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Exploring the Innovation System of the Animation Industry: Case Study of a Chinese Company

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Abstract: In the past 10 years, the animation industry has developed rapidly due to new technology and market expansion. Leading firms such as Disney are continuously seeking strategies to expand business towards products and service innovation, whereas Pixar and DreamWorks focus mainly on technology management. Driven by market and government policy, there is a blooming of the animation industry in China. However, most Chinese companies, in shortage of knowledge and experience, are unclear about innovation strategies. Thus, this paper aims to investigate the innovation system of China's animation industry as a late comer. The literature is covered together with an industry review. To further explore the details, an in-depth case study into a Chinese company is conducted. This company has developed an open innovation system by interacting with industry, university and government; meanwhile, it is penetrating into the character business and service sector, seeking for sustainability. Findings indicate that a combination of internal knowledge management and open innovation is important; government plays a vital role at the early stage of forming the innovation system; innovation is a dynamic process with different configurations at each stage. Discussions are given to address the critical issues of the innovation system in the animation industry, followed by conclusions and recommendations for future research areas.

Keywords: innovation; open innovation; policy; creative industries; China

1. Introduction

With the Fourth Industrial Revolution, currently there is more linkage between open innovation and convergence for vibrant economic innovation than before [1]. Driven by the popularity of digital technology and increasing market requirement, in the past 10 years, there has been rapid growth of the creative industries worldwide with emphasis on innovation and creativity. Creative industries, which combine the concept of arts, technology and business, are considered as efficient ways of ensuring a nation's competitiveness within an integrated global economy [2]. According to DCMS (Department for Culture, Media and Sport, U.K. government), creative industries have their origin in creativity, skill and talent, which have potential for wealth and job creation through IP generation and exploitation [3]. Representative sectors include advertising, architecture design, fashion design, games, music, TV and film. Statistics show that creative industries provided 12.9% of Canada's employment and employed 14.2 million people in the USA in 2011 [4]. The value of arts and cultural production in the USA in 2015 was \$763.6 billion, 4.2% of its GDP [5]. The global market size was 244 USD billion in 2015 and 254 USD billion in 2017, with the main markets being from the USA, Canada, Japan, China, France, the U.K., Korea and Germany [6]. China as the largest emerging economy shows increasing demand

for creative products and services. In 2015, the Chinese cultural industries grew by 11% to a value of 2723.5 billion RMB, which was 3.97% of China's GDP. Creative industries are now regarded as core sectors by the Chinese government, aiming to transfer from the economy from manufacturing towards knowledge and innovation [7].

Among the creative industry sectors is the animation sector, which highlights original design, technology innovation and market diversification, overlapping with design, game and TV industries. This industry has expanded rapidly due to the availability of the Internet, satellite TV, mobile devices, social media and growing demand for entertainment, gaming, animation movies and VFX (visual effects). The current animation industry shows features of partnerships and international co-production, while MNEs (multinational enterprises) are engaged in activities from pre-production to distribution, as well as new sources of revenue including IP licensing [8]. In general, the making of animation products follows the phases of conceptualization (idea generation, project proposal), pre-production (script, picture story board, character design), production (key animation, colour designation, colouring, special effects, background, computer graphics) and post-production (composing, editing, voice recording) (Figure 1). On completing an animation film TV product, it then comes to the stage of distribution (Internet, cinema, DVD, social media) and character business (game, clothing, stationary, service, theme park). Innovation in the conceptualization stage can result in a successful character business in the late stages by generating profit from consumer products and theme parks. On the other hand, animation movie production needs significant investment in technology, such as 3D computing technology and live-real effects. Existing company case studies reveal that world-leading companies have long been devoted to innovation.

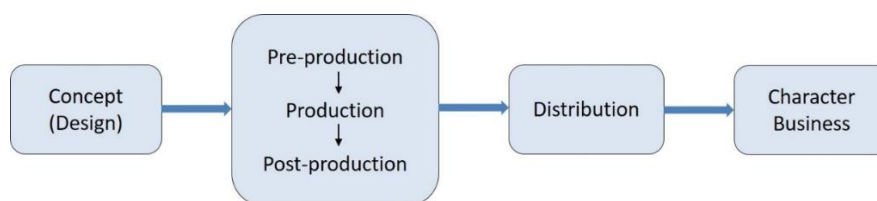


Figure 1. A general animation industry supply chain.

