STATEMENT OF RESEARCH

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My research focuses on the strategic interactions of information technology (IT) and business, in particular, how firms use IT to create innovative services and transition from product providers to service providers. I solve problems in three types of IT services markets—the cloud services, financial services, and e-commerce and online services markets—from economics and strategic management perspectives.

My works generate new knowledge and deliver practical solutions. They assist firms to evaluate the value and risk of service-oriented business models, make recommendations for IT adoption decisions, examine services provision and pricing mechanisms, suggest optimal strategies in competition, and forecast market structure and trends. Since the industry practices that I examine are fairly new, my research makes original and pioneering contributions.

1. RESEARCH PROBLEMS, SOLUTIONS, AND INSIGHTS

Figure 1 sketches my research in terms of areas, problems, theories, and methods. I next will discuss my works in each area—the problems I looked at, solutions I delivered, and managerial insights I offered.

1.1. The Cloud Services Market

Computing resources, such as CPUs, networks, data storage and software applications, all can be provided as services to customers through a network. In the past two decades, the cloud services market has grown dramatically. My work in this area is pioneering. Unlike researchers in Computer Science who investigate technique-related issues, I focus on strategic management in cloud computing. My contributions are two-folded. I have formulated a number of practical competitive strategies and proposed services provision and pricing mechanisms for cloud services vendors; for cloud services users, I have developed approaches to support the cloud adoption decision-making.

Competitive strategies for cloud services vendors. The first stream of my research in the cloud services market examines vendors’ competitive strategies. My paper “Analyzing Software-as-a-Service
with Per-Transaction Charges,” in Information Systems Research (Ma and Seidmann 2015, in press), analyzes the competition between the traditional software vendor and the software-as-a-service (SaaS) vendor and its impact on the software market structure. While the industry has recognized the fundamental differences between the two, how these differences lead to different competitive strategies is not clear yet. We develop an analytical model to capture the vendors’ differences in cost structure, pricing methods, risk management, and capacity hedging approaches.

The major contribution of this work is to highlight the importance of the lack-of-fit costs between a firm’s computing needs and the SaaS solution. Lack of fit is a unique by-product of the multi-tenancy structure of SaaS. When the lack-of-fit costs decrease, the software market is expected to shift more toward the services model. This result has far-reaching implications for the SaaS vendors’ application design and long-term development strategies. It explains why the fast growth of SaaS has been observed mostly in services marketplaces such as email, office productivity, accounting, billing, and human resource management software, but not for complex applications such as enterprise resource planning (ERP) or electronic medical record (EMR) systems. Moreover, it supports the efforts of big SaaS vendors, for example, Microsoft, Oracle, IBM, Hewlett-Packard, and Salesforce.com, in facilitating technical standards and launching large-scale uniform cloud computing services platforms.

This research recommends a counter-intuitive “higher quality but lower price” strategy to SaaS vendors in competition. SaaS vendors should charge less when their value and cost efficiency are enhanced. This will enable them to compete aggressively for large users. Large users are more valuable to a SaaS vendor because they generate high revenue due to the unique “per as you go” pricing method of SaaS. This result sheds light on the SaaS’ continuous price-cutting behavior. Microsoft has reduced prices three times for its Office 365 cloud-based software portfolio and Amazon Web Services has done it 37 times.

I also investigate competition among SaaS vendors and recommend effective competitive strategies. In the paper “Competition between Software-as-a-Service Vendors,” published in IEEE Transactions on Engineering Management (Ma and Kauffman 2014), we develop a game theory model to capture important features of SaaS competition, including vendor differentiation in services offerings, users’ incomplete information, and the potential for lock-in risk. This work suggests that SaaS vendors use a differentiation strategy to avoid head-to-head price competition among them. It explains the great diversity in cloud services provision observed in the market. In addition, we show that users’ switching costs, mainly as data recovery costs and set-up costs with the new vendor, can be a double-edged sword. The vendor should help to lower users’ switching costs, and protect users’ interests by offering them flexibility to backsource. This finding enhances the managerial understanding of the common free-trial practice offered by SaaS vendors. For example, Salesforce.com and Oracle On-demand give 30-day free trial of their services. They essentially offer potential users the flexibility of “sampling and switching,” which is highly appreciated by users and nurtures a good long-term relationship with them in the first place. As a result, giving users the flexibility to switch creates further value for the vendor.

