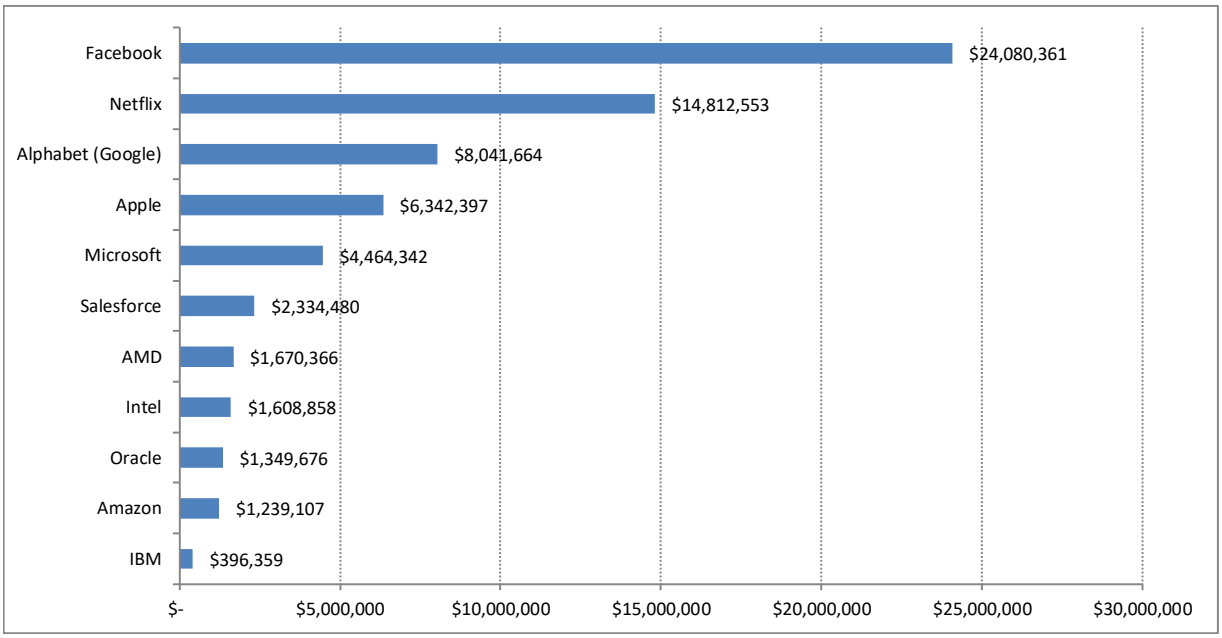

Figure 1. Market Capitalization per Employee, Dec. 31, 2016. Source: Google Finance

of product platforms and software and, most significantly, the highly profitable iPhone and its growing service division.

Digital-platform firms generate more value from the efforts of their employees than other technology companies do. Notably, IBM is a company that is transitioning from a manufacturing firm to a cloud services firm with its deep learning cloud platform-based Watson ecosystem gaining traction. Service applications and target markets include cognitive systems, analytics, finance, banking, blockchain, health care, manufacturing, smart cities, and IoT [2]. The company's relatively low market cap per employee is a measure of the current state of its service transformation as well as the value-generating potential as IBM becomes more cloud-platform based and service intensive.

Financial media, governments, and other observers have become increasingly critical of the "winner take all" success of the digital platform companies that can generate massive business value with relatively few employees [28]. Facebook, Google (Alphabet), and Netflix, all highly successful platform firms, do not create many jobs (See Table 2). Collectively, they have 93,801 employees generating $118.7 billion in sales. This is only 82.3 percent of the number of Microsoft employees, who generate $85.3 billion in sales. Intel and IBM, traditional product-focused organizations have significantly more employees at much lower sales per employee.

Cloud firms can be massively disruptive of industries and markets as cloud platforms redefine market boundaries by changing the rules of competition and the manner of value creation. The essential platform asset is the community of cloud ecosystem (service ecosystem) actors (members) with their knowledge, skills, technology and other resources. Employees and captive machines (AI, M2M, etc.) are members of the ecosystem as well, but in terms of numbers, the ecosystem community is much larger, and more resource endowed than the platform resources. Future research will undoubtedly address the economic contributions from the platform ecosystem communities. It will likely involve a total reconfiguration of work and the economy along the lines of the flexibility and freedom offered by a "gig economy" or a "sharing economy" that enables companies like Uber and Airbnb [1].

Service ecosystems serve critical purposes that include collaboration between actors to develop the value proposition and to co-create value through the continuous development of innovative user experiences. New experiences can result from open innovation practices such as crowd sourcing, mass collaboration, and social networking. The *experience mindset*, defines value as realized from human experiences rather than features and processes [42]. It is essential for organizations to work with customers and other actors to design the high-value experiences that will drive purchases of the solution and strengthen customer relationships and brand loyalty [9]. Once designed, service experiences need to be integrated into the business processes of the enterprise [14]. This is an important notion that has become fundamental for understanding value co-creation. It informs a service-thinking mindset that is essential for service innovation.