China has also experienced the expansion of the animation industry in recent years; however, many companies are still struggling to upgrade from contract studios to R&D activities. Historically speaking, China's animation industry was prosperous in the 1970s. However, with the open door policy in the 1980s, numerous foreign animation products were imported with diverse content and a lower price. A number of Chinese companies, no longer with government financial support, found it difficult to survive in the competition and eventually turned into contract studios. There was lack of original design and innovation for the next 20 years accordingly, hugely lagging behind the USA, Europe and Japan. Realizing the importance of keeping national culture and achieving sustainability, the Chinese government started to nurture domestic animation production since 2001. With the popularity of mobile Internet and video platforms since 2013, there was more investment in supply chain establishment, training and learning. The recovery and blooming of the Chinese animation industry is largely influenced by government policy (Table 1). With central and local government support, animation industry clusters were established, where animation studios, software companies, distributors, character business developers and game companies gathered, learned and shared knowledge collaboratively. By 2016, the State Administration of Radio Film and Television approved 20 national animation industry bases and eight national animation teaching and research bases. The Ministry of Culture set up eight national animation and game industry revitalization bases. The General Administration of Press and Publishing planned 11 national animation and animation industry bases. Numerous industry parks were formed at the province level with features of SME incubators, software development and education [15]. Advanced technology such as fast rendering software and VFX software was widely introduced to improve the product quality. In 2016,

more policies covering government allowance, production and operation, tax concessions, animation investment and financing and projection sales were issued, with a special highlight on original IP creation [15]. In 2011, China's animation output value was 62.1 billion RMB, and it reached more than 100 billion RMB in 2014 [15]. In 2016, the nation's animation industry output value achieved 130 billion RMB (8% of the global share), with a 15.0% annual growth rate [9]. There is a continuous growth trend due to highlight IP creation and increasing more mobile phone and Internet users in China. According to CNNIC (Office of the Central Cyberspace Affairs Commission, known as the central Internet regulator in China) [16], by the end of December 2015, the number of Internet users in China was 688 million, with mobile phone users reaching 620 million, and the national Internet penetration rate was 50.3%. Figure 2 shows the Chinese animation industry output value from year 2010–2016.

Table 1. Main policies to support Chinese animation industry.

Time	Issued Organizations	Name of Policy	Content
2005	SARFT (The State Administration of Radio Film and Television)	Notice from SARFT strengthening the management of TV cartoon broadcasting	All channels of TV stations at all levels throughout the country are prohibited from broadcasting overseas animated cartoons, extending from 17:00–20:00. The broadcast ratio of domestic cartoons must not be less than 60%.
2008	SARFT (The State Administration of Radio Film and Television)	Notice from SARFT strengthening the management of TV cartoon broadcasting	From 1 May 2007, all channels of TV stations at all levels throughout the country are prohibited from broadcasting overseas animated cartoons from 17:00–20:00–21:00.
2009	State Council	Promotion plan for cultural industry	The animation industry should strive to create an international animation image and brand that is popular with the audience and become an important growth point of the cultural industry. There is support for animation and other cultural industries to enter the international market.
2011	Ministry of Culture, Ministry of Finance, State Administration of Taxation, General Administration of Customs	Interim provisions on the import and export of animation development and production products exempt from import tax	The import tax exemption policy shall be implemented for approved animation enterprises to import products for animation development and production, including import tariffs and value-added tax on import links.
2012	Ministry of Culture	National animation industry development plan in the 12th five years (2011–2015)	Strive to create 5–10 well-known domestic animation brands and key animation enterprises
2014	Ministry of Culture	Opinions on implementing "State Council's policies on promoting the integration of cultural creativity, design services and related industries"	Support the creation, production, dissemination and consumption of original animation products, which are healthy in content and creative.
2015	Ministry of Culture	Supporting small and micro culture enterprises in 2015	Focus on supporting the growing small and micro culture enterprises

Though it is important to upgrade to value-added products and services, many Chinese companies are still struggling from gaining technology and transforming from contract studios to original producers. The incompleteness of the supply chain, poor quality and shortage of knowledge, talent and experience remained to be obstacles [15]. Some large companies (e.g., ALPHA, Beijing Glorious Animation Co.), which previously had R&D capability, seek to expand through licensing and international collaboration, whereas SMEs without IPs and capital are struggling to learn. Currently, there are a number of studies on the success of leading animation firms' innovation strategies. For example, Pixar adopts three internal parallel and interactive work groups: the technical group, the

creative group and the production group [11]. DreamWorks highlights the atmosphere of being fun, free and open in its organizational culture [12]. Disney extends its product and service range through collaboration and customer relationship building [13]. In Japan, the animation industry is supported by the comic book industry and character business such as computer games. An example is Studio Ghibli, which focuses on original creation, integrating design, production and character, acting just as a Japanese Disney [14]. However, so far, there is a lack of research into this industry from the emerging country point of view. In particular, the issues of how companies with limited resources can innovate, grow and upgrade remain unknown yet.