Service provision and pricing mechanisms for cloud services vendors. The second stream of my research sheds light on cloud vendors’ choices for service provision and pricing mechanisms. My paper “Pricing Strategy for Cloud Computing: A Damaged Services Perspective,” in Decision Support Systems (Huang, Kauffman and Ma 2015, in press), uses Amazon EC2 services as a motivating case and establishes the value of a hybrid strategy from the vendor’s viewpoint. In 2009, Amazon introduced the spot-price on-demand instances together with the fixed-price reserved services. To understand this hybrid strategy of offering two types of services and charging different prices for them, we examine clients’ self-
selection behavior, the resulting market segmentation, and vendor profitability. We show that the vendor should use service interruptions as a quality differentiator between its two services to assure the efficacy of the hybrid strategy. The presence of interruptions also provides the vendor with resource reallocation flexibility. We contribute to the literature by proposing a damaged services perspective in the cloud services market. This is analogous to ‘damaged information goods’ and versioning in packaged software. To my best knowledge, it is the first research attempt to understand strategic management in the IT services market from the perspective of damaged goods strategy in Economics.

In addition, the paper “On the Financification of Cloud Computing: An Agenda for Pricing and Service Delivery Mechanism Design Research”, a featured article at International Journal of Cloud Computing (Kauffman, Ma, Shang, Huang and Yang 2015, in press), interprets current practices and identifies future research directions for cloud computing mechanism design. This research conducts a comprehensive survey on various services delivery mechanisms and pricing strategies in the current cloud market. It covers 19 major services vendors and 27 types of services. The research demonstrates a practice-led set of scientific observations and examples in cloud services delivery and pricing, including on-demand and reserved services, spot prices and dynamic prices, cloud insurance, and brokered cloud services. We interpret them from the perspective of relevant financial economics theory and offer the theoretical financification view of the cloud services market.

This is a useful contribution to managerial understanding. The cloud services market is experiencing a fundamental shift from the traditional model of software sales to computing capacity provision mechanism designs. This evolution is similar to what financial markets have done. Through the lens of financification, managers and consultants will be empowered to make more confident predictions and thoughtful explanations for what is to come. Furthermore, this new perspective lays out a research agenda related to the fundamental mechanism design issues in the cloud market.

Adoption decision-making for cloud services users. The third stream of my research tries to assist user firms regarding their decisions of cloud computing adoption. From my contacts and consulting experience with local organizations, I realized that firms, especially small and medium enterprises, need support and guidance in making cloud adoption decisions. Is cloud computing for them? When is the best time to switch to this service-oriented business model? What are the factors they need to consider before, during and after adoption? What are the changes and impacts that they should expect after adoption?

To address these concerns, in the paper “Cloud Computing Adoption Readiness: Empirical Evidence for the Efficacy of a Firm-Level and Cloud Business Model-Specific Metrics Suite” (Kauffman, Ma and Yu 2014), we propose and design a metrics suite for measuring an individual firm’s cloud adoption readiness. The research focuses on four relevant categories, including technological, organizational, economic and environmental factors. Based on a series of empirical mini-cases, and supporting evidence from industry white papers, business press sources, and field interviews with vendors and government agencies, we explore empirical evidence for the efficacy of the metrics suite application to different cloud services models. The paper is currently under review at Electronic Markets, based on a special issue submission invitation that I received from the co-chairs of the 2014 Grid Economics Conference (GECON 2014). With the support from the local government agencies and business organizations in Singapore, I plan to apply the proposed metrics suite in the Singapore market in 2015.

1.2. The Financial Services Market

I have extended my research interests to the financial services market. My mission in this area is to
help managers and financial analysts to understand the nature of IT-based financial innovations, and support managers’ adoption decision-making.

The paper, “Innovations in Financial IS and Technology Ecosystems: High-Frequency Trading (HFT) in the Equity Market,” in Technological Forecasting and Social Change (Kauffman, Liu and Ma 2015, in press) proposes a financial IS and technology ecosystem approach to understand innovations in the HFT area of financial services. The ecosystem model in this research brings together three original core elements: technology components, technology-based services, and technology-supported business infrastructures, representing supply-side forces for technological change. It then also contributes a fourth new element to this ecosystem approach: stakeholder analysis, as demand-side forces. Analyzing HFT innovations, this work empirically validates the existence of several different patterns of the historical evolution of technology ecosystems. This research represents some of the first work that investigates how financial services innovations emerge in ways that are driven by both technologies and stakeholders.