TABLE 2. SALES/EMPLOYEE FOR IT COMPANIES, 2016. SOURCE: ANNUAL REPORTS

Company	Employees	2016 Sales $	Sales/Employee
Netflix	4,700	$8,831,000,000	$1,878,936
Apple	116,000	$215,639,000,000	$1,858,957
Facebook	17,048	$27,638,000,000	$1,621,187
Alphabet (Google)	72,053	$90,272,000,000	$1,252,856
Microsoft	114,000	$85,320,000,000	$748,421
Intel	106,000	$59,387,000,000	$560,255
Amazon	341,400	$135,987,000,000	$398,322
VMware	19,900	$7,093,000,000	$356,432
Arm Holdings	4,584	$1,280,000,000	$279,232
Salesforce	25,000	$8,392,000,000	$335,680
Oracle	136,000	$37,047,000,000	$272,404
IBM	414,400	$79,919,000,000	$192,855

Firms that can create a culture of value co-creation with their customers and service ecosystem partners have a greater potential for business success. Engagement experiences serve to keep actors current with customers, market dynamics, innovative ideas, and other insights. IT enables enterprises to transform the structure of value creation from physical co-located contexts to a dynamic, distributed, cloud-based service ecosystem [8]. The service-oriented experience mindset keeps the entire system open to real-time opportunities for service innovation. The design of the user experience strategically organizes and aligns the whole service ecosystem on its foundational responsibility, the enablement of value co-creation.

C. *Seeking a Service Mindset*

When researchers consider why IT organizations and technology firms fail to innovate by delaying or failing to move to cloud services, the reasons usually offered are the lack of appropriate strategy or insufficient technology. A more comprehensive list of barriers to IT innovation might include: technological debt in legacy IT systems, poor technology choices, lack of implementation, lack of or poorly designed innovation strategy, insufficient corporate leadership, financial barriers, lack of internal resources, organizational barriers, lack of skilled personnel, incentive system does not reward innovation, lack of market intelligence, poor marketing communication, organizational culture is hostile to change, and risk averse culture among other reasons.

Most likely, other barriers to innovation can be added to this list. Perhaps the most important addition is the lack of service thinking. Service thinking is a SDL mindset that encompasses the design of service experiences, adoption of a service thinking organization culture, a flexible and adaptive organizational architecture, multisided platforms, and service analytics that are necessary to create, monitor, and support a dynamic service ecosystem. Service thinking may occur naturally to some innovators. There are ample cases where service innovation in the cloud has been phenomenally successful such as the emergence of the cloud service platforms. The platform model, or the service ecosystem model, is truly disruptive. There are obviously people and firms with a service mindset that conceived these firms. However, too many companies are not familiar with this type of thinking. But, service innovation knowledge is hard to find. While business schools typically offer a services marketing course, few offer service innovation courses or a degree program. The same is true for most engineering and computer science programs.

IV. SERVICE THINKING

Service thinking, or SDL thinking, is a transformational and transcendent service mindset that enables a holistic view of the service ecosystem in terms of opportunities, value propositions, value co-creation, dynamic resources and capabilities, customers, suppliers, partnerships, alliances and other engaged actors, service networks, markets, positioning, revenue mechanisms, user experiences and strategies for opportunity maximization. Service thinking is about developing and executing innovative business plans by mobilizing resources and actors for the co-creation of value that can redefine old markets, create new markets and lead to strategic success. Service thinking depends on developing a service culture within organizations that can drive and support service transformation. Service innovation is based on a view of strategy that requires business organizations to continuously reinvent themselves within dynamic complex service systems.

Service innovators are change agents. IT innovations such as cloud computing are especially disruptive to existing markets and customer relationships. The move from face-to-face services to cloud service customer support, e-commerce, hospitality, transportation, government, search, video and music streaming, social media, games, and business services has disrupted the traditional customer experience which impacts the customer relationship, satisfaction and brand choice. Successful innovators have advantageously driven, and/or responded to changes in customer and other ecosystem relationships by incorporating service thinking into their business models. Figure 2 depicts the five key considerations for service-thinking: service design thinking, service thinking culture, service-ready organizational architecture, multisided platforms, and service analytics that are key determinants of service value [12].

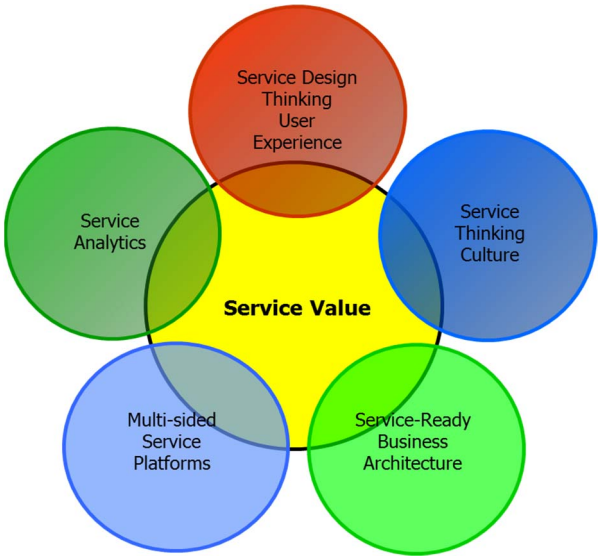

Figure 2. The Mindsets of Service Thinking [12]

A. *Service Design Thinking*

Design has historically been the goods-dominant domain of how objects, things, and commercial products are conceived and shaped. The transformation to a service dominant approach began when design leaders such as Tim Brown of IDEO envisioned the design process as a collaborative effort among diverse participating stakeholders, competencies, and resources where ideas are envisioned, prototyped, and explored in a hands-on manner. Innovative designs need to be human centered, aspirational, and infused with empathy and optimism [5]. Designers for high-technology firms initially engaged in the design of product hardware such as computers, mobile phones, electronic devices and appliances. These responsibilities morphed to include designing graphical user-interface software and eventually the user experience [9].

