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The Emergence and Growth of Ecosystem: The Strategic Role of Digital Innovation

Dandan Ye
University of Nottingham, China, Dandan.YE@Nottingham.edu.cn

Martin J Liu
University of Nottingham, China, Martin.Liu@Nottingham.edu.cn

Jimmy Huang
The University of Warwick, jimmy.huang@wbs.ac.uk

Jun Luo
University of Nottingham, China, maria.luo@nottingham.edu.cn

Zi Wang
University of Nottingham, China, Zi.Wang@nottingham.edu.cn

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Completed Research Paper

Dandan YE
University of Nottingham, Ningbo, China
Trent Building 353, No. 199, Taikang East road, Ningbo, Zhejiang Province, The People's Republic of China, 313000
Dandan.YE@Nottingham.edu.cn

Martin J Liu
University of Nottingham, Ningbo, China
Trent Building 353, No. 199, Taikang East road, Ningbo, Zhejiang Province, The People's Republic of China, 313000
Martin.LIU@nottingham.edu.cn

Jimmy Huang
University of Warwick
Warwick Business School, Scarman Road, Coventry, The United Kingdom, CV4 7AL
Jimmy.Huang@wbs.ac.uk

Jun Luo
University of Nottingham, Ningbo, China
Trent Building 353, No. 199, Taikang East road, Ningbo, Zhejiang Province, The People's Republic of China, 313000
Maria.Luo@nottingham.edu.cn

Zi Wang
University of Nottingham, Ningbo, China
Trent Building 353, No. 199, Taikang East road, Ningbo, Zhejiang Province, The People's Republic of China, 313000
Zi.Wang@nottingham.edu.cn

Abstract

Ecosystem is increasingly prevailing in global competitive landscape, which has received heightened attention in academia and practice. Extent literature has largely concentrated on the development of digital ecosystem in stage-based manner, however, viewing it from the perspectives of scale up and scope extension remains void. Based on an in-depth case study of a flower technology company in China, we inductively adopt the lenses of scale and scope to address how digital innovation can empower the development of ecosystem. In particular, we critically trace three mechanisms of ecosystem scale up: supplier agility, logistic optimization and network structure orchestration. Among which, we indicated a positive network effect in business digital ecosystem, identified influences of digital innovation toward market and further revealed the effectiveness of supplier inclusiveness in supply chain relationship. This model offers significant implications on information system, supply chain management literature and provides essential managerial implication.

Keywords: Digital Innovation, Digital Ecosystem, Qualitative Research

Introduction

As the inter-network has permeated every aspect of the business landscape, companies in various industries have established networks of partners or ecosystems to improve the scope of delivery of their products, services and technologies (Nambisan & Sawhney, 2007). Since Moore (1993) introduced the metaphor of "ecosystem" in the business literature, the last decade has seen a significant elevation in interest in ecosystem (e.g. Apple's iOS, Google's Android), which offers individual companies an avenue to participate in shared learning and mutual benefit. Evolving ecosystems has rapidly gained attention in strategy and innovation literature (Adner, 2017; Helfat & Raubitschek, 2018; Jacobides, Cennamo, & Gawer, 2018). Parallel to the evolvement of ecosystem literature, the surge of digital innovation has transformed the manner in which entities do business (Yoo, Boland, Lyytinen, & Majchrzak, 2012)**.** For instance, Uber drivers and AirBnB operate akin to a typical taxi or hotel service yet they are functional and popular due to the fact they leverage digital innovation.

What if digital innovation were to be combined with the ecosystem? The operation of digital ecosystems is currently becoming increasingly intriguing and particularly the challenges to governance and orchestration (Tilson, Lyytinen, & Sørensen, 2010; Helfat and Raubitschek, 2018). Jacobides et al., 2018; Datt'ee, Alexy, & Autio, 2018). However, what drives the emergence and growth of the ecosystem in the digitally enabled world, in particular with regard to ecosystem scaling up and scope extension, remains unclarified. Scale up in this paper is defined as the increasing of number of same kind of actors with the same activities in original geography. While the scope expansion refers to more actors from different areas join in along with the complementary service or activities. The focal point of scale up is the number, in contrast, the main idea of scope expansion is richness of the categories, activities and geography scope in the ecosystem. In some ways, prior research has simply highlighted the network effect of digital innovation playing in ecosystems of digital platforms, whilst neglecting technology that focuses on integrations among user capabilities and certain internal technological capabilities. These considerations highlight issues raised in this paper: *How firm leverage digital innovation mechanisms in ecosystem? How do interrelated mechanisms cause the business ecosystem to scale up and scope extension?*

Taking Easy Flower Technology Company, one of the largest companies in China, we are explicitly examining the way in which the phenomenally successful ecosystem is created, and growth can be enjoyed by leveraging the digital affordability of over 10,000 producers and more than 4,600 buyers. In several ways, the study aims to contribute theoretically. First, this paper adds an innovative perspective to ecosystem literature: scale and scope in the digital ecosystem through the combination of digital affordability and focal firm coordination. The majority of existing literature illustrates the whole process of emergence and growth on stage (Leong, Pan & Newell, 2016; Tan, Pan, Lu & Huang, 2016). Wisdom is still lacking in considering the ecosystem in terms of scale and scale. Second, we have identified other characteristics digital innovation. Market forecasting and market regulation, when intersected by ecosystems that respond exactly to the call for new characteristics of digital innovation (Autio, Nambisan, Thomas, & Wright, 2018). Furthermore, supplier inclusiveness can call into question dominant and prevailing literature of the supply chain, which stresses, on the other hand, supplier base reduction and long-term relationships (De Toni & Nassimbeni (1999)). In order to further extend current literature to the digital ecosystem format by introducing an empirical business ecosystem, the paper indicated the positiveness of network externality in another ecosystem format. Different empirical research in ecosystem literature seems particularly justified in respect of the different taxonomies of digital ecosystems (Jacobides et al., 2018).

The following section describes the conceptualization base of the paper and follows the methods used in case studies. In next section, this paper links empirical evidence and theory concepts identified with specific case. We then produce a conceptual model to show how digital innovation driven mechanisms influence the emergence and growth of ecosystem. Finally, we discuss the respective theoretical and practical implications along with limitations.