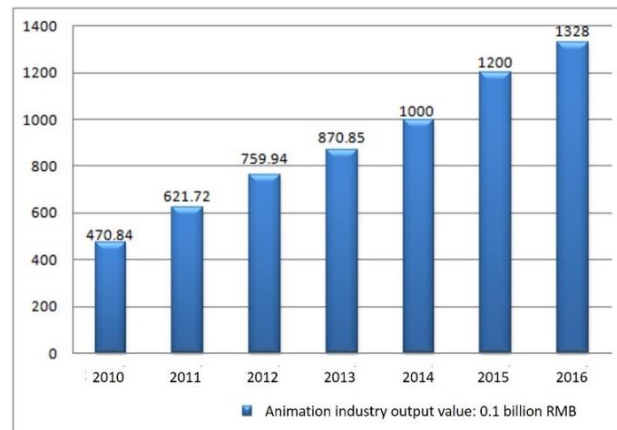


Figure 2. Chinese animation industry output value, adapted from ZhiYan.org [15].

Driven by research and industry requirement, our paper aims to find out the innovation system of the animation industry in China. The main research question is “How can Chinese animation companies with limited knowledge resources form an innovation system through the university-industry-government collaboration, along with the value chain?” Through an in-depth single case study, four sub-questions will be addressed. (1) How can innovation be managed inside animation companies? (2) How can external innovation activities be conducted? (3) What is the interaction among companies, industry, university and government policy? (4) What are the different configurations of the innovation system in the animation industry?

2. Literature Review

The current literature has covered areas of open innovation, innovation ecosystems and the triple helix model. The concept of innovation is related to ideas, invention, creation and implementation. Schumpeter [17] highlighted the importance of innovation as bringing into production a new combination of factors of production, which can be new products, technologies, markets, sources of raw materials and industry organization. According to Ames [18], invention includes a flow of prototypes of articles that have never been made or processes that have never been used before. Marquis [19] indicated that technology innovation starts from a new idea and concept, through solution and development. Tang [20] emphasized that creation as new idea generation is the first step of innovation, whereas innovation also involves the later stage of implementation. According to the degree of outcome, innovation can be classified as incremental, radical and disruptive innovation [21].

To explore the organizational boundaries in the innovation process, Chesbrough [22] generated the concept of open innovation. By comparing companies that focused on internal R&D with those relatively weak in internal R&D capabilities, but making use of external resources consciously, it is found that the former is not as good as the latter in terms of innovation speed and rate of return. Open innovation is then defined from the enterprise perspective, referring to the flow of innovative resources across organizational boundaries. Valuable ideas can be obtained from within and outside the company. The commercialization of internal technologies can also take place internally or externally

(internalization of external resources and externalization of internal resources). Since the concept's introduction, there are many studies on open innovation. From the information source perspective, Piller et al. [23] considered that open innovation is a systematic process in which enterprises acquire and innovate, revise or regulate information. Christensen et al. [24] viewed open innovation as the flow and integration of innovative assets between firms and firms, firms and R&D institutions. From the knowledge management perspective, Lichtenthaler [25] believed that open innovation is an activity in which enterprises systematically carry out internal and external knowledge development, retention and utilization through the innovation process. Yun [26] proposed a dynamic model of an open innovation economy system (OIES), which starts from an open innovation economy, through a closed innovation economy, to a social innovation economy, and back to an open innovation economy as a life cycle. Concerning the innovation process, there is a trade-off between the risk of unanticipated social cost and the amount of innovation [27]. Based on studies in China, Yang [28] believed that open innovation is a strategic behaviour of enterprises, to encourage and explore a wide range of sources of internal and external innovation opportunities, which include the use of external innovation, as well as the change of internal intellectual property. Chen and Chen [29] analysed from the stakeholders' view, indicating that open innovation is a multi-agent model focusing on attracting more innovative elements and based on innovative stakeholders. Peng [30] believed that enterprises should fully integrate internal and external innovation resources, absorbing innovative elements in all aspects, and building an ecological system to improve the innovation performance. By reviewing research papers from 2003–2013, Greco et al. [31] classified the relationship between OI and performance into inbound actions (internal use of external knowledge), outbound actions (external exploitation of internal knowledge), coupled actions (collaboration by means of partnerships, collaborations, alliances, joint ventures) and internal OI actions (actions promoted within a company order to improve innovation performance in an OI perspective). Their research shows that public investment funds encourage enterprises to cooperate closely with professional partners to innovate, which is significant for developing country companies to carry out open innovation [31].

