

# Research Statement

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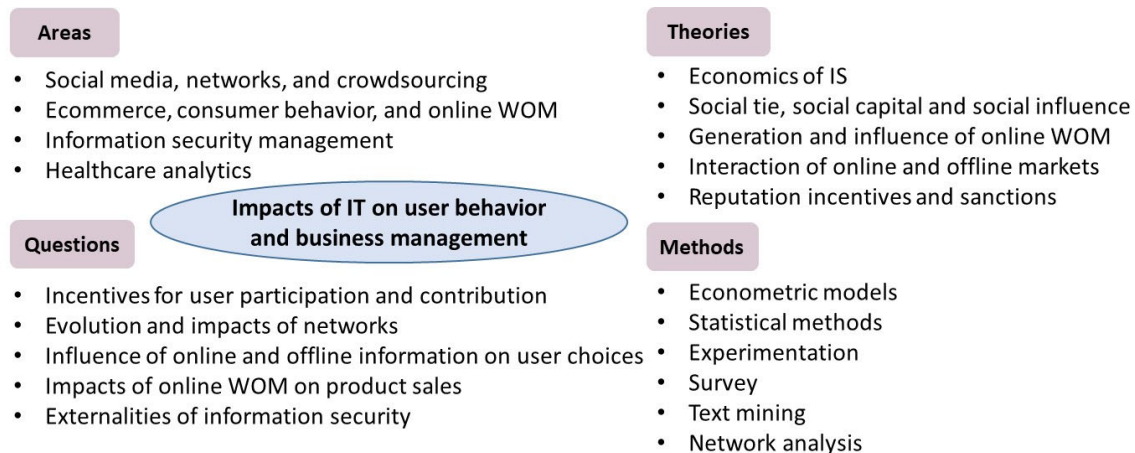
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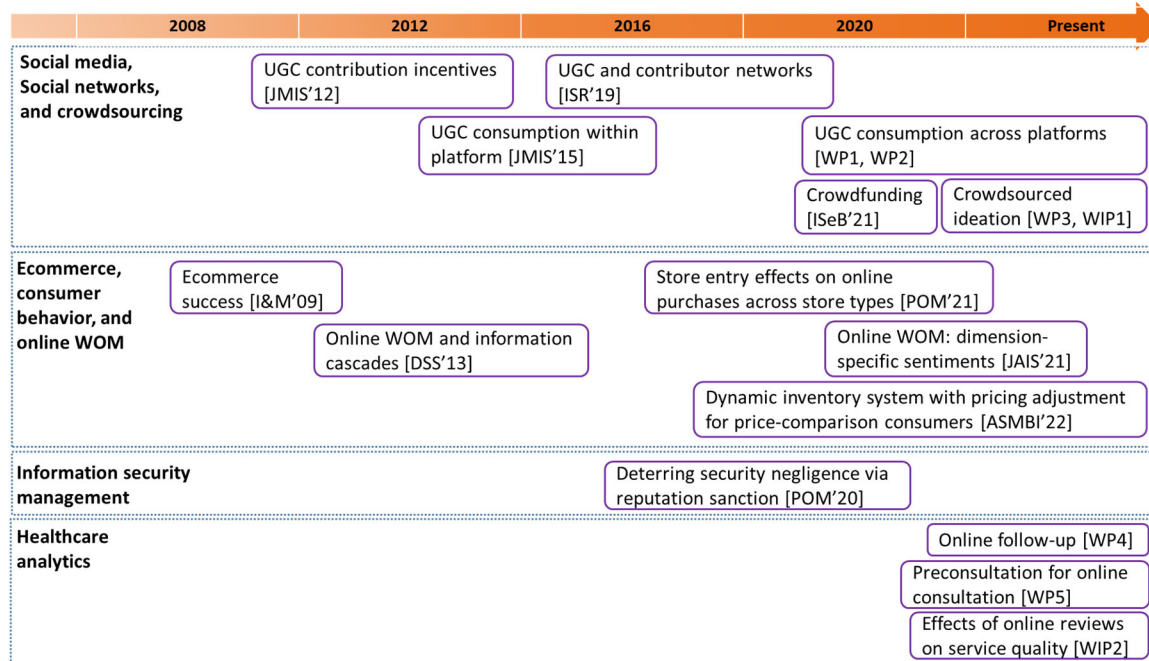
## Background, Motivations, and Research Summary

Information technology (IT) has revolutionized personal lives, business models, and management practices. Personal lives and interpersonal communications have dramatically changed with the rise of social media. Integrating user generated content (UGC) with social networks, social media have greatly empowered individuals to broadcast their opinions, interact with others, and participate in communities. In response to changing consumer behavior and technology advancement, new business models and operations have been created at an accelerated rate in online and offline markets. As the dependence of business operations on IT grows, managerial practices are increasingly challenged by cybersecurity threats, making information security an essential part of risk management and business continuity.