Conceptual Basis

Digital Ecosystem

Selander, Henfridsson and Svahn (2013) developed a digital ecosystem as a group of actors driven by digital innovation, eager to materialize their product or service innovations and in doing so, expounded upon the emergence of the area in the early 21st century. Digital infrastructure and people are two cornerstones of the digital ecosystem (Sussan & Acs, 2017). Influenced by the central actor, an environment that is user driven, downstream and open source-oriented, is characterized by the interactions between nonliving elements (digital technologies) and living components (users using technology).

In order to expand its actors and strengthen its self-feedback circuits, the digital ecosystem has relied considerably on the enhanced impact of network (Katz & Shapiro 1994), thus co-developing it. The network has a stronger impact. The ecosystem's value is determined by both the amount and quality of actors in the systems, argued De Reuver, Sørensen, and Basole (2018). However, it is uncertain whether positive network effects would be generated automatically. Extent academia examined largely how platform ecosystem interfaces have technological influence (De et al., 2018; Helfat & Raubitschek, 2018; Sussan & Acs, 2017). Beyond a platform, literature is sparse with respect to the addressing of the digital ecosystem in the format of other ecosystems apart from being quite general in nature (Tsatsou, Elaluf-Calderwood, & Liebenau, 2010; Weill & Woerner, 2015). Thus, whether the attributes explored from digital platform ecosystem (e.g. network effect) can be applied to another format of ecosystem is still unknown.

Due to the reinforcement of interdependent relations in digital ecosystems, ecosystem design and orchestration have become more focused (Teece, 2018). Special emphasis was placed on academia, focused on ecosystem government (Autio, Nambisan, Thomas & Wright 2018, Helfat, & Raubitschek 2018) and ecosystem emergence (Jacobides et al. 2018). Digital ecosystem governance means the reconfiguration of digitized elements by means of digital convergence, associated generativity and balance the paradoxical relationship of change and control, which at the same time requires stability and flexibility in the attraction of new enthusiasts (Tilson et al., 2010). Studies have shown that “focal” and “hub” companies play a strategic role in ecosystem development (Jacobides et al., 2018; Tans et al., 2016). In particular, Du et al (2018) saw the creation of the digital entrepreneur ecosystem as a process of forming a meta-organization using the case study of Zhongguancun, thus splitting work into three roles and integrating effort through two processes. Others divided the whole process into various phases, e.g. from birth to self-renovation (Leong et al., 2016) and from Hub and Spoke to Symbiotic (Tan et al., 2016). To theoretically sum up, extensive research pertaining to ecosystem emergence and growth prioritized the respective stages of ecosystems. As such, little is known about ecosystem in terms of its scale and scope and how they are varied.

Digital Innovation

Digital innovation refers to a recombination of digital components to create value in-use to users. It can be both innovation process and innovation outcome (Huang, Henfridsson, Liu, & Newell, 2017). Three of the most influential characteristics of digital innovation are *reprogrammable* which allows digital devices to conduct a wide range of activities, *homogenization* which makes any digital contents become accessible and *self-reference* which means that the diffusion of digital innovation creates positive network externalities (Yoo, Henfridsson, & Lyytinen, 2010). That is to say, different modalities with architectures are loosely coupled through standardized interfaces, leaving room for further homogenization and re-combinability.

In combination with different context and for different purposes, different attributes will become prominent (Briel, Davidsson, & Recker, 2018). Nambisan (2017) has further developed digital innovation that is less well defined in entrepreneurship, incorporates attributes of market capability, fluid process and results. In particular, entrepreneurial processes and results have been transferred from isolated, unattainable, stable boundaries to increasingly porous and fluid borders. With the infusion of digital innovation, the “intentionally incomplete” which means that features, values and outcomes offer

continuously evolving although the product or service is sold, and idea is enacted. Besides, Briel et al (2018) contend there are two digital innovation attributes which can have the effect of altering the elements of actors' work by controlling both action and interaction, namely *specificity*. The degree of specification is of vital importance since it manifests the level of adaptability and malleability. The second attribute is defined as the *relationality* (Briel et al., 2018), which indicates digital innovation are interdependent and structural connected, capable of self-reference.

Obviously, the focal attributes and functions of digital innovation are various when it comes into numerous contexts. The adaptability of digital innovation makes it easier to be adapted to a variety of situations and result to the salience of abundant characteristics. Yet, how these specific contexts driven attributes intersected with ecosystem has rarely been refined other than the aforementioned network effort.

Methodology

Research Context

Founded in 2014, Easy Flower is a technology company selling flowers. Aggressively, in just one year, it became China's most renowned flower supplier. Currently in Beijing, Shanghai, Guangzhou, and the surrounding area, it has covered 40 major and medium-sized cities and has cooperated with almost 10,000 growers in nine major production areas. In the last four years or so, the efficiency of original floral industries' circulation has increased significantly by 70% and by using its central digital innovation it has become the standard founder in China's floral industry. Easy Flower is instructive for the purposes of this study for two reasons. First, Easy Flower has leverage digital innovation to help establish ecosystem and has had a sustainable development period, which is particularly appropriate in order to explore how ecosystems emerge and grow. Second, digital innovation of Easy Flower has changed over time which can precisely provide us a dynamic and longitudinal perspective toward ecosystem.

Data Collection

Data was collected with extensive interviews from April 2016 to August 2018. We visited the Headquarters of Easy Flower and interviewed a few senior members of staff and members. We also made phone call interviews toward other actors that have business transactions with Easy Flower in the last two years to engage in informal dialogues (see table 1). Together with telephone follow-ups, emails and messages interviews, we have conducted a total of nine field studies from the period of 2016 to 2018 to continuously confirm our interpretation of their digital ecosystem (see table 2).