Another research that serves to understand financial technology innovations is the paper “Competition, Regulation, and Innovation: Understanding the Evolution of the Mobile Payments Technology Ecosystem,” in Electronic Commerce Research and Applications (Liu, Kauffman and Ma 2014, under review for a special issue to appear in 2015). This work argues that, competition, cooperation and regulation play important roles in shaping the evolutionary path of technology innovations in the mobile payment ecosystem. To illustrate, we retrospectively analyze innovations that have occurred in the payments space in the past two decades. We also analyze cases such as Square, Google Wallet, PayPal and Alipay, and the most recent Apple Pay. This research helps managers to understand how competition is able to spur or stall financial services technology innovations, and how regulations can pave the way for them.

In order to help managers make IT adoption decisions, the paper “Technology Investment Decision-Making under Uncertainty,” in Information Technology and Management (Kauffman, Liu and Ma 2015, in press), proposes a new continuous-time stochastic valuation modeling approach for IT investment decision under uncertainty. The model incorporates a mean reversion process to capture cost and benefit flow variations over time. We apply the proposed approach to two real-world empirical cases: an IT investment in the consolidation of data warehouses at a major airline, and a large-scale mobile payment system infrastructure investment in the financial services industry. They illustrate our model’s applicability and offer insights to decision-makers so they understand the value of investment deferral and establishing an effective strategy for IT investment timing.

All my works in this area make two kinds of contributions. They extend existing theory and modeling methodology, and offer new analysis perspectives. They also demonstrate empirical applications of the proposed approach to real cases in financial services contexts.

1.3. The E-Commerce and Online Services Market

I studied the e-commerce and online services market, with a focus on the value and impact of IT use.

I have published two sole-authored papers, studying the value of new technology adoption. In “Use of RSS Feeds to Push the Online Content to Users,” published in Decision Support Systems (Ma 2012), I show that it may not be value-adding for an online provider to deliver its products and services through an IT-enabled new channel. The negative cannibalization effects on the conventional delivery channel may outweigh the positive market expansion effects brought in by the new channel. In the follow-up work, “Push or Pull? A Website’s Strategic Choice of Content Delivery Mechanism,” in the Journal of
Management Information Systems (Ma 2015, in press), I extend the value analysis by incorporating competition. The analysis shows the complexity of technology adoption strategies in a competitive setting and further suggests that, to fully reap the benefits of technology, firms should make an appropriate investment to increase users’ technology awareness level.

In addition, the paper “Information Technology Diffusion with Influentials, Imitators, and Opponents: Model and Preliminary Evidence,” in the Journal of Management Information Systems (Cavusoglu, Hu, Li and Ma 2010) analyzes why and how the diffusion path of new security technologies, such as trusted computing and RFID, is different from traditional IT due to user’s privacy concerns. Also in “Wake Up or Fall Asleep – Value Implications of Trusted Computing,” in Information Technology and Management (Hu, Huang, Liu, Li and Ma 2009), we investigate the economic value of trusted computing technology by examining the stock market returns for the adopting firms.

2. RESEARCH OUTPUT, AND EVIDENCE OF IMPACT AND RECOGNITION

I position myself in the community of IS management, strategy, and the IT-and-business interdisciplinary area. My scholarly achievements are demonstrated by high-quality journal publications and external recognitions in both the professional community and related industries.

2.1. Research Output and Impact

To date, I have ten journal publications and in-press articles. They include IS journals such as Information Systems Research, the Journal of Management Information Systems, and Decision Support Systems, and also interdisciplinary journals such as IEEE Transactions on Engineering Management, and Technology Forecasting and Social Change. My current pipeline includes papers under review at MIS Quarterly and Electronic Commerce Research and Applications. Figure 2 shows the evolution of my research output (journal publications).

Figure 2. Evolution of My Research Output (journal publications)
My works have been cited widely by peers both inside and outside the IS community. As of December 2014, the Google Scholar citation count for my research was 265, about 90% from the cloud services research (A detailed citation analysis is in Appendix A.). They are interdisciplinary citations across multiple research fields, including IS and Management, Economics, Computer Science, and Engineering. The number of my citations is showing fast growth in the most recent three years. To a large extent, it is because research in cloud services is a relatively new field, and its importance has been recognized by academia only in the recent several years. With a number of pioneering works in this field, some published in 2014 and some in press for journal publication process, I am expecting a continuous stream of citations in the near future and a fast increasing impact on the related research communities.

