



Digital Innovation and Transformation to Business Ecosystems

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Abstract. Digital technologies have been penetrating every aspect of business. Such pervasive deployment of digital technologies enables organisations to reinvent themselves in defining and conducting business. Leveraging the value of information as the key resource, through digital innovation such as digitisation and servitisation of products and services, becomes necessary for a business to survive and to remain competitive. Business ecosystems of the organisations and their partners have been formed through digital connectivity and digital platform which offer clearly strategic advantages and competitiveness. Interconnectivities between entities in the ecosystem are realised through multiple flows such as goods, finance, and information. For a business organisation to gain competitive advantages, a successful transformation of the organisation in many dimensions is essential to allow value co-creation with other members in the ecosystem. These dimensions include mindset, culture, values, leadership, structure, process and IT systems. This keynote will discuss the notions of digital innovation and transformation, and the prerequisites and readiness for the transformation towards business ecosystems. By examining the current practice of successful examples, key findings will lead to the principles and models of organisational transformation for value co-creation and optimising benefits in the business ecosystems. This keynote will hopefully inspire practitioners and researchers to benefit from existing theoretical lenses and methods and to derive their own guidelines and models to support organisations in digital transformation.

Keywords: Digital Business Ecosystems · Digital innovation · Digitisation · Servitisation · Value co-creation · DBE typology · Organisational onion

1 Introduction

ICT has become strategic weapons for business organisations to enhance their business competitiveness in forming an alliance through effective communication and collaboration (Bensaou and Earl 1998). More importantly, ICT has also become essential tools for the survival of the business which has deployed and embedded in organisations and business processes to perform necessary functions and maintain expected efficiency and effectiveness for the set goals and objectives (Venturini 2009, Lyver and Lu 2018, Gërguri-Rashiti et al. 2017). With the help of digital technologies, business organisations

gain additional capabilities of innovation in research, development, production, distribution and delivery of products and services. Moreover, these also lead to the innovations in products, services and even new business sectors which were not possible without the underpinning of digital technologies, e.g. electronic commerce, online education, digital entertainment and many other digital economic activities (Bloom et al. 2016).

Meanwhile, challenges still remain in how digital technologies can best fit into organisations in all dimensions (Camarinha-Matos et al. 2009, Shachaf 2008). As new technologies emerge from time to time, every adoption of a new technology may require changes in organisations and business processes which generate impact on the company and sometimes affect the way of working with partners. Friction and resistance within the company at leadership or other levels of workforce may occur. All have to be handled properly if the benefits of ICT are to be optimal.

To a business organisation, the deployment of digital technology gives it more capabilities to extend or to enhance their performance into digital arena or virtual world where signs such as data and information can be utilised to create or add value to business. Such extended capabilities can be seen as new affordances that can be studied by the discipline of informatics. From the technical perspective, informatics focuses on the development of technologies and enhances the functions to aid organisations and end-users; and from the business perspective, informatics places emphasis on the value added by ICT and relationship between business and technology. Digital technology enables the creation of the virtual world that corresponds to its physical counterpart in the physical world. With the disposal of signs in the virtual world representing the physical world, experiments and inventions become less expensive and much quicker, for example, typically through digital design, prototyping, simulation and validation (Liu and Li 2015).

2 Characteristic of Digital Innovation

Digital innovation often refers to the innovation carried out with the help of digital technology, and its characteristics are as follows.

A digital innovation may require one to re-envision familiar products and services empowered by digital technology. Unlike the technological innovation in a traditional sense, some digital innovations enable one to conceive completely different features and even change the nature of familiar products and services, resulting in disruptive changes (Christensen et al. 2015). For example, with the help of digital connectivity, entertainment (e.g. gaming), finance (e.g. online banking), consultancy and training can deliver their products and services all online. Traditional shopping can become online shopping. The e-commerce, online-payment, unmanned store and chatbot have brought in new features to the familiar business which are only possible by enjoying the unique capabilities of digital technology.

A digital innovation involves a combination of digital and physical components by wrapping the physical product with a service layer, which is also referred to as servitisation. Such an innovation requires not only the understanding of the products and users' needs, but also the capabilities of an organisation to create mutual value through leveraging digital innovations to undergird their competitive advantages.

A digital innovation aims at creating new types or forms of business previously not existed. For example, the emergent digital platforms have made possible for a new type

of business and economic activities which is called the platform economy. Two sides of the economic players, i.e. the suppliers and customers are facilitated to identify their ideal counterparts and conduct their business transactions through the support of the technology platforms.