Design thinking is a discipline that integrates the sensibilities and methods of the designer with the understanding of the users' expectations, the feasibility of the technology, and the strategy to convert market opportunity into customer value. Design thinking helps multiple actors work collaboratively together as a system to create value. It is about the user experience. Elizabeth van Kralingen, SVP of IBM Global Business Services argues "There's no longer any real distinction between business strategy and the design of the user experience. The last best experience that anyone has anywhere, becomes the minimum expectation for the experience they want everywhere [52].

B. *Service-thinking Culture.*

Building a strong organizational culture for service innovation is a key consideration for any enterprise transitioning to service-based business models. The organization needs the right mix of service innovation skills, team members with a service thinking mindset, appropriate resources, and executive support. Strong leadership is needed to develop a service innovation-ready organization with the right mix of service innovation skills, individuals and team members with a service thinking mindset, service specific resources and technologies, and executive support to ensure service innovation is the priority for the enterprise. Service relevant processes are needed to ensure collaboration between employees, customers, and service network stakeholders. Service innovation champions within product companies are rare, but necessary for driving cultural change. Cloud based service innovation is global in scope and high-volume in scale. Increasingly, cloud services are mobile, social, and on-demand in nature. Service thinking leaders need to expand their organization's thought horizons accordingly. Situation awareness by individuals, teams, and entire organizations is necessary. Service transformations are about cultural change and designing the right organizational structure.

C. *Service-ready Business Architectures*

The experience economy is based on rapidly changing consumer expectations and continuous reconfigurations of co-created value within dynamic service ecosystems. As a result, service enterprises experience continuing pressure to respond by redesigning or repositioning business functions, assets, and resources such as engineering, production, marketing, finance, human resources, and IT from slow growing businesses to those with greater potential. For instance, enterprises transforming from client-server-based IT to cloud business models such as SaaS, PaaS, or IaaS can choose among private, public, or hybrid cloud resources. Other options include partnering, mergers, or acquisitions of firms that have already transformed themselves into service dominant enterprises.

Componentized business architectures are another approach for enterprises to react to complexity and rapid change in service systems [26]. The basic question is what components and systems are essential for the enterprise to retain and develop in-house vs. what can be outsourced to other actors in the service ecosystem? This can free up resources, promote specialization, and can benefit from comparative advantage within the service ecosystem. The other consideration is identifying what organizational functions, systems and procedures need to be in place to develop and deliver the service solution.

Service thinking is about resource integration and relationship development among a variety of actors for value co-creation. Think in terms of large systems integrators such as Boeing and Airbus. Do they make every part and system for their airplanes? Or do they manage, coordinate, and integrate internal and external components and capabilities from many suppliers and demand-side actors to create their solutions for enabling an experience that will transport their customer's customers anywhere in the world in a day?

D. *Multisided Service Platforms*

Multisided platforms (MSPs) have enabled enterprises to shift from linear to networked business models [38]. This shifts value creation from the firm to a market network of users, partners, and other actors within a service ecosystem. It is not necessary for platform owners to own the product or service content since the platform enables service providers and users

to engage directly, such as merchants and credit card users. MSPs facilitate value creation by enabling direct and indirect interactions between two or more distinct actors, each of which is affiliated with the platform. Direct interactions occur when no intermediary is involved in the interaction between actors. Direct interactions may involve commercial trans-actions, relationships, or communications between various actors. Indirect connections are typically suppliers or other service providers for direct participants.

Platform affiliation requires a collaborative relationship with other actors for integrating resources for value co-creation. A two-sided platform directly connects buyers with third-party sellers. Cloud service MSPs such as those used by Google, Facebook, Netflix, Microsoft, Amazon, and Alibaba are the result of service innovation business models where the platform supports and facilitates an external ecosystem that connects platform managers, service providers, users, customers, suppliers, partners, alliances, products, services, complementary resources, and facilitates feedback between the ecosystems' actors. MSPs are digital platforms for value co-creation which places them at the core of service thinking. The potential for value creation and rapid growth is much greater than that of a solitary product or service.

Multisided platforms include search engines, social networks, auctions, cloud-based software, and mobile operating systems that connect two or more distinct type of customers (actors) in a matchmaking relationship [20]. IOS and Android mobile operating systems can be viewed as multisided platforms users and providers engage on the platform including buyers, handset makers, component manufacturers, network operators, app developers, and advertisers [10]. Platforms foster a network effect where the more users on the platform, the more valuable the platform becomes to each user, and the more attractive the platform becomes for new users. For cloud computing enterprises the multisided platform and its associated service innovation ecosystem is SDL in action.

MSPs capture enormous amounts of data from the service ecosystem interactions. Analytics provide near real-time insights for shaping, managing, and controlling the ecosystem and its individual actors. The platform manager does not have to control all the resources in its ecosystem, just those whose value creation potential is greatest. Multisided cloud platforms can act as institutions that regulate service ecosystems. The emerging platform economy is rapidly reshaping markets, businesses, and global societies. Cloud service platforms are in position to dominate economic growth.

E. Service Analytics

Service thinking is about becoming a smarter enterprise; smarter about markets, customers, solutions, processes, systems, operations, and value creation. A smarter enterprise connects people, integrates processes, and makes intelligent use of big data analytics to make better decisions [18]. *Analytics* has replaced the term business intelligence (BI) to refer to computerized decision support applications.