To analyze the data in depth, the research method of interviews can not only help researchers to understand the experience of participants through self-reflectivity but can also obtain reliable information relating to research objectives and research issues (Holstein & Gubrium, 2004). Multiple semi-structured interviews are therefore the ideal approach for examining questions relating to the process. We have transcribed 34 (average duration: forty minutes) interviews with 28 key members of the management of Easy Flower, the senior managers of its different business departments, company staff from various departments and dealers, buyers and more in ecosystem.

Therefore, we produced a suitable word account with a total number of 210,000 words for transcription purposes. We also adopted observations of participants, archival information and informal research dialogue, other than interviews. Easy Flower project meetings, workshops, forums and other forms of meetings, allow us to capture the rational decisions taken by companies precisely. It is especially important that we gain insight into the underlying versions of actions for senior and mid-level leaders.

Archival data can also be considered as an addition to data, so that we can track Easy Flower's ongoing activities before and after the interview period. In addition, the informal dialog with management can not only help to identify the relationships between the relevant interviewees but can also give them access to their senses, which are especially vital for vision, rationale and outcome associated with the ecosystem's emergence process.

Table 1. The summary of source of data collection

Data Sources	Total and Breakdown
Interviews	34 interviews (length：40 minutes) with 28 respondents in the focal company, generating word count of 210, 000 words in mandarin; 17 phone call interviews (length: 15 minutes) with 17 respondents, generating 17 pieces of interview notes with word count of 9,000 words in mandarin
Participant observation	9 occasions with average length of 30 minutes, encompass 3 project meetings, 3 workshops, 1forums and 2 internal week meetings
Archival data	Project descriptions, meeting minutes, online releases, customer data base, sale forecasts, technical specification
Informal dialogue	With the CEO and the management teams during the field visits, including 11 phone conversation with CEO secretary

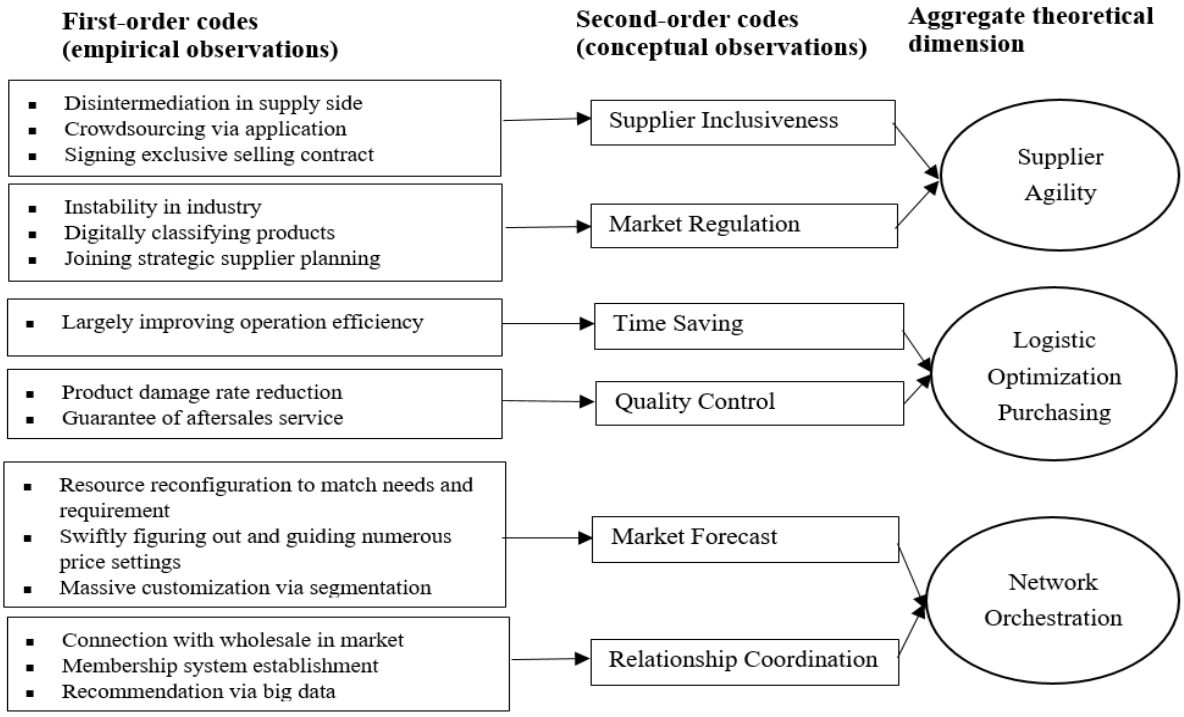
Table 2. The summary of key participants

Critical actors of ecosystem (Niche Actors)	Roles and Examples from the Case
Focal firm	The flower technology company
	28 participants in total in various departments both in head and subsidies, e.g. general managers, operation manager, customer manager, technical manager, marketing director ect.
Suppliers	Domestic farmers in Yunnan, Chong Qing ect. provinces; International agencies overseas
	3 key farmers in domestic and 1 manger in international agency by the operation manager of focal firms for phone call interview
City partners	The cooperators who is interested in joining the ecosystems, which can be either people who have conducted the relevant work before or purely entrepreneurs
	3 partners recommended by the operation manager of focal firms for phone call interview
Evolution of B-merchant	Owners who have purchased products from the focal firm; After joining it, actors who focus on specific work (design or creative work) only
	Randomly pick from B-merchant base, and made 5 phone call interviews
C-side Customers	Customers who have purchased products from the focal firm or followers of the we-chat official account
	Randomly pick from c-side customer base, and made 3 phone call interviews
Diversity of actors (Florists)	Flexible contract with the focal firm; Actors who provide complementary service as the evolving of the ecosystem
	2 florists recommended by the operation manager of focal firms for phone call interview

Data Analysis

Our inductive study follows the ground theory variant in accordance with the approach of Gioia and Chittipeddi (1991), as shown in figure 1. This approach encapsulated in the first place the analysis (provisional codes) for empirical codes, case narratives and terms such as the activities of the supplier as to how the market changes in the formats central to those in the left-hand column of figure 1, after the emergence of the ecosystem.