A digital innovation can lead to radically different business models. Business operations and business models have been transformed with a more focus on the added value to the end users as well as business partners. A successful digital innovation can breed open processes of value co-creation which generates win-win outcomes for all participants in collaboration within a business ecosystem. The transformations for business models and the new user experiences are underpinned and driven by digital innovations, although digital technology is a necessary, not sufficient condition (Yoo et al. 2010).

3 Digitisation and Servitisation

Digitisation and servitisation are the two critical phases for an enterprise to join the digital business ecosystem cooperation and competition. Digitisation emphasises using ICT to extend the affordance of a company by performing business functions (e.g. marketing, sales, design, production and delivery); while servitisation, focusing much on the value and experience for customers, treats all transactions as services by wrapping a service layer to each product the company offers to the customer. With servitisation, a one-off sale of a product, which may be a physical device or a digital product, will be transformed into an offering of user experience over a lasting period of time which encamps for the user to enjoy the utility of the core commodity as well as a repertoire of collateral activities (e.g. services).

Digitisation makes it more possible for servitisation of products and goods by adding service wrappers enabled by digital means. The digitization-enabled servitisation is a journey of transformation with the purpose of creating the mutual values. The ideology of servitisation goes hand in hand with the shift of emphasis from product to service, and requires the producers and their partners in the business ecosystem to focus on the value and experience for the end-users. The value co-creation activities between the partners in the business ecosystem expand from the physical space as well as much in the virtual space. Such combination of virtual and physical dimensions is coined as servgoods by Tien (2015, 2017). With the tangible goods transformed to servgoods, the variability of products has been shifted from identical to assorted in order to better meet the diversified demands. The servgood aligns the interests of clients and providers.

Digitisation and servitisation open up new value propositions for the enterprises and a whole range of new possibilities for them to position and pursuit (Table 1).

Table 1. Tangible goods, intangible services, servgoods and connected servgoods (Tien 2015).

Focus	Tangible goods	Intangible services	Servgoods	Connected servgoods
Production	Pre-produced	Co-produced	Demand-produced	Internet-connected
Variability	Identical	Heterogeneous	Assorted	Assorted
Physicality	Tangible	Intangible	Mixed	Mixed
Product	“Inventoryable”	Perishable	Identifiable	Identifiable
Objective	Reliable	Personalizable	Adaptable	Connectable
Satisfaction	Utility-related	Expectation-related	Satisfaction-related	Status-related
Life cycle	Recyclable	Reusable	Flexible	Agile
Example	Car	Electronic-assists	Internet of Things	Connected autonomous cars

4 Digital Business Ecosystems

A digital ecosystem often refers to a virtual environment populated by digital entities such as software applications, hardware and processes which serves as an interconnected environment for creating and disseminating digital services over the Internet (Nachira et al. 2007). Meanwhile a business ecosystem is a community of individuals and organisations that operate outside their traditional industry boundaries (Moore 1993). A digital business ecosystem (DBE) is a socio-technical environment supported by digital technologies within which business organisations operate. The members of the DBE collaborate or compete and form dependent and interrelationships with their customers (Senyo et al. 2019, Liu et al. 2018).

4.1 Main Drives of Digital Business Ecosystems

Three types of flows can be identified in business ecosystems: information, finance and physical goods. These three flows commonly appear in most types of enterprises with different proportions. For instance, the Internet companies may not have physical goods flow because the products and the services they provide are all digital or virtualized. While, when analysing the types of Digital Business Ecosystems, these three flows will be seen as the principal driving forces behind the formation and growth of each digital ecosystem.

As shown in Table 2, the drivers of the business ecosystem can vary. Even the Internet companies, with similar business models, may have different motivations. The principal drivers of forming individual business ecosystems are highly associated with business operating.

Table 2. The types of typical DBE.

Principal driver	Typical enterprise	Typical DBE typology	Operating philosophy
Financial flow	Amazon	Mesh topology	Discover profitable businesses
Information flow	Tencent	Bus topology	Traffic monetization
Physical goods flow	Mercedes	Star topology	Increase sales
Financial flow	Huawei	Ring topology	Raise barriers, secure leadership

4.2 Topologies of DBE and Examples

Amazon's (<https://www.aboutamazon.com/>) business diversity is no less than the ecological diversity of the Amazon Basin, where is the world's largest rainforest and a web of ecosystems. Amazon builds its various business ecosystems around customers in a wide range of perspectives. These business sub-ecosystems symbiotically interact with each other while maintaining their separated business objectives at the same time. Each of them provides users with its unique business value and enriches the user experiences by the support of other business sub-ecosystems, and then eventually, these multiple sub-ecosystems involved in value integration forms a symbiotic and prosperous ecosystem. For example, the Kindle-centric e-book sub-ecosystem, on the one hand, is an integration platform for content innovation, and on the other hand, is the e-book distribution channel for the Amazon online shopping platform. Therefore, Kindle and Amazon shopping website forms a typical symbiotic ecology. In addition, the Amazon Prime sub-ecosystem, derived from the Amazon online shopping platform, provides value-added services to enhance customer loyalty and promotes website sales.