Analytics involve the extensive use of data, quantitative analysis, explanatory and predictive models to drive decisions and create value. Application areas extend throughout the service ecosystem including marketing, business operations, IT, finance, human resources, supply chain, production, solution development and delivery, and service optimization. Analytics are particularly useful for the optimization of systems and network performance. Big data analytics can extract the hidden value in data to uncover market opportunities and drive growth. Companies that can acquire accurate situation awareness by leveraging a wide variety of high-volume, rapidly growing data types are likely to grow faster than competitors that do not have this capability [32]. Since service is a complex science, having timely and accurate information supports the development of service innovation strategies.

The three fundamental classes of analytics are descriptive or diagnostic, predictive, and prescriptive.

1. Descriptive analytics is the simplest and most used class of business analytics. It condenses big data to report past performance to provide a view of why it happened. New data is also monitored to determine current performance. Descriptive analytics offer a visualization format for analyses that uncover patterns in the data that offer insights about underlying causes and trends relevant to changes in business performance [41]. *Social media analytics* is a special type of descriptive analytics. It analyzes data from blogs, social media websites, and forums to mine community sentiment. Its most common use is to support marketing and customer service activities such as obtaining product feedback and customer satisfaction. Sentiment volume and trends on specific topics are typically displayed visually on a dashboard.
2. Predictive analytics, the next level of big data reduction, use statistical data mining, modeling and machine learning techniques to forecast what events might happen in the future. A typical approach is to identify patterns and trends in historical data to make predictions about what is likely to happen. All predictive analytics are future focused. For instance, predictive credit scoring models use past payment history to predict risk profiles for customer loans. CRM and other data can be used to predict customer retention and churn (brand switching), future purchases, and responses to marketing campaigns [46].
3. Prescriptive analytics recommend one or more courses of action associated with the likely outcomes of each decision on key performance indicators. The goal is to achieve the best possible performance outcomes to solve specific problems or to address specific opportunities. As a type of predictive analytics, it predicts multiple futures based on the actions of the decision maker [58]. Prescriptive analytics uses existing data and data on actions taken to feedback decision outcomes iteratively to guide decision makers to a desired outcome. It can recommend the best course of action for any pre-specified outcome. What is missing is execution, so actual outcomes may vary from desired outcomes. Prescriptive analytics have been used in

marketing, finance, insurance, mobile communications, e-commerce, and supply chain optimization, among others.

4. Entity analytics focus on resolving multiple references to the same entity across several data sources [47]. The goal is to improve data quality that will increase the accuracy of analytic models. For instance, it is important to determine if three transactions were carried out by three people or by one person. Also, several records might have incomplete data on one person. Data can be aggregated from those records to create a more complete profile of that person. Context computing uses an incremental process for context accumulation for relating new data to existing data to better understand entity-relevant relationships. A more accurate picture of the entity is enabled as more context identifiers are accumulated. Achieving a more accurate picture of the entity provides for better model development and better outcomes such as determining which customers are better risks for bank loans.

F. Service Value

At its core, service thinking is about value and how it is created. From a traditional GDL marketing perspective value is what firms create and deliver through products and services. Value is typically expressed in terms of the tradeoff between benefits and costs within an exchange transaction. In the traditional provider-customer/use relationship that characterizes many IT organizations the creation of business value and customer value are primary concerns. A third type of value, societal value derives from business and customer value concepts broadened to encompass the long-term wellbeing of the social and environmental ecosystems. Finally, we will discuss the asymmetric characteristics of value that can be amplified by cloud-based technologies within service ecosystems.

1. Business value is the total value received by the enterprise that results from sales of its products and services [48]. However, business value is a complex concept that is not easily defined. Conceptually, business value is the aggregation of all forms of value that determine the long-term value of the firm such as economic value added, employee value, supplier value, alliance partner value, managerial value and societal value. Evidence that business value is being created typically include revenue growth and/or decreases in costs that can lead to increased profits, ROI, and shareholder value. Although this definition of business value implicitly recognizes the necessity for creating customer value, the primary focus of business value is generating returns for the enterprise. Business value is more GDL than SDL [27].
2. Customer value may be defined as the "overall benefit derived from the product or service, as perceived by the customer, at the price the customer is willing to pay [45]." A focus on customer value requirements defined around desired customer experiences enables cloud enterprises to look beyond their organization to engage the customer both individually and collectively as a market. Engagement with the customer and other service ecosystem actors for value co-creation should be the true focus of business activity.
3. Societal value holds that companies should meet their business goals in such a way that enhances the customer's and the society's long-term wellbeing. In that way, customer value and business value will be maximized as well. Companies must balance profits, customer requirements, and social responsibility in their business models. Both customer value and societal value are amenable to a SDL conceptualization based on the creation of value-in-use, where higher ratios of service in the solution can minimize societal impact. Societal value is ecosystem based which raises awareness of the need for aligning the economic and social health of the service ecosystem with the physical health of the natural ecosystem.

V. Service Transformation

Traditional internally-focused IT companies share a lot in common with business-to-business (B2B) product-oriented manufacturers. They have been slower to engage in value co-creation with customers and to develop service-oriented business models. They have been slow to adopt cloud-based service business models. Market-driven services, if they exist, support the internal workings of the employees and processes of the firm. These services are typically not aligned on business strategy, customer value creation, or based on service innovation principles.