Figure 1. Data Structure



Secondly, the theoretical concepts of empirical materials have been identified as the 2nd order in the middle of figure 1. Afterward, as listed in the right side of figure 1, we aggregately produced a "data structure" deriving from 1st and 2nd order in figure 1. It is an effective approach to make a combination of collected data, original findings and relevant literature review in a reasonable way, thereby synthesizing conceptual observations to aggregate dimensions. We also composed five tables to illustrate how empirical observations (1st order) are connected with conceptual observations (2nd order). Lastly, we engaged in a selective coding process (Strauss & Corbin, 1998) to elaborate on the process and as to how digital innovation dynamically works alongside supplier agility, logistic optimization and network orchestration, therefore determining to the scale up of ecosystem and simultaneously evoking the flowing co-evolvement and actor fungible. Consequently, flowing co-evolvement and actor fungible concordantly triggers the actualization of ecosystem scope extension. The generated conceptualization that theorizes the phenomena is demonstrated in figure 1.

Findings

How the Scale up and Scope Extension of Ecosystem Take Place

As a service company in the flower industry, Easy Flower found it was quite inflexible when purchasing flowers from the wholesale market in Beijing meaning it was effectively restricted by the market situation, especially during festivals. Founder Rong Chao noted the following:

> *Agriculture urgently needs intelligence and needs more people to go deep into the industry. The main issue of agricultural interconnection is to truly match supply with demand.*

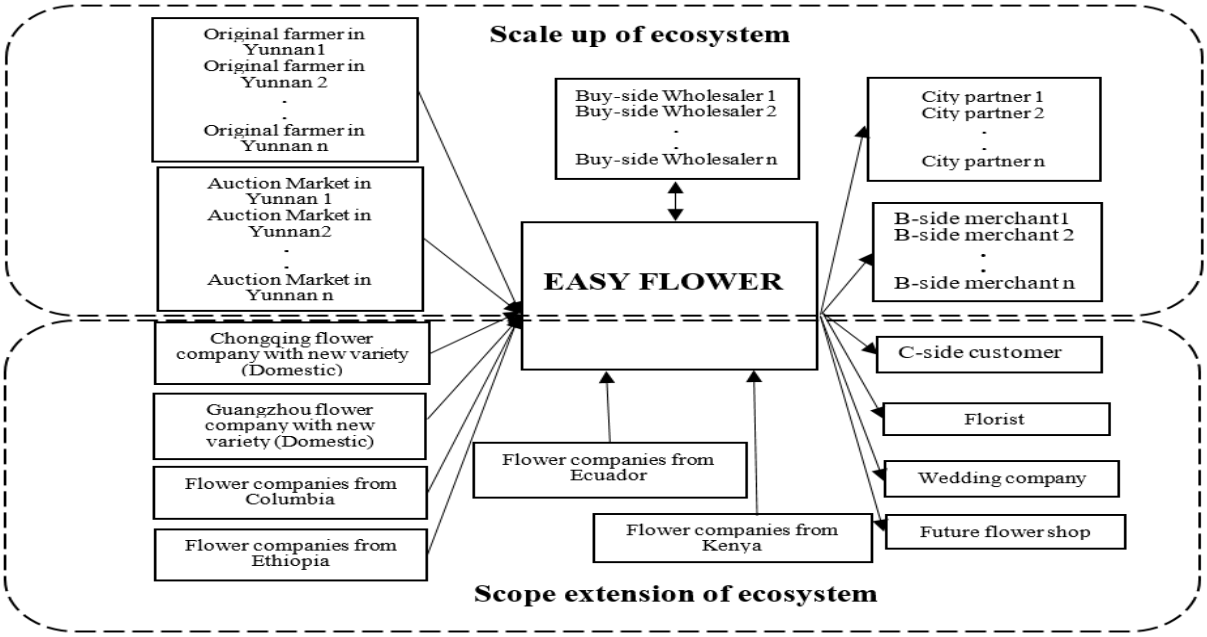
Easy Flower started its resource reconfiguration journey with its distinctive digital access to substantially solve the problem of supply and demand. In 2015 the main operations of WeChat were initially transformed into two applications (flower supplementation and flower search) that were responsible for both sides of the supply chain. The flower ecosystems rapidly developed and expanded in a year, together with automatic pricing and distribution plans via EPS (Electronic Payment Systems) BI (Business Intelligence) and Big Data, WMS (Warehouse Management System)/TMS (Terminal Management System) and quality control system. As Mr. Rong reflected in June 2016:

> *There are three main difficulties in flower industry. Flowers are difficult to source, ship and sell. However, we can solve the three obstacles with our big data and technology.*

At present, shipments represent an average of 1.5 million flowers, representing 15% of the country's flowers. Starting in April 2015, over 100 strategic partners from Easy Flower have been developed today as channels, as some areas in China are expensive to explore for Easy Flower itself. It covered 63 towns and more than 46,000 floral channels and almost every flower scenario such as weddings and funerals. In addition, it has cultivated customers as esthetics that are consistently linked to its brand mission —It has brought the beauty to the world. In fact, ecosystem development by the focal company—Easy Flower can be seen strategically from the perspective of scale and size. For scale up, in particular, this means that the number of actors present in the ecosystem is increased (see the upper part of Figure 1). The continuous participation in the ecosystem is considered as an ecosystem scale for actors who share similarities with existing actors. The numbers of farmers in the same areas, for example, can be seen in the ecosystem as the same actor.

The change in the phenomena previously described is the number of farmers but nothing new is added to the ecosystem. It references scale expansion (see Figure 1 in the bottom) once new elements or a new category of players are incorporated into the ecosystem. It has often cooperated with overseas countries and famous flowering regions (e.g. Ecuador, Colombia, Ethiopia and Kenya). As a result, the floral varieties in East Africa and Central America, as compared to the original, are significantly enriched in the world.

Moreover, due to the market variation, the ecosystem has more or less connections between occupations and agencies with flowers (e.g. wedding firms and florists). The membership of these new players abounded in the ecosystem's diversity and contributed to ecosystem extension. However, if the new actor increases in number for instance, the situation can be considered as scale up. This results in a large number of interconnected scope extension and sale up and scale up can in contrast trigger scope and



scope extension. Here is the illustration of scale up and scope extension of Easy Flower in figure 2.