Under this background, my research focuses on the intersections of IT, user behavior, and business management. To study how IT changes user behavior and business management, my research solves problems in four major areas created by IT – social media, ecommerce, information security, and online healthcare services. My research approaches are mainly empirical and experimental with the objective of revealing causality and establish rigorous data analytics. I apply a wide range of methodologies including econometric models, statistical methods, experimentation, survey, text mining, and network analysis. My work generates new knowledge on how users behave under the influence of IT and provide managerial insights on how business can strategize on the emerging opportunities and rising challenges. Figure 1 briefly summarizes my research areas, questions, theories, and methods. The evolution of my research in the three areas over time is shown in Figure 2.



**Figure 1. Summary of My Research**



**Figure 2. Evolution of My Research**

## Research Areas

### 1. Social Media, Social Networks, and Crowdsourcing

#### UGC contribution and consumption

As content platforms, social media websites connect UGC contributors with consumers. To understand contributors' behavior, the first and foremost question is why they contribute. In the early stage, advertising revenue sharing with selective contributors was initiated by many websites to encourage content contribution. Motivated by this phenomenon, my research studies the incentives for content contribution and the effectiveness of revenue sharing programs [JMIS'12]. This study constructs a dynamic structural model that allows contributors to be forward looking when making contribution decisions. The findings identify the motivations of both intangible online reputation and tangible monetary rewards for contributors, demonstrating that revenue sharing is effective but not necessary to sustain user contribution. My research also shows that the relative importance of these incentives changes over time, and that the consideration of contributor heterogeneity leads to more effective platform interventions.

For consumers' behavior, the central question is how they choose content. To address this question, my research examines the mechanisms for content consumption, i.e., social learning and network effects [JMIS'15]. While the mechanism of social learning is information externalities that the expressed WOM reveals the underlying content quality, the mechanism of network effects is payoff externalities that consumers' utilities from the content increases as the number of existing consumers. Using a Bayesian learning model, my research identifies the presence of both mechanisms in the context of YouTube. Categorizing popular content into high-quality content (with consistently positive WOM) and controversial attention-grabbing content (with mixed WOM), we find that the mechanism of social learning is more pronounced in the

consumption of high-quality content, whereas the mechanism of network effects more strongly drives the consumption of attention-grabbing content. These findings contribute to the theory of social influence and the literature on content diffusion. The practical implications regarding the virality of online content were reported by Bloomberg Businessweek.<sup>1</sup>

### *Impacts of social networks on UGC*

In social media, diffusion of UGC is largely due to social networks. There have long existed networks among consumers (e.g., friends) and networks between contributors and consumers (e.g., followers/subscribers). Recently, networking between contributors (e.g., collaborators) has been added to many content platforms for collaboration and cross-promotion. The tie between two contributors is directional and benefits only the one with the incoming tie, as it directs a contributor's viewers to others following the outgoing ties. Only bilateral ties are mutually beneficial. Yet contributors can only initiate outgoing ties unilaterally and expect their ties to become bilateral with reciprocation. Such networking activities have become an important strategy for content providers to increase the visibility of their content. To study the impact of contributor networks on their content, my research investigates both the likelihood and benefit of tie reciprocations between content contributors on YouTube [ISR'19]. From the content- and structural- perspectives, this work finds that content similarity and common ties between two contributors increase reciprocation probability but decrease reciprocation benefit for the tie initiator, highlighting the tradeoff between reciprocation probability and reciprocation benefit as the challenge faced by many providers. Using simulation, we find the optimal content similarity and common ties between the two providers for the tie to yield the highest expected reciprocation benefit. The results provide practical managerial implications on contributors' networking strategies and shed light on predicting the co-evolution of social networks and content consumption.