A. Hybrid Solutions

A logical starting point for service transformation is to consider the development of hybrid product service systems [4]. Hybrid solutions are a combination of one or more goods with one or more services that have the potential for creating more customer value than if the good or service were commercialized separately [44]. The development of product-service system offerings can provide a strategic roadmap for transitioning from GDL solutions, where services are designed to support the product (SSP), to SDL-like solutions that support the customer's business processes or perform them on behalf of the customer. These solutions are services that support the customer (SSC).

Product-service systems align with SDL in that there is a shift in where and how value is created; from products to services and from the firm to the customer. It is helpful to envision a product-service continuum where the product-dominant initial point is characterized by hybrid products (with add-on services) and the service-dominant endpoint where services are provisioned by products. At some point along the continuum, as firms increase the service component, services revenues, and profits will reach sufficient intensity to support a more service-dominant business model. In Table 1 of Section III the center column depicts the characteristics of the hybrid product service system business model as a transitional waypoint between GDL and SDL.

A hybrid solution that features a combination of IT infrastructure, applications, and customer-oriented services is a logical evolution on the service innovation continuum that can enable strategic alignment with the business, stronger market positions for the firm, and strategic legitimacy for the IT organization.

Value propositions for hybrid-solutions can be categorized as either service oriented toward the supplier's product (SSP-like) or a service oriented toward the customer's process (SSC-like), each of which can be subcategorized as a supplier's promise to perform a specific act (input) or supplier's promise to achieve a specified level of performance or outputs.

A classification scheme of four types of hybrid-solution offerings provides insight for the service transformation process [50]:

- *Product life-cycle services* (PLS) are SSP-like input-based services that support the product. PLS facilitate availability and enable the customer's access to the product and ensure its performance over the use lifecycle. Examples are product delivery, deployment, set-up, inspection, testing, warranty, product-specific support, and life-cycle management of the product. PLS innate features of the solution.
- *Asset efficiency services* (AES) are SSP-like and output-based. The services are designed to improve the productivity potential of the product and associated customer assets. Examples include services for risk assessment, cost reduction, scalability, remote monitoring, and cloud-based services. AES are services that enable the solution to be more efficient.
- *Process support services* (PSS) are SSC-like and input-based. These services move beyond improving the efficiency of the product to focus on improving the business processes of the customer. Examples include business process improvements, training, logistics, energy use, and data analytics. Cloud-based applications can be dominant in this space.
- *Process delegation services* (PDS) are SSC-like and output-based. They are services to perform processes on behalf of customers. The goal is to make the supplier's solution indispensable for the successful execution of the customer's business strategy. These services may be embedded or co-located at the customer's site or hosted by the provider or a third party. From a customer's perspective, PDS are outsourced solutions. For example, these services include cloud enabled maintenance management, inventory management, remote monitoring and maintaining of jet engines, drone-based infrastructure and construction inspections, biometric security services, and 3D printing services.

A typical service migration path is thought to progress from PLS to AES to PSS to PDS as the manufacturer, or product-oriented IT organization, gradually adds service capability to the product and subsequently focuses more on services that support or take over customers' processes. In effect, a manufacturer could focus on services in other sequences. Hybrid solutions can increase positional advantage through two avenues: differentiation that can favorably impact pricing and through the creation of cost, scale and network advantages. Superior capabilities and resources are essential for the development and execution of complex service strategies.

B. Service Transformation Process

A firm's commitment to service innovation can impact its business value. Service innovation capabilities and resources, or lack thereof, can affect service transition strategies. On the positive side leveraging service knowledge to engage the customers in value co-creation can result in better relationships and increased customer loyalty. On the negative side is the potential for conflict between product and service priorities and the loss of strategic focus from ill-conceived and implemented service initiatives that can lead to strategy failure. The good news is once the critical mass for service capability is reached the potential for success improves.

The "service intensity ratio" of actual sales from services to the total sales of the organization is a performance metric that indicates the progress of a firm's service strategy migration. The notion of a "service ratio" of actual service sales to total sales is useful. As service intensity reaches 20-30% of sales the business effects of transitioning to services become apparent in terms of increased profitability [22]. Higher returns result from service innovation that can develop new markets and redefine old markets with the potential to achieve higher margins. Successful companies that have become sufficiently service oriented have transitioned beyond the product-focused transaction-based customer relationship to service-focused collaborative relationship with customers based on the co-creation of value.

Table 3 provides an overview of the service transformation process. Of interest is the linkages between service transformation strategies, value orientation, degree of service intensity, the type of customer/actor- relationships, and the type of services applications. The transition between stages 2 and 3 of the service strategy migration is where the value proposition changes from being predominately product oriented to being predominantly service oriented. This may indicate the existence of a "service intensity threshold" that when reached triggers a change in service thinking and enterprise approaches to customer engagement and value co-creation activities.

This threshold effect may be the result of a deliberate service transformation strategy on the part of the enterprise, or perhaps an organic change in customers' value requirements and service innovation expectations. As enterprises and customers, indeed all ecosystem actors, adopt cloud services a complexity gap can arise. The pace of innovation in the cloud requires specialized knowledge, organizational changes, and integrated management for all actors in the ecosystem. In any event, navigating through the threshold will involve a change in service thinking to meet increasing value expectations and value migration that can enable both the customer and the provider to engage in service readiness activities for more

TABLE 3: SERVICE TRANSFORMATION FRAMEWORK. ADAPTED FROM [12].