Note: Figure 2 solely focuses on the interactions with focal firm. Intersections among actors may actually exist in the ecosystem. And scale up phenomenon do happen in scope extension part when the number of new actors increased, however, it is not illustrated in this figure since it concentrates only on focal firm. The overlap between scale up and scope extension is exactly what we figure out in conceptual mode, which is in figure 3.

Figure 2 The Illustration of Ecosystem Scale up and Scope Extension

Supplier Agility

The part of supplier agility has two attributes, namely supplier inclusiveness, market regulation (see specific in table 3). Easy Flower has to figure a way of reaching primary suppliers directly and removing intermediate wholesalers alongside the supply chain, which increases stability and saving costs significantly in order to become competitive players on the market. They offer crowd-sourcing which involves first-level suppliers and encourages them to participate in a digitally enabled procurement process. Suppliers therefore don't necessarily have to go to a floral auction or wait until some dealers are over.

Rather, farmers can voluntarily decide whether to take part in transactions or not. In addition, the farmers' liberty burden of planting is exclusive selling contracts. Easy Flower will take over and reclassify them for future sales regardless of what they plant in a particular field. Suppliers, in particular farmers in first tier, and Easy Flower formed cohesive supplier collaborations. Leveraged by the use of flower supplication, Easy Flower can not only effectively coordinate the supply relationship between numerous suppliers, but also continuously extend the external network because of the bargaining power.

More and more suppliers are willing to join the bottom up ecosystem of because of the expansion base of suppliers. With the growth of ecosystems, the focal company is more persuasive, complementary companies are more willing to agree and to believe the benefits of joining ecosystems. Farmers are particularly satisfied that, once they are signed with it and receive orders from the application, their supporters are potentially sold. Farmers are also kindly eager to choose different flowers when they should select flowers because they tender to believe the estimation and data analysis result of Easy Flower.

The focal company, Easy Flower, automatically becomes responsible for market regulation as the backward and unstable of the flower industry. It is far behind the international level in China, which is rather unstable and concentrates only on a few floral variations. From the source, Easy Flower decode strategically and encode the flowers according to criteria, so that a large number of floral experts are not necessary for the upcoming supply chain process. Initially it could arrange flowers by the ABCD classification.

Table 3. Supplier Agility

1st-order analysis and illustrative evidence	**2nd-order analysis (theoretical observations)**	**Aggregate theoretical dimension**
▪ **Disintermediation in supply side** Before the emergence of Easy Flower, some flower farmers themselves as flower dealers, asked a variety of flower farmers to give their flowers to them with a relative low price, then dealers would take over the whole sales thing. Another approach was that the flower farmers themselves directly took flowers to the local wholesale market and sold flowers to the auction market in Yunnan. (Purchasing manager) ▪ **Crowdsourcing via application** Easy Flower will send the flower demanding messages on flower supplementation, a well-designed apps set up by us for suppliers. Registered flower farmers will take the order in apps accordingly. The successful flower farmers will receive a message reminder, and the corresponding level of flowers will be sent to the designated location (FDC) within the specified time. The quality control will be monitored by us along logistic process. (App brand manager) ▪ **Signing exclusive selling contract** Correct. I have bought all the flowers in the field from contracted farmer this year, and then all their good and bad (species) flowers belongs to us. We will further classify them, then sell them. (Secretary of CEO）	**Supplier Inclusiveness**	**Supplier Agility**
▪ **Instability in industry** It is hard to distinguish species of flowers and much more difficult		

to set standards and ensure the stability of the price which are significantly influenced by weather in Kunming, Yunnan province (the biggest plant district of flowers in China). (General Manager) ▪ **Digitally classifying products** Our CEO has strategically "decoded and encoded the flowers". For example, after the flowers are "freshly cut" from the field, they will be labelled according to a 300-page quality control booklet. There are 16 varieties of red roses, and each of them is divided into 5 grades according to their origin, stem length and other standards. These dimensions are the samples of the code. Merchants only need to use the APP to purchase flowers with codes. (Secretary of CEO） ▪ **Joining strategic supplier planning** Easy Flower has strategically launched the strategic plan "Thousand acres of flower – Flower Planting Improvement Project" to help farmers deal with species and capacity planning. We can also suggest farmers the specific flower, for instance, Eustoma is more profitable than others this year. (Purchasing manager)	**Market Regulation**	

Logistic Optimization

The two dimensions of logistic optimization are saving time and quality control. The work is extremely lean due to the digitization of the flowers. They have saved 1/3 of transportation time by relying on infrastructure built into the flowers source (front inventory) and the tracking system. In the interim, the rate of flower loss decreased to around 5 percent from 29 percent originally thanks to the cold chain covered by the supply chain. This is an operationally beneficial outcome for Easy Flower on so many levels and with the reduction in barriers to entry in industries today due to the omnipresence of technology, this competitive advantage can only be a good thing. In this way, it is able to remain at the centerpiece of the industry and continue to capitalize on its first mover's advantage. The flowering period has therefore extended for customers from 3 or 4 days to 10 days, enhancing essentially customer satisfaction. In contrast to the "adjustment" actions of the wholesale market, the after-sales services offered by Easy Flower are pioneering in the industry. In particular, flowers bought on the wholesale market are a mix of good and bad flowers, which is a hidden rule for the flowers industry. In addition, when supplying flowers to their own destinations, customers are held responsible for losses. While Easy Flower can ensure 100% freshness, customers may request exchange and replacement of products within 24 hours otherwise. Table 4 provides detailed explanations.