Besides the social networks within a platform, social networks of other platforms may also contribute to content diffusion. As consumers are using multiple social media platforms, their cross-platform activities give rise to many social endorsements (SE), the positive sharing via one's social ties. For instance, YouTube viewers may share watched videos with their followers on Twitter or friends on Facebook. To study the interaction between cross- and within-platform content diffusion, my research examines the interplay of content views and WOM with SE [WP1, WP2]. We combine a content-level observational study using a multi-platform dataset and individual-level randomized experiments to study consumption and endorsement jointly. The observational study finds that SE is driven by WOM but not content views and that SE increases both consumption and post-consumption WOM. Randomized experiments further reveal that positive WOM increases SE by increasing perceived quality and negative WOM decreases SE by reducing perceived interestingness, and that only SE from strong ties increases content views and WOM. Following the strong-tie SE, consumption increases because of higher expected quality and interestingness. After SE-induced consumption, positive WOM increases because of better perceptions of the content, and negative WOM also increases due to higher prior expectations. These findings complete our understanding on content diffusion both within and across platforms.

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<sup>1</sup> <https://www.bloomberg.com/news/articles/2012-09-21/the-economics-of-pussy-riot-on-youtube>

## Crowdsourcing

Besides individually contributed content, UGC can also be co-created via crowdsourcing. By tapping into the wisdom of the crowd, crowdsourcing has been redefining knowledge contribution and innovation. Platforms such as Wikipedia and TVtropes enable users to co-create content and ideas, which motivated my recent research on crowdsourced ideation [WP3, WIP1]. The crowdsourced ideation process starts with users proposing initial ideas, refines with the crowd providing feedback and co-editing the ideas, and ends with the idea being accepted or rejected. During the refinement process, users revise the idea's content semantics via text editing and networks by linking to existing ideas. To measure semantic refinement, we apply text mining technique of Term Frequency-Inverse Document Frequency (TF-IDF) to analyze the textual edits. For network refinement, we use network analysis to measure the centrality and bridging importance of an idea in the idea network. We find that semantic convergence, network centrality, and bridging importance of an idea significantly increase idea acceptance [WP3].

To understand how useful knowledge and innovative ideas arises from the wisdom of the crowd, my research on crowdsourced ideation further examines idea refinement, feedback and evaluation before acceptance and idea adoption/diffusion after acceptance [WIP1]. My research in this area will continue to combine the semantic and network perspectives. Text analytics such as text mining and natural language processing (NLP) will be used to explore rich information in the content text, while network analyses will be conducted on the dual-mode network of content and users on these platforms.

## **2. Ecommerce, Consumer Behavior, and Online WOM**

Since the inception, ecommerce is competing with offline retail stores, as consumers search across channels for low-price and best-fit products. To compete with online retailers, omni-channel retailers often leverage offline store openings to provide brand and product information, attract new customers, and improve operational efficiency. My research examines the impact of store openings on the competing online retailer [POM'21]. We collected a unique panel dataset combining data from multiple sources for (1) offline store openings of 22 major retail chains, (2) online purchases at a major online retailer, and (3) location characteristics for all zip code locations in the U.S. We find that the entry of regular-price narrow-assortment stores generates a complementary effect that increases online purchases; the entry of discount wide-assortment stores leads to a substitution effect that reduces online purchases; and the entry of other store types has no significant effect. Moreover, the complementary effect is mainly driven by the mechanism of unsatisfied product exploration due to narrow assortment in stores, and thus it not only increases the online purchases of store-brand products but also creates spillovers to other brands [POM'21]. My earlier work also examined the transition of traditional brick-and-mortar businesses to e-business [I&M'09]. To evaluate the success of their ecommerce initiatives, we developed a performance assessment model using indicators of marketing and sales, customer service, supply chain efficiency, and financial performance, and collected data from the retail sector in China using surveys.