2.2. Professional and Industrial Recognition

In addition to journal publications and conference presentations, the professional community has recognized my work in a number of other ways. I am an active member and contributor to my research community in the roles of journal associate editor and reviewer, conference session chair, invited presenter, program committee member, review panel member, and discussant. I serve as an Associate Editor (AE) for the journal of Electronic Commerce Research Applications, and the Managing Guest Editor for a special issue on “IT-enabled services” at Decision Support Systems. I am a regular reviewer for the top-tier IS journals, including Management Science, the Journal of Management Information Systems, Information Systems Research, and Management Information Systems Quarterly. I have also served as a program committee member or an AE for a number of major IS conferences including the International Conference on Information Systems (ICIS), the Hawaii International Conference on System Sciences (HICSS), the Workshop on e-Business (WeB), the International Conference on Economics of Grids, Clouds, Systems and Services (GECON), the China Summer Workshop on Information Management (CSWIM), and the European Conference on Information Systems (ECIS).

I have interacted actively with industry organizations and practitioners to establish my research visibility and increase its real impact. I worked closely with industry partners and government agencies, including Infocomm Development Authority (IDA) of Singapore’s National Cloud Office, the Agency for Science, Technology and Research (A*STAR Singapore), and SingTel, the largest telecommunication and digital entertainment company in Singapore. I was invited to present my research findings at these places, and with their support and help, I was able to put my research findings to use. My cost-and-analysis model for cloud services has been used by several organizations to help them make cloud adoption decisions in Singapore. I also have shared my work on the cloud services pricing scheme with SingTel, supporting their initial launch of SingTel Innovation Exchange (SIX) platform. In addition, I am an active member and presenter at a number of industrial-audience-oriented workshops and events, such as CloudAsia and MIS Asia I.T. SUMMIT. My research findings have been well received by industry participants.

3. TAKING MY RESEARCH TO THE NEXT LEVEL

I believe that understanding the value, risk, strategy, and new management rules in emerging IT services markets will be one of the major research streams in the future. I will continue to work and make contributions to this research field.

In the area of shared-IT cloud services, my next-level effort, in addition to publishing more top academic publications, is to take a further step to enhance my impact by turning my research findings into value-creating solutions for industry. I am actively developing new opportunities to talk to top managers and strategists of the cloud vendors, such as Amazon Web Services in Singapore, IBM on Demand Sin-
Singapore, and SingTel, and present my research findings to them. They are the ideal and ultimate audience of my work. I will assist them to understand the existing market practice and problems, promote my solutions – a number of pricing and competitive strategies, and convince them to implement these recommendations. In Singapore, there are many ways to do so. I have good working relationships with the IDA National Cloud Office and A*STAR Singapore, who have access to local vendors and users and have been very supportive of my work. In addition, being an active member of several international and local cloud events, such as the CloudAsia conference and Asia Cloud Computing Association roundtable meeting, offers me the opportunity to discuss IT services issues with industrial partners and show my research findings to them. Meanwhile, to increase my academic impact and also to promote the cloud research in Asia, I am actively participating and organizing the International Conference on Economics of Grids, Clouds, Systems and Services (GECON) 2015 as a track chair. I hope to bring it to Singapore in 2016.

I will commit more effort to financial IS and technology research, which I believe is another important area with strong potential that has not been fully explored by academic researchers yet. The School of Information Systems (SIS) at Singapore Management University (SMU) provides a great opportunity to work in financial services area. Singapore is a leading Asian financial center and SMU has partnerships with a number of leading banks here. These create an unprecedented chance to gain access to financial industry people, problems and data. Currently, I have Ph.D. students who are working with CitiBank in Singapore on problems related to merchant locations, card services, and payments systems. I will keep moving this collaboration forward. Exploring new opportunities, I am determined to participate actively and contribute to the LARC and SMU-Citibank partnership, especially on problems related to payments platform competition and pricing strategies for bank products and services. I also have an ongoing project with my faculty colleagues funded by the SWIFT Institute regarding real-time gross settlement systems for payment. In the future, I plan to work with the team to bring in MOE Tier 2 funding in the financial IS and technology area.

I am also extending my interests to investigate how to incorporate consumer behavior to understand the impact of IT on business, society, and policy-making. My research expertise fits multiple interconnected areas in both LARC and the iCity Lab in our school. They include cloud-based solutions for small and medium enterprises, shared services and business models, and adaptive learning of consumer behavior and decision-making. Building upon Social Science theories and Economics models, I am especially interested in understanding and predicting consumer behavior in the changing technological ecosystem, which is naturally aligned with my research interests in Strategic Management – developing new firm strategies in marketing, for product recommendation, and effectively competing. The rich resources available in LARC and LiveLabs provide wonderful opportunities to run large-scale consumer experiments in different organizational environments. This will enable me to understand consumer behavior better, generate actionable organizational strategies, and answer the design and policy questions that firms face when integrating social media technologies into their innovative business models.