Table 4. Logistic Optimization

1st-order analysis and illustrative evidence	**2nd-order analysis (theoretical observations)**	**Aggregate theoretical dimension**
▪ **Largely improve operate efficiency** One-stop cold logistics reduces shipping time to 30 hours. I am very confident that we are the only one in industry that can deliver flowers within 24 to 28 hours. Once making the order, you will basically see the flowers next day. Most of flowers were sold at the moment they arrived at the warehouse. The turnover rate is extremely fast to ensure flowers' freshness. (Operation manager)	**Time Saving**	**Logistic Optimization**
▪ **Product damage rate reduction** The flower loss rate is reduced to about 5%. The transportation loss rate of flowers has dropped from 29% to less than 3%; the freight rate has decreased by 48%; and the flowering period of Easy Flower has also increased from roughly 3-4 day to more than 10 days. (Product manager) ▪ **Guarantee of aftersales service** Correct. Once you make the purchase decision from Easy Flower, we immediately deliver the flower to you. If you find some flower damaged, just send a photo as evidence to us. We can provide 24 hours after-sale service. However, if you buy it from wholesale market, you have to take responsibility of damage by yourself along the logistic process. Additionally, it is usual that there are some adjustments in flowers sold in the market, which means a mix of good	**Quality Control**	

and damaged flower in each bundle of flower. Easy Flower never does that (Customer manager).		

Network Orchestration

Easy Flower essentially targets on market forecast, relationship coordination to establish network orchestration. The precise and complex prediction of the market enabled by EPS system, decision-making and business intelligence (BI) is a key element of Easy Flower. Based on the data collected at the buyer's side, they divided the market into eight segment categories, time and frequencies purchases, floral preferences, etc. These characteristics, covering around 30,000 B-side retailers, provide specific models. With more than 300 million lines of codes, the backend system is updated daily. By calculating 720,000 algorithms, different B-sector merchants can accurately calculate mass prices with different orders and numerous delivery fees. This allows for a daily follow-up on the exact time, user delivery and traffic information of sales. More important, the unmatched supply and demand can be automatically alerted by the system and the regional inventory adapted for them. The focus firm is more likely to coordinate demand and need from a horizontal perspective since the ecosystem has been created. Due to the information obtained, the focal company tends to manage the price on the buyer side. The large pool of users enables the focal firm to make massive customization with the digital innovation of Easy Flower.

Relationship coordination in a bottom-up type of ecosystem is essential. In its sales application and membership system, for example, the recommendation system is personally designed for individual customers. In particular, in accordance with previous purchasing behavior, the app will only recommend 40 varieties of flowers by individual customer, although it contains more than 4000 product types in stock. The wholesale market, with a competitive relationship with focus companies, is another example. Both are suppliers of B-side traders, but they also have crossroads in the ecosystem. In an urgent situation, Easy Flower could buy some wholesale supplements for not losing the entire order for its customers, whereas the wholesaler in market could order from Easy Flower for its special offers. Table 5 shows empirical evidence.

Table 5. Network Orchestration

1st-order analysis and illustrative evidence	**2nd-order analysis (theoretical observations)**	**Aggregate theoretical dimension**
▪ **Resource reconfiguration to match needs and requirement** In fact, online is basically a direct sale channel for us with the Internet plus mode. Then there is another category called offline. Actually, there are many interesting things inside. For instance, for the flower shop around the hospital, the majority of flowers they pick are lily and carnation. While for wedding company, they prefer red rose. Sort of thing like that. (Customer manager) The back-end system of Easy Flower app has more than 300 million lines of code, updating on every 7 days, which guarantees the accurate of all transactions and circulation every day. (Director of technical department) ▪ **Swiftly figuring out and guiding numerous price settings** The system has to make 720,000 calculations per day for pricing. It automatically generates more than 330 forms every day. You can see the precise time, user distribution and traffic distribution of the sales channels every day. The system can also automatically alarm and calculate to adjust regional inventory, thereby further matching supply and demand. We can now guide the price of the sale side. While the supplier side is what we are working on. (Marketing manager) ▪ **Massive customization via segmentation** For example, its consumption behavior, the frequency of purchases, then the flowers B-side customers pick varies. Therefore, we build some underlying data logic (buyer classification) to cooperate with all the users of the company. The behavior of the process will be coordinated. (Customer manager)	**Market Forecast**	

▪ **Connection with wholesale in market** If we go to wholesale market to purchase some flowers, we still gain some advantages. We can buy flowers with a lower price than other B-side buyers. Regardless, we will sell them even at the same price as we pay for the market wholesalers. Because we are worried that customer may cancel the whole order because of the missing of one kind of flowers. (Key customer manger) ▪ **Membership system establishment** We are building a membership system now. Different types of users will definitely give you different privileges. First of all, its geographical location, then the flower material and the frequency are made as a record, after that, based on these records, we will actually classify users into membership division, which means, for example, the more you purchase, the higher of your ranking. The higher the ranking, the better the service and price you will enjoy. It is called service discrimination and price discrimination. (Marketing director) ▪ **Recommendation via big data** Pinking 30 kinds of flowers from a pool of 4,500. It is very troublesome, right? Actually, the home page will recommend only 50 flowers for you. Is it more convenience? Data can tell us everything. (CEO)	**Relationship Coordination**	**Network Orchestration**

Discussion

Digital innovation amplifies the ecosystem's emergence and growth through mechanisms. It covers two typical mechanisms enabled by digital innovation, specifically to scale up and scope extension, to grow the ecosystem as illustrated in Figure 3. Specifically, the upper part consists of three mechanisms, aggregate supplier agility, logistics optimization and network orchestration which directly lead to the ecosystem scale up and scope extension. As presented earlier, the scale up and scope extension are by no means isolated operations in terms of the ecosystem. The scaling up of the ecosystem can, to a certain extent, trigger the scope extension of ecosystem. Conversely, scope extension can deeply enhance the level of scale up.

As step one, the focal company develop its supplier side agility through supplier inclusiveness and supplier base expansion that are driven by disintermediation, convergence and generativity attributes of digital innovation (Autio et al., 2018; Nambisan, 2017; Yoo et al., 2010). Leverage on crowdsourcing digital platform, network effect in supplier side is increasingly pivotal in the nascent stage of ecosystem. The co-specification relationship is remarkable in the ecosystem, since actors can concentrate on its own role exclusively. The trust in the ecosystem can be built between non-focal and focal actors in the ecosystem. Thus, the focal firm has more persuasive bargaining power to attract more actors to join the ecosystem.