Stage	Offering Type	Service Strategy	Primary Value Orientation	Customer/Actors Relationships	Service Applications
5	Pure service No product required from same provider	Integrated cloud services that are typically product agnostic	Service-dominant, value-in-use, value-in-context. Input and output based	Highest service ratio. Focus on scale, scope, and engagement with actors within service ecosystems, service system institutions and arrangements.	Multi-sided cloud platforms, social media, streaming media, cognitive services, crypto currencies, cognitive assistant services, AI services, service ecosystem management, smart city integration, C4iSR, block chain applications.
4	Process Delegation Services (PDS)	Services performed on behalf of customers that are critical for business operations.	Service-dominant value in use, output based	High service ratio. Actor-to-actor service ecosystem. Service provider takes over end-user processes.	Cyber-physical systems such as in-flight jet engine monitoring and maintenance, drone inspection services, autonomous vehicle services, IT service management, smart systems services, analytics services, digital advertising, contract electronic manufacturing services, biometric security, identity management.
3	Process Support Service (PSS)	Results-oriented services that enable the improvement of the customer's operations	Service-dominant, value-in-use, input based	Moderate to high service ratio. Developing actor-to-actor service ecosystems. Service leads, product provisions.	SaaS, PaaS, and IaaS services in public, private, and hybrid cloud deployments. Co-development, process consulting, training, etc.
Service Intensity Threshold					
2	Asset Efficiency Services (AES)	Use-oriented services that increase output and/or reduce costs associated with supplier's product	Goods-dominant, value-in-exchange, output based	Low to moderate service ratio, mostly transactions focus. Service enables product efficiencies. Rudimentary service systems	Productivity improvement, upgrades, updates, product customization, consulting, training, private data center, cloud-based storage and customer service.
1	Product Lifecyle Services (PLS)	Product-oriented services that ensure product availability and performance over the useful life	Goods-dominant, value-in-exchange, input based	Low service ratio, transaction focus. Product dominant with services required to support sales and maintenance of product.	Product integration services (design-in), field engineering support, transportation, installation, quality assurance, documentation, installation, inspection, and testing. Refurbishing, recycling. Hotline help desk.
0	Pure Product	Product-oriented manufacturer with minimal or no services	Goods dominant, value-in-exchange, input based	Transaction focus, provider created value and provides to customer	Range from no service to industry standard customer service, support, and warranty.

Increasing Cloud Service Integration

innovative value co-creation opportunities. The progression through the various stages of service transformation models needs to be better understood. Is the transition step-by-step and orderly? Or is the process less deterministic and more random and potentially more disruptive and risky? How can complexity gaps that arise from service integration be managed?

VI. CLOUD SERVICE INNOVATORS

This section provides overviews of three cloud- service innovators to assess their service-transformation strategies, stage of the transformation process, and evidence of adoption of service thinking principles. All three companies are in the process of migrating from legacy goods-dominant product orientations to cloud-based service innovation business models.

A. Microsoft's AI Cloud

Microsoft, a legacy software firm from the PC era, was not an early advocate for the cloud service business model. It was the disruptive innovator with operating systems and applications software. However, as competitive technologies challenged the market leader, the firm was and continued to be GDL product and services-as-a-product focused. The company chose to protect its dominant position in operating systems and office productivity software. It was slow to innovate. Bill Gates almost missed the Internet. Microsoft fought open source and missed the mobile revolution to continue focus on the PC [6]. The company failed to see the cloud. Bing is a "me too" search engine. Windows 8 was a disaster and Windows 10 adoptions have been relatively slow when compared with Windows 7 [7]. Microsoft plays catch up to Amazon Web Services with Azure Cloud and to Google with Office 365 and Outlook. To compete, Outlook is morphing from just email to a cloud platform that connects users to other Microsoft and third-party services such as LinkedIn, Uber, Evernote, and Yelp [59].

Can Microsoft transform itself from a product company to a service dominant cloud platform-based service innovation enterprise? The answer to that question is, yes; they are doing just that. In 2017, Microsoft generated $18.9B in cloud revenue. The company is no longer all Windows and PC related.

In a recent reorganization, Microsoft deemphasized the role of Windows as its applications are shifting to the cloud. In the last quarter of 2017 Azure Cloud Services revenue grew 98% and Office 365 grew 41%. The Windows legacy operating system grew only 2% [24]. The move enables Microsoft to focus on cloud applications, their largest areas of growth.

Microsoft CEO Satya Nadella has repositioned the company as large enterprises and SMEs have recognized the high performance and downward trending prices of cloud applications presents a compelling value proposition. Recently, Mr. Nadella shared Microsoft's strategy to become a dominant cloud services organization [21].

1. Focus on implementing a seamless architecture across the entire "digital estate." Customers choose the Microsoft Cloud for its operational consistency, productivity and security that spans the entire digital estate, including Windows 10, cloud security and management, Dynamics 365, Enterprise Mobility and Security, and Azure. Microsoft has a customer focused service thinking mindset.
2. Deliver on consistency. A consistent stack across the public cloud and the edge is needed to support emerging applications such as Intelligent Cloud and Intelligent Edge. Consistency across development environments, operating models, and technology stacks. Microsoft's hybrid cloud's consistency is one reason nearly all Fortune 500 companies have chosen Azure.
3. Microsoft 'deeply' partners with global corporations to help them build their own software capability. The company transfers its capability to customers to build their own industry and firm specific applications.
4. Hybrid cloud is a strategic destination. Intelligent cloud and intelligent edge are centered on AI and IoT.
5. AI is the new heart of competitive advantage. The core competency of any business organization in future will be its ability to convert data into AI that drives competitive advantage. Microsoft recently introduced Windows Mixed Reality. The application, which has a voice, gaze, and gesture interface, aims to change how teams collaborate.
6. Reject the software suites-for-everyone mentality. Connections between diverse applications are much more important. For example, Dynamics 365 seamlessly connects with Microsoft 365. The Dynamics 365 consists of CRM applications that are called the Customer Engagement Plan. Microsoft 365 consists of Office 365, Windows 10, and Enterprise Mobility + Security.
7. Expand, deepen, and accelerate the infusion of AI into not only everything Microsoft makes, but also everything its developer community makes.