I view myself as a diligent scholar and also a contributing colleague. I understand that being a middle level faculty member means taking on more responsibility than I have handled to date. In the future, conducting regional research and actively applying for MOE Tier 2 government research funding will be on my priority list. I will align my research interests with the school’s strategic goal, and support my junior colleagues and graduate students. By working cooperatively with others, I hope to contribute to the SMU by building our collective research capabilities, and help to establish an international reputation for SIS and SMU in innovative research.
Appendix A. Citation Analysis

As of December 30, 2014, my research citation counts from Google Scholar and Web of Science were 265 and 42 respectively. Table A1 summarizes the number of citations from both sources.

Table A1. Citation Report by Google Scholar and Web of Science

<table>
<thead>
<tr>
<th>Authors, Title, and Reference Information</th>
<th>Google Scholar</th>
<th>Web of Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>D Ma. Offering RSS Feeds: Does It Help to Gain Competitive Advantage? Hawaii International Conference on System Sciences, 2009.</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>D Ma. Use of RSS Feeds to Push the Online Content to Users. Decision Support Systems 54, 740-749, 2012.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Others</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>265</td>
<td>42</td>
</tr>
</tbody>
</table>

Citation counts from different sources have considerable variation. The two citation engines are effective in very different publication venues, journal and conference coverage, and research areas. In addition, Google Scholar considers both published and working paper citations, while Web of Science mainly counts citations of one’s published papers by published works. Given that I will have six journal papers forthcoming in 2015, in my case, the Google Scholar citations can show the impact of my research better. Here I provide an in-depth analysis based on Google Scholar. I will present my citation trend, find out who are citing me, and list some top citations.

After deleting self-citations and duplicate entries, the adjusted Google Scholar citation count is 254. My h-index is 6 and i10-index is 5.

Citation Trend. As Figure 1 shows, there is a steady and significant increasing trend for my citations. 90% of my citations (228 out of 254) are from my works in cloud services market. The IS research in cloud computing services has just picked up in past several years. I am an early entrant to the cloud services research. So far, I have one journal publication (IEEE Transactions on Engineering Management in 2014), 3 papers in press (Information Systems Research, Decision Support Systems, and International Journal of Cloud Computing), 2 book chapters, and 20 conference papers in the cloud computing research field. So I am confident that in the next 5 ~10 years, my citations will increase dramatically.
Interdisciplinary Citations. My works have obtained interdisciplinary citations. Besides IS and management, I was well cited by other research disciplines. Figure 2 analyzes the citation counts by disciplines. My citations from IS and Management, Computer Science, and Engineering are 115, 77, and 46, respectively. The citation count from other fields, including Mathematics, Material Science, Life Science, Finance and Banking, is 16.

Top Citations. Figure 3 shows my citations by their source types: 104 citations from conferences, 74 from journals, 29 from books, and 47 from other sources including working papers, student dissertations, industry white papers, and patents. Table A2 takes a closer look at these citation types in each discipline.

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<thead>
<tr>
<th></th>
<th>IS &amp; Management</th>
<th>Computer Science</th>
<th>Engineering</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Journals</td>
<td>29</td>
<td>29</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Conferences</td>
<td>56</td>
<td>8</td>
<td>40</td>
<td>-</td>
</tr>
<tr>
<td>Books</td>
<td>12</td>
<td>17</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Others</td>
<td>18</td>
<td>23</td>
<td>1</td>
<td>5</td>
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Table A2. Citation Analysis by Types and Disciplines
In the IS and Management field, peer-reviewed high-impact journal articles are viewed as the primary indicator of productivity. I have 29 citations from major IS journals. Some top ones include:


Computer Science and Engineering Management value publications in highly selective conference proceedings more. As Table A2 shows, in Engineering Management, most of my citations are from IEEE conferences relevant to cloud computing. Some of them are IEEE International Conferences on: Grid and Cooperative Computing; Web Services; Service Computing; Services Economies; Cloud Computing; Management and Service Science; E-Business Engineering; Consumer Electronics; Cloud Computing, Technology and Science; Commerce and Enterprise Computing; and Utility and Cloud Computing.