Second, the logistical optimization can be demonstrated by reduction of the workforce, saving time and controlling floral quality respectively. The characteristics of re-programing and self-reference of digital innovation (Yoo et al., 2012) have greatly making the operation leanness and efficiency. The huge reduction of cost in this step and increased marginal profit become the most attractiveness to absorb more actors into the ecosystem. The relationship in this step can be synthesized as co-competitive. Whether you are partners or competitors before, actors join to the ecosystems for the mutual benefits.

Thirdly, thanks to prior foundations, the ecosystem is further absorbing new actors with network orchestration. The ecosystem's flexibility results from homogeneity of digital innovation (Yoo et al., 2012), that makes heterogenous information become into bit stream. The ecosystem is basically established after the three steps. The success in each mechanism has laid fundamental basis for the emergence of the ecosystem. Among them, actors are interdependent for co-evolution. More essentially, the three mechanisms are continuously iterative leads to the scale up of ecosystem.

Once the ecosystem reached a certain scale, it jointly evoked fungible and flowing actors to update the ecosystem scope. It naturally has an attractiveness to absorb new actors that could automatically evolve and change the market from its original player. Focal companies then actively align with

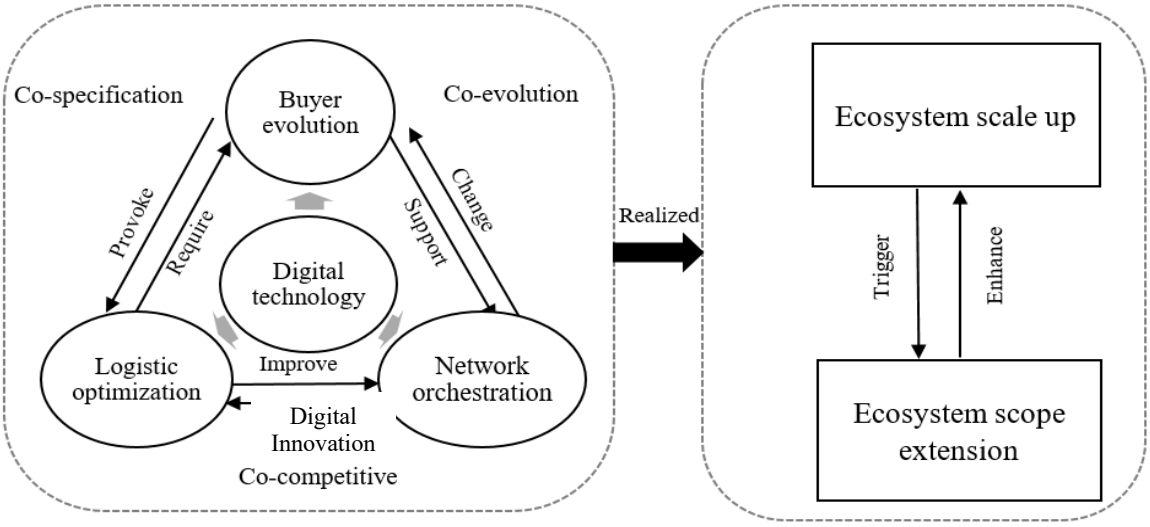


Figure 3. The Mechanisms of Ecosystem Scale Up and Scope Extension

external actors interested in the ecosystem, to enrich both the variety of the ecosystem. The boundary is blurred (Nambisian, 2017) and actors lock themselves in and out voluntarily in accordance with their interests. Burgeoned by co-evolutionary flow, the actor may be fungible and closely looped. One ecosystem player can actually exchange functions in certain ways with other players.

Implications and Conclusion

Although preliminary, our digital ecosystem conceptual model contributes to the innovation， information system and supply chain management literature. First, the model shows how the digital innovation of the focal company influences the scale and scope of the ecosystem. In the past literature, whereas scale up and scope extension for the ecosystem are rarely proposed in literature, to say nothing more of mechanisms which enhance scale and scope, the entire emergence and growth process are touched on tangentially (Leong et al 2016; Tan et al., 2016) is stage-based. Secondly, from the standpoint of digital innovation, when it intersects with ecosystems more digital affordability is identified. Our study has conceptualized new market outlooks in response to a call for new aspects of digital innovation (Autio et al. 2018), specifically deepened preliminary argument of market shape capabilities of digital innovation (Nambisan, 2017) by adding market regulation and market forecast. Our study further validated the empirical evidence of digital innovation in business ecosystems for network and self-reinforcement (De Reuver et al., 2018), namely co-specification. Thirdly, a new perspective can be provided by the concept of the extension of the suppliers. The supplier base reduction (De et al., 1999) and long-term relationships (Carr & Pearson, 1999) are proverbially highly regarded in dominated and prevailing supply chain management literature. However, our conceptualization model has empirically challenged these arguments, as the model shows the efficiency of a variety of suppliers and the flexible relationship in the ecosystem. Moreover, the positive effect of network externality in another format has also been confirmed in our ecosystem. Prior study further invites empirical research into other formats of the ecosystem, especially in the area of digital ecosystem to validate the positive effect of network (De Reuver et al., 2018; Helfat & Raubitschek 2018; Sussan & Acs, 2017), our study exactly meets the expectation.

As far as practical implications are concerned, there is some insight provided by the paper with respect to the guidelines firms ought to develop to harness its own competitive strengths by leveraging the ecosystem strategy in industry. First, our digital innovation driven mechanisms (e.g. supplier agility) of scale up specifically present successive stages of increasing the quantity of similar actors in ecosystems. Second, the mechanisms of scope extension explicitly show specific initiatives made by, for example, market education, information transparency and closed loop system. In this way, the focal firm is able to absorb new kinds of actors. This further attracts virtually new actors to participate in the ecosystem to reinforce the co-evolving effect occurring. Thirdly, our study also highlights the key relationships among actors which can be derived from the ecosystem. For instance, actor specification in the nascent stage of ecosystem tends to be more salient and we can easily identify how fungible an actor or actors are during the growth stage. These indications should be considerably useful for firms who are in an ecosystem and are experiencing difficulty in capitalizing upon ecosystem resources to maximize their own profits. Finally, it is possible that firms pursue more suppliers and flexible relationships if they acknowledge certain level of digital innovation mentioned in the paper.