Relying on the large customer base, Amazon generates substantial intermediary profits by providing the platform services, which contributes the majority of the margin in the whole ecosystem. The sub-ecosystems of home assistant and Amazon Web Services are all the extensions from its core businesses to enrich the user experiences of their customer. From this case, it can be reckoned that the mutual synergy of the symbiosis provides a perfect basis for companies to maintain their competitiveness through entering new fields, figuring out the new profit growth points and keeping the vitality of the company.

The topology of Amazon ecosystem mainly displays the characteristics of a mesh type (Fig. 1). The sub-business entities within the ecosystem are connected with each other in symbiotic relationships. Although the products or services offered by each sub-business system come in different forms, the purpose of the links among them is the same: to support each other and grow together. The sub-business system can be generated based on business envisioning or the users' needs, but the main criterion for whether it can grow into a symbiotic sub-business entity is whether it can bring cash profit now or in the future.

Tencent (<https://www.tencent.com/en-us/about.html>) is one of the Internet giants and builds its mega internet ecosystems to interconnect its social networking, fintech, games,



Fig. 1. The Mesh topology of Amazon ecosystem.

videos and cloud services all altogether. Tencent’s business philosophy is to provide free services to the vast majority in order to accumulate huge customer base and monetize the enormous volume of internet traffic bringing by the users.

WeChat and QQ are Tencent’s star products which link more than 1 billion Internet users in China. Both of them are free to use and provide a variety of services covering almost all dimensions of the users’ daily life, including social, online shopping, mobile payment, investment and travel services. The users contribute their time, attention and their data to the service provider, so that Tencent made considerable profits from advertisement. Also, these large numbers of participants provide a better experience for high-end users. For example, the free gamers increase the popularity of game products and create a promising gaming atmosphere for the high-end fee-paying game players.

Based on the huge customer base, Tencent builds its profit model cautiously to maximize the value of directed traffic between sub-business systems and also to avoid ruining the user experiences. The business sub-ecosystems in Tencent are orchestrated and interdependent.

As shown in Fig. 2, the topology of Tencent ecosystem shows the key features of a bus type. The core platform in bus topology is the huge customer base acquired by the free apps. The business sub-ecosystems that grow on this nutrient block are the various methods of monetizing the vast internet traffic by providing different services. Therefore, the types of business sub-ecosystems are diversified, as long as the user base can be leveraged to support its business growth.

Daimler (<https://www.la.mercedes-benz.com/en/passengercars/mercedes-benz-cars/models/e-mobility/project-eq/models/electric-intelligence.module.html>), has been evolving around its new strategy. The automotive industry giant is repositioning its competitiveness from four aspects: the fields of networking (Connected), autonomous driving (Autonomous), flexible use (Shared and Services) and electric

drive systems (Electric). The abbreviation of CASE depicts the Daimler’s understanding of the future of the automotive industry. Comparing with the dumb vehicle, the smart car largely extends the scope of the ecosystem and grows to diversify. In this case, the characteristics of the digital business ecosystem are fully expressed. The first is digital enabler (Selander et al. 2013), which is the foundation of servitisation. The digital enabler enables the physical vehicle to turn into a carrier of services. From the angle of connectivity, users’ driving experiences are redefined by personalised services via the app, website, or straight from the assistance software in automotive. The second and the third characteristics of DBE is reflected by the participants of ecosystems. For instance, the feature of autonomous driving introduces software platform, data analytics, image identification, artificial intelligence and connective technologies into the new automotive ecosystem. The participants are highly interdependent with each other, while sharing the benefits of the ecosystems (Senyo et al. 2019, Stanley and Briscoe 2010). The last characteristic is self-organising (Senyo et al. 2019) which elaborates the spontaneous behaviours of the participants to maintain the balance of ecosystems in term of service providing.