Microsoft is clearly driving its cloud strategy to stress the company's role in enabling the co-creation of value within its ecosystem, whether that value is created by human actors or AI machines. Although AWS is the cloud industry leader, the gap is closing. Microsoft appears to be in position to bridge the gap with AWS with its continued investments in the strategic imperatives Mr. Nadella highlighted above. Microsoft is claiming a future role as a Stage 5 pure service company.

The company appears to have adopted service-thinking principles to drive its transformation. Service design thinking, service thinking culture, service business architecture, cloud-service platforms, service analytics, and ecosystem-based service value are all in evidence and being integrated throughout the firm.

Microsoft under new leadership is performing at an industry-leading level. Its transformation is almost complete as a leading service innovator that has come all the way from being a Stage 1 GDL product company.

B. Intel's Drone Cloud

The market for aerial drone systems is one of the fastest growing in the IoT sector. Intel Corporation is becoming a solution provider in an industry that represents a major opportunity for technology companies. Drones are packed with the type of sophisticated chips that Intel makes. Drones have become flying cloud-based computer systems with advanced 3D imaging systems, autonomous navigation capabilities, analytics, and advanced communications. Applications include aerial inspection and monitoring of industrial infrastructure such as oil and gas onshore and offshore installations, wind and solar utility installations, cellular towers, construction sites, agriculture, and mining. Intel has adopted the IoT cloud concept of computing at the edge of the network to the drone business. Drone technology can be used for other IoT opportunities such as autonomous vehicles, trains, ships, smart cities, military, and numerous other applications. Intel is already developing systems for self-driving cars.

Over the last three years Intel has a pursued a strategy that would enable it to become a leading B2B keystone actor in the autonomous aerial vehicle service ecosystem. Unlike the chip market where Intel makes and markets computer chips, its first commercial entry in the autonomous UAV market has been a complete end-to-end drone system. The larger strategy is to become a systems integrator of the various components which include various ICs, 3D cameras, drone operating systems, analytics, data management, cloud services, and complete drone flying systems. Intel's B2B services involve supplying drone operators with complete ready-to-fly drones with operating, navigating, sensing systems, and cloud-based analytics and reporting.

To fully populate the drone-based service ecosystem Intel has augmented its internal resources by the acquisition of a successful drone manufacturer and investments and partnerships with other actors in the drone ecosystem.

- Ascending Technologies, a German company, was acquired in 2016. Ascending had built one of the industry-leading professional drones, the high-end Falcon 8, with best-in-class auto-pilot software and algorithms [49]. Combined with Intel's RealSense imaging technology with depth-sensing and distance sensing features, the Falcon 8 has sense-and-avoid and follow me capabilities. The result is the ability to avoid obstacles and collisions that improves drone safety. RealSense can remember its environment and know to avoid previously identified obstacles on subsequent autonomous missions. Intel's Falcon 8+ octocopter drone is an upgrade of the Ascending Technologies Falcon 8.
- In 2015 Intel invested $60M in Shanghai drone aerospace company Yuneec. The company is the world leader in electric aviation. It manufactures more than one million units per year for the hobbyist and commercial markets. The Typhoon H series professional drone product line *hexacopters* uses Intel RealSense detect and avoid and follow me system. These drones are used for industrial and other 3D imaging aerial inspections [15].

- In 2015 Intel invested in technology startup Airware, a software developer of drone operating systems. It has expanded to sell a complete flying drone system: drone hardware, vision systems, control software, and cloud data storage. It has raised more than $70M to make it the best capitalized drone company in the U.S. [33]. Airware offers a cloud-based platform to manage, process, view, analyze and manage aerial drone 2D/3D imaging and other data. It is used for insurance, mining, quarry, and construction site inspections.
- In 2014 Intel invested $10M in fixed-wing professional drone maker PrecisionHawk.

Other drone-based investments include the acquisition of MAVinci GmbH, a developer of professional unmanned aerial drones and software systems in 2016, and formed a strategic partnership with Delair-Tech, a developer of long-range fixed-wing professional drones for mapping, surveying, inspecting, and monitoring commercial infrastructure.

With Intel's pursuit of a world-class professional drone service system, it is seeking to become an essential actor in the drone service innovation ecosystem. It not only provides customers will a fully-featured professional drone, it also creates a market for Intel components and software, especially aerial control systems, 3D sensing, and cloud-based analytics and reporting.

In the drone market space, Intel appears to have transitioned from a GDL resource orchestration model to more of an SDL platform-based systems integrator that seeks to co-create value within a service innovation ecosystem. Evidence suggests Intel is in Stage 3, Process Support Services (PSS) of the service transformation process. However, with its acquisitions and partnerships it could readily become a provider of Stage 4 Process Delegation Services (PDS) for drone inspections, mapping and surveillance applications.