Consumer purchases, both online and offline, are influenced by online WOM. Customer reviews in particular, provide rich information that assists consumer purchase decisions. My research on online WOM focuses on the effect of the review sentiment,

inferred from either the numerical rating or the textual content. First, based on the numerical rating, my research [DSS'13] examines how positive and negative WOM affect popular and niche products differently, to investigate how online WOM changes information cascades, the phenomenon that consumers follow the popular choices of previous consumers. Reviews are expected to reduce information cascades by revealing the private information of the previous consumers in addition to their choices. However, we find that, due to heuristic bias, consumers tend to ignore the WOM information inconsistent with their prior beliefs and overreact when it confirms their prior beliefs. Thus, online WOM does not correct information cascades sufficiently and instead makes popular products even more popular. Second, my research also examines the textual WOM information for dimension-specific sentiment effects [JAIS'21]. Compared to the numerical rating, review text provides richer information, e.g., why the customer evaluated the product positively or negatively. We extract dimension-specific sentiments from review text and analyze their respective effects on sales. Specifically, we identify key product dimensions evaluated in online reviews using a dynamic topic modelling algorithm without predefining the number of dimensions. Therefore, our methodology can be applied to many products in general. My research also studies optimal pricing and inventory strategies for retailers by modelling consumers' price-comparison shopping behavior [ASMBI'22].

### **3. Information Security Management**

As information has become the lifeblood of many organizations, information security risks impose a daunting challenge for business management. Many vulnerabilities remain undetected or unresolved because of the significant costs involved. The consequences of negligence are further magnified by the heightened interdependency among organizations because of mergers, acquisitions, outsourcing and collaboration. Security breaches in any link can be propagated to the entire supply chain. My research searches for an effective solution to deter negligence of security vulnerabilities [POM'20]. We propose a reputational sanction mechanism, under which firms' security practices are publically ranked and reputational sanctions are imposed on those with persistent vulnerabilities. To test the effectiveness of this mechanism, a large-scale quasi-experiment was conducted on organizations across 215 countries and areas, among which, Belgium, Canada, Turkey, and the United States were treated with a monthly top-10 list of the organizations with most security issues in terms of outgoing spam. Following the top-10 list, organizations of the four treated countries, especially the listed top-10, were observed to have reduced their outgoing spam on average, compared to organizations of the control countries. We further attribute the effectiveness of the reputational sanction mechanism to the reputational effect on the sanctioned organizations and the awareness effect on all organizations in general. Our mechanism provides a cost-effective solution for policy makers to improve overall cybersecurity without disclosing sensitive information.

### **4. Healthcare Analytics**

Online healthcare platforms (OHCs) provide an important means for patients to learn about illnesses, seek medical advice from healthcare professionals, and connect with

other patients remotely. The function of online follow-up services enabled by OHCs provides offline patients with an important channel for medical follow-ups after their treatment. My research studies the effect of adopting online follow-up services by physicians on offline and online physician demand in the context of chronic disease [WP4] and the effect of preconsultation on service efficiency and patient satisfaction of the online consultation [WP5]. The results consistently demonstrate that adopting online follow-up services leads to higher offline physician demand. Interestingly, in contrast to the channel substitution effect documented in the literature, my research finds that providing online follow-up services also increases online physician demand. Furthermore, the results of mechanism tests reveal that online follow-up services affect online demand by boosting physicians' online exposure and increasing the availability of information on their online service characteristics to patients. Regarding the effect of preconsultation, my work reveals that adding preconsultation by assistant physician increases service efficiency of the attending physician while decreasing patient satisfaction. My future research in this area will explore the impacts of other new functions introduced by OHCs such as online service reviews, which separate the reviews for online consultations from those for offline services [WIP2].

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### Publications

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#### Working Papers

[WP1] TANG, Qian; SONG, Tingting; QIU, Liangfei; AGARWAL, Ashish. 2021. Online content consumption: Social endorsements, content popularity, and word-of-mouth.

[WP2] ZHAO, Anqi; TANG, Qian. Impact of original and reposted social endorsements on product consumption: The moderating role of the endorsers' network.

[WP3] MACK, Vincent; ZHOU, Yimei; TANG, Qian. Combinatorial creativity in online platforms: A knowledge network perspective.

[WP4] ZHAO, Anqi; TANG, Qian; GAO, Yang. The effect of online follow-up services on offline and online physician demand: Evidence from chronic disease physicians

[WP5] TANG, Qian; ZHAO, Anqi. Physician-patient interactions in online healthcare: Evaluating the effects of preconsultation on service efficiency and patient satisfaction.

#### Work in Progress

[WIP1] ZHOU, Yimei; MACK, Vincent; TANG, Qian. The role of user comments and editor responses in crowdsourced idea refinement.

[WIP2] ZHAO, Anqi; TANG, Qian; GAO, Yang. The effect of online service reviews in online healthcare consultations.