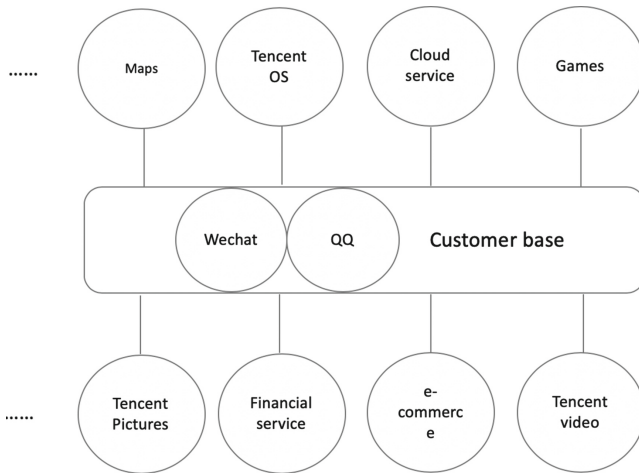


Fig. 2. The bus topology of Tencent ecosystem.

The topology of Daimler ecosystem can be best represented as a typical star type (Fig. 3). All the sub-business systems are tightly integrated around the main product deliverable: the Mercedes automobile. In this topology, the Mercedes automobile are both the product for external users and the platform for its symbiotic partners.

Huawei (<https://www.huawei.com/en/fully-connected-intelligent-world>), has become a telecom giant and occupies an important position in fields of telecommunication and computing. In order to maintain the industry leadership status, Huawei develops its own ecosystem tightly surrounding the core business. As Huawei dedicated in the telecom industry for decades and gradually becomes a global leader, its first core business is the telecom equipment which bridges telecom operators and users, and the

positioning of this core business lasts for a few decades. After they gains notable advantages in telecom equipment, encircling tis core business, the smart phone business start to extend Huawei’s business model from 2B to 2C, and then the cloud service which can further enhance the end-to-end user experience is established immediately. These two new fileds of business not only open up the market space and bring new points of profit growth, but also will gradually build up the core competitiveness on the sub-ecosystems of smart phone and cloud services respectively. With the computing power becoming the core competitiveness of internet companies, AI has been introduced into its various products and services as another core competitiveness. Therefore, as shown in Fig. 4, the topology of Huawei ecosystem can be typified by a ring type. The four business fields are developing independently and at the same time relying on each other to form a symbiotic relationship.

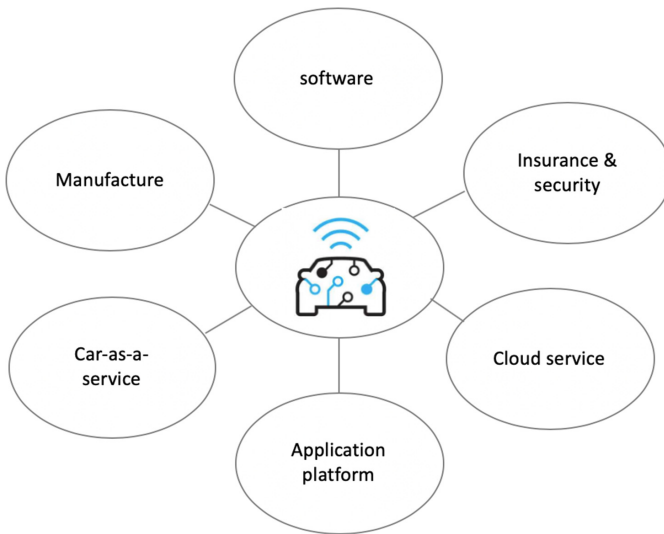


Fig. 3. The star topology of Daimler ecosystem.

5 Impact of Digital Transformation on Enterprises

Digital transformation is a journey of an enterprise to gain a competitive advantage and to maximise its business value. However, this journey seems never to end, because of the continued development of ICT and also due to ever-changing, complicating and challenging business world. Organisational semiotics, as the discipline to study the nature, characteristics and effect of information in organised activities, offers us an effective approach to study the interplay between physical and virtual world. To fully understand the impact of digital transformation, an organisation can be seen as three interdependent layers (Fig. 5). The outer layer encompasses the whole organisation where organisational values, trust, culture and other informal components exist and

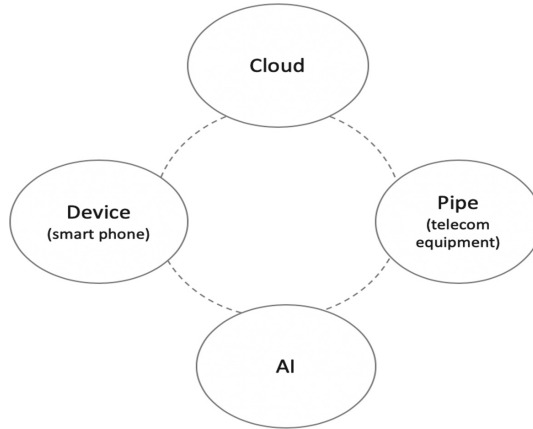


Fig. 4. The ring topology of Huawei.

determine the mission, vision and value propositions. On the premise of the informal layer, the middle layer comprises of formal components such organisational structure, policies, procedures and work processes. In the inner layer of an enterprise, some formal elements as defined in the middle layer are digitised for automatic execution. Changes in any one part will generate impact on others and induce necessary alignment adjustment, possibly sometimes radical and disruptive (Stamper 1991, Liu and Li 2015).