The following restrictions apply to this study. First, there is common criticism about the generality in the single case study (Walsham, 2006). But it seeks to generalize from description to theory and add new knowledge (Lee & Baskerville, 2003). A second limitation is that the study focuses on the digital ecosystem affordability of the focus company. We assumed that the focus company has a strong, direct influence on the ecosystem's development and growth. The ecosystem consists of various entities, however, although it can be less direct, non-focal complements may have an impact on growth. The effect of digitally resonated non-focal players in the ecosystem may be eliminated in the paper but this is beyond the scope of this study.

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Reference

Adner, R. 2017. "Ecosystem as Structure: An Actionable Construct for Strategy," *Journal of Management* (43:1), pp. 39-58.

Autio, E., Nambisan, S., Thomas, L. D. W., and Wright, M. 2018. "Digital affordances, spatial affordances, and the genesis of entrepreneurial ecosystems," *Strategic Entrepreneurship Journal* (12:1), pp. 72-95.

Briel, F. von, Davidsson, P., and Recker, J. 2018. "Digital Technologies as External Enablers of New Venture Creation in the IT Hardware Sector," Entrepreneurship Theory and Practice (42:1), pp. 47-69.

Carr, A. S., and Pearson, J. N. 1999. "Strategically managed buyer–seller relationships and performance outcomes," *Journal of Operations Management* (17:5), pp. 497-519.

Datt´ee, B., Alexy, O., and Autio, E. 2018. "Maneuvering in poor visibility: How firms play the ecosystem game when uncertainty is high," *Academy of Management Journal* (61:2), pp. 466-498.

De Reuver, M., Sørensen, C., and Basole, R. C. 2018. "The digital platform: A research agenda," *Journal of Information Technology* (33:2), pp. 124-135.

De Toni, A., and Nassimbeni, G. 1999. "Buyer–supplier operational practices, sourcing policies and plant performance: result of an empirical research," *International Journal of Production Research* (37:3), pp. 597-619.

Du, W. D., Pan, S. L., Zhou, N., and Ouyang, T. 2018. "From a marketplace of electronics to a digital entrepreneurial ecosystem (DEE): The emergence of a meta-organization in Zhongguancun, China," *Information Systems Journal* (28:6), pp. 1158-1175.

Gioia, D. A., and Chittipeddi. K. 1991. "Sensemaking and sensegiving in strategic change initiation," *Strategic Management Journal* (12:6), pp. 433-448.

Henfridsson, O., and Bygstad, B. 2013. "The generative mechanisms of digital infrastructure evolution," *MIS quarterly* (37:3), pp. 907-931.

Holstein, J. A., and Gubrium, J. F. 2004. "The active interview," *Qualitative research: Theory, method and practice* (2), pp. 140-161.

Helfat, C. E., and Raubitschek, R. S. 2018. "Dynamic and integrative capabilities for profiting from innovation in digital platform-based ecosystems," *Research Policy* (47:8), pp. 1391-1399.

Jacobides, M. G., Cennamo, C., and Gawer, A. 2018. "Towards a Theory of Ecosystems," *Strategic Management Journal* (39:8), pp. 2255-2276.

Katz, M., and Shapiro, C.1985. "Network externalities, Competition and Compatibility," *American Economic Review* (75:3), pp.424-440.

Lee, A. S., and Baskerville, R. L. 2003. "Generalizing generalizability in information systems research," *Information Systems Research* (14:3), pp. 221-243.

Leong, C., Pan, S. L., and Newell, S. 2016. "The Emergernce of Self-organizing E-commerce Ecosystems in Remote Villages of China: A Tale of Digital Empowerment for Rural Development," *MIS Quarterly* (40:2), pp. 475-484.

Lyytinen, K., Yoo, Y., and Boland Jr., R. J. 2016. "Digital Product Innovation Within Four Classes of Innovation Networks," *Information Systems Journal* (26:1), pp. 47-75.

Moore, J. F. 1993. "Predators and prey: a new ecology of competition," *Harvard business review* (71:3), pp. 75-86.

Nambisan, S., and Sawhney, M. 2007. "Meet the innovation capitalist," *Harvard Business Review* (85:3), pp.

24-25.

Nambisan, S. 2017. "Digital Entrepreneurship: Toward a Digital Technology Perspective of Entrepreneurship," *Entrepreneurship: Theory and Practice* (41:6), pp. 1029-1055.

Strauss, A. C., and Corbin, J. 1998. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory.* London: Sage.

Sussan, F., and Acs, Z. J. 2017. "The digital entrepreneurial ecosystem," *Small Business Economics* (49:1), pp. 55-73.

Tan, B., Pan, S. L., Xianghua, L., and Huang, L. 2016. "The Role of IS Capabilities in the Development of Multi-Sided Platforms: The Digital Ecosystem Strategy of Alibaba.com," *Journal of the Association for Information Systems* (16:4), pp. 248-280.

Teece, D. 2018. "Profiting from innovation in the digital economy: Enabling technologies, standards, and licensing models in the wireless world," *Research Policy* (47:8), pp. 1367-1387.

Tilson, D., Lyytinen, K., and Sørensen, C. 2010. "Research commentary-digital infrastructures: The missing IS research agenda," *Information Systems Research* (21:4), pp.748-759.

Tsatsou, P., Elaluf-Calderwood, S., and Liebenau, J. 2010. "Towards a taxonomy for regulatory issues in a digital business ecosystem in the EU," Journal of Information Technology (25:3), pp. 288-307. Walsham, G. (2006). "Doing interpretive research," *European Journal of Information Systems* (15:3), pp. 320- 330.

Weill, P., and Woerner, S. L. 2015. "Digital infrastructures: The missing IS research agenda," *MIT Sloan Management Review* (56:4), pp. 26-34.

Yoo, Y., Henfridsson, O., and Lyytinen, K. 2010. "The new organizing logic of digital innovation: An agenda for information systems research," *Information Systems Research* (21:4), pp. 724-735.