Intel's legacy DNA is manufacturing based with the focus on adding value to silicon. Service innovation, while not new, will continue to require cultural and organizational change at the company. The drone business, autonomous vehicle development, and integration with the cloud are encouraging signs that Intel is turning the corner on adopting cloud-based service models. To that end, Intel is in the process of introducing service design thinking, service culture, service business architecture, service platforms, service analytics, and service value throughout the enterprise.

C. IBM Watson Health Cloud

IBM Watson Health provides a secure and open cloud platform for physicians, researchers, insurance companies, firms and governmental organizations. IBM is developing health and wellness applications for its Watson cognitive computing system to improve the quality and efficacy of personal health care. Watson Health services are HIPAA compliant and enable secure access to individual health data and a comprehensive view of the factors that impact personal health. The service platform consists of Watson's advanced cognitive computing capabilities to connect the Watson Health's ecosystem of researchers, practitioners, and partners into a community on an open, secure and scalable platform.

IBM is partnering with the American Medical Association and Cerner Corporation to bring data structure and best practices to health data such as patient information and care outcomes. The collaboration is addressing the continuing problem of a lack of a common data structure in many healthcare organizations. The initiative is developing a shared framework for organizing health data, especially patient-centric data, to identify elements that are most predictable of better patient outcomes [30].

Many other organizations engage in data collection, analysis, and solution development with IBM. For example, IBM Watson and Apple have integrated mobile cloud services and analytics with Apple's open-source ResearchKit to develop applications for iOS and Apple iWatch [37]. Watson Health collects and analyzes data from watch users and surveys. The SleepHealth app is a research study and wellness tool that uses Apple Watch sensors, including the gyroscope, accelerometer, and heart rate monitor to record sleep activity.

iWatch users can utilize the data to improve sleep. Doctors and researchers use the data to explore the relationships between sleep quality and user's alertness, productivity, general health, and medical conditions. User data is stored ion IBM's Health platform. SleepHealth is the first ResearchKit collaboration with Watson Health [43].

Other applications are under development. Medtronic is using the Watson platform to collaborate on the development and delivery of highly personalized care management solutions for diabetes patients [57]. Johnson & Johnson is collaborating on pre and postoperative patient care and the management of chronic health conditions that account for more than 80% of global health care costs [13].

The IBM Watson Health's cognitive computing cloud platform may be viewed as a Stage 3 Process Support Service (PSS) initiative that improves the customer's operations. Fully implemented, the IBM Watson cloud-services platform could assume many of the Stage 4 Process Delegation Services (PDS) functions such as diagnostics and health management applications now performed by individuals in healthcare organizations that lack Watson's cognitive computing capabilities.

More than a decade ago IBM invented the discipline of Service Science [29]. Since then, the company is engaged to transform itself into a service innovation enterprise. Service thinking is at the core of the new strategy. IBM is at the forefront of driving service design thinking, service culture, service business architecture, service platforms, service analytics, and service value throughout the enterprise.

One caveat: transforming a 100-year-old manufacturing company is not without risk. The take up for Watson Health and other IBM strategic imperatives has been slower than anticipated. It takes a lot of effort and risk taking to change a

goods-dominant culture to service-dominant one for both providers and customers [25].

VI. Conclusion

The three firms described herein are engaged in service transition initiatives that may, or may not, result in a full transformation to world-class providers of innovative service solutions. All are utilizing the cloud as a platform for service development and delivery. Service innovation can enable competitive advantage for such organizations as means for repositioning away from commodity markets. Good dominant competitors that are not yet capable of developing sophisticated service offerings, much less marketing and deploying them will be left behind. The transition to service business models can enable a firm that adopts a service innovation strategy to extend its scope, scale, and value propositions to gain advantage over slower moving competitors.

Although there is much known about the service transformation process for manufacturers, the first product companies to move some operations to the cloud did not change their culture or business models. Motives likely were to reduce operating costs. Typically, market performance remained static or declined. Over time, innovative technologies such as cognitive computing, robotics, autonomous capabilities, cloud-based analytics services, energy harvesting devices, smart systems, smart sensors, and the Internet of Things (IoT), and AI are driving more asymmetric and disruptive service innovation. The new service business models now being developed are resetting the competitive arena with the advantage going to high-technology innovators that can design, produce, and deploy smart solutions that can provision even smarter services.

For many of the old-line companies and IT organizations this wave of disruptive technologies will present huge challenges to their organizations and business models. The next generation of AI-based service innovation will indeed be very dynamic and disruptive.

For IT companies, service thinking will foster a deeper understanding of the service transformation process and provide essential insight on how to compete in service innovation ecosystems. The transformation of product-oriented organizations to service innovation powerhouses is one of the most important trends of our time. In future, only enterprises that fully embrace service innovation are likely to be the leaders of the next transformation.

Although this paper is exploratory and conceptual in nature, it does support findings from the service science literature that service transformation is a process that changes how and where value is created. Legacy GDL approaches where providers create value to be delivered to customers are being superseded by service ecosystems where value is cocreated by a network of collaborating actors. Cloud networks have become service ecosystems and service thinking is essential to service strategy.

Finally, this paper proposes that service thinking is foundational to successful service transformations. Successful cloud companies appear to exhibit service thinking characteristics. Future research should assess the specific roles of service thinking and its impact on the market performance of cloud enterprises. Similarly, are cloud-based business models innately service innovation ecosystems? Does the cloud enable changes in how value is created and experienced and thus impact enterprise performance?

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