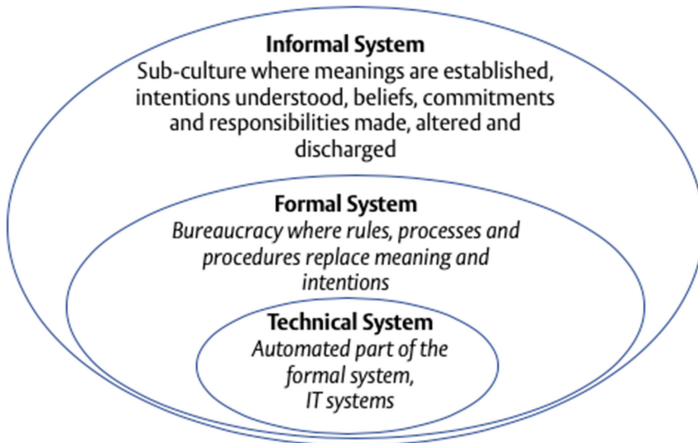


Fig. 5. The organisation onion (Stamper 1991, cited from Liu and Li 2015).

The process of digital transformation is complex. The success rate of digital transformation based on industry statistics is relatively low, because the process of transformation requires participation from actors in all levels of the organisation and brings in profound impact on entire organisation, including all dimensions such as parts from technical, formal to informal parts.

Therefore, an effective leadership is critical in ensuring a successful digital transformation. Such leadership at the senior level in an organisation, as what is called digital leadership or e-leadership (Li et al. 2017), should be able to plan, orchestrate and direct the transformation process. This leadership involves understanding of digital innovations, technologies, products, services, customer requirements, and even the whole business ecosystem.

The challenges to a digital leadership are hard to predict and often multifaced. For example, due to the emergence of issues such as digital sovereignty, data privacy and network security, digital leaders may have to rethink whether an enterprise has the capabilities to respond and remain in control. As another example, external factors such as Covid-19 are hard to foresee; however, the ability to respond quickly with digital capabilities to support remote working determines whether or not the company could survive when facing such emergencies. Aftermath changes in every state in the value network including production, marketing, sales, working with partners and services delivered to the end-customers are expected which may require further transformation of business in many aspects that are facilitated by digital technologies. The digital leadership will play a key role in facing and responding to the challenges.

6 Discussion and Conclusion

Digital technologies can offer organisations capabilities of expanding their access and powers in the virtual world. With the acquired repertoire of capabilities, organisations can enjoy digital innovation to increase the productivity and competitiveness. Servitisation of physical goods and products aided by digital technologies makes it possible for the enterprise to work closely with partners by forming business ecosystems. The competition between business partners become win-win, collaborative competition (or copetition) that maximise value for all members in a business ecosystem. Through servitisation, the enterprises have more opportunities of creating value by focusing on enhancing the user experience instead of just selling physical goods. The combination of goods and services leads to the notion of servgoods which inspire further emergence of new business possibilities for enterprises.

An advanced stage of digital transformation is characterised by digitally interconnected enterprises. Each enterprise is a legal entity and acts as a member in the business ecosystem; yet they share visions and values which is enable them in value co-creation. By going through the three stages from digitisation, servitisation to digital business ecosystem, a whole range of advantages have opened up for enterprises to gain more competitiveness, returned value and security.

Challenges for digital transformation of an enterprise come from many dimensions. A successful transformation will continue for aligned changes in all aspects which can be represented as the three interdependent layers of the enterprise. The informal part of the organisation encompasses the leadership's vision and mindset, values and organisational culture. The formal part consists of organisational structures, policies, procedures, work processes and formally defined functions and responsibilities. The technical part is constituted by automated processes and functions as defined in the formal part of the enterprise. The automation and digitisation of the processes and functions are realised

through the adoption of digital technologies and digital platforms which offer pervasive connectivity for working collaboratively within the company and in the business ecosystems. The understanding of the interrelationship between these parts guides us in preparing for and coping with the complexity and profound impact of digital transformation from the perspective of individual companies, and more widely, digitally connected business ecosystems.

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