The innovative ecosystem is a core feature of the Innovation 3.0 paradigm. Moore [32] was the first scholar to describe systematically the business ecosystem as a business combination based on organizational interactions. According to Moore [32], business ecosystem starts from existing collaboration, towards expansion, convergence and renewal stages. On the basis of Moore's opinion, Iansiti and Levin [33] proposed the concept of niche, considering that the innovation ecosystem consists of enterprises that occupy different, but related niches. Once one niche changes, other niches also change. Adner and Kapoor [34] believed that innovation depends on changes with the external environment and participation of members of the ecosystem. The innovation ecosystem refers to a synergistic mechanism in which individuals are associated with one another. Zhang [35] argued that the innovation ecosystem is a technology innovation system formed by high-tech enterprises with technical standards as the innovation coupling link. Li et al. [36] thought that innovation ecosystems use stronger metaphors of biology to reveal the system paradigm of innovation, promoting the realization of innovation value with a smoother flow of knowledge, differentiating levels of innovative ecosystems by the emergence of more sustainable innovations. To understand the process of the innovation system of the ICT industry, Cooke [37] combined the theories of global innovation networks and territorial innovation systems, highlighting the innovative core of creative destruction.

The triple helix and quadruple helix models have overlaps with the innovation ecosystem, as the triple helix model highlights the dynamic interaction among university, industry and government [38–40]. It is a non-linear innovation system, within which the industry acts as the source of production, the government providing regulations, stability and rules of play and the university supplying new knowledge and technology [40]. The model shows a different view from traditional linear knowledge transfer from university to industry. As a further expansion of the triple helix model, Carayannis and Campbell [41] proposed the concept of the quadruple/quintuple helix model, by introducing another element of the innovation system, civil society. Civil society including media, users,

agencies and culture can be the driver of the innovation process [42]. The new innovation ecosystem model is described as the co-opetitive spatial and sectoral fractal innovation and entrepreneurial ecosystem, which is a helical, complex, dynamic system with the features of multi-level, multi-modal, multi-nodal and multi-lateral co-existence, co-evolution, co-specialization, and co-opetition [42]. Under this framework, explicit knowledge and tacit knowledge can be transformed. Therefore, universities, governments and enterprises can jointly form an innovation ecosystem, in which knowledge creation, exchange, sharing and transfer are carried out. The introduction of civil society is of great significance for expanding collaborative innovation and improving innovation performance [42].

It is seen that the current literature emphasizes open innovation, ecosystem and triple helix as new features of innovation in Industry 4.0. Open innovation has clear objectives, focusing on a certain industry; whereas the process model of the ecosystem starts with existing collaboration. As for triple helix, the details of how university, government and industry interaction can generate innovation need to be further validated, especially in the context of emerging economies and emerging industries. In particular, how SMEs from emerging industries such as the Chinese animation industry, with limited technology resources, should innovate through a combination of internal learning, collaboration, open platform and interaction with government is unknown yet. Thus, our research aims to contribute to the theory of innovation from this perspective.

3. Research Methodology

With the aim of exploring the innovation system in Chinese animation companies as late comers with little resources, our research adopts the theory building approach with qualitative methods. Although the literature review helps to generate the research framework on innovation, the limited findings do not provide a meaningful hypothesis that can be tested. Instead, theory building can provide a good understanding of significant issues that have not been explored [43]. In particular, an in-depth case study can be an effective research method, as cases allow investigators meaningful points of real-life events [43]. We have selected a representative Chinese company, HD Arts, as the main case study. This company is located in Wuxi, a commercialized city in the east of China, known as the Yangtze River Delta, surrounded by creative industry clusters. There are several reasons to choose this company as in-depth case study. (1) HD Arts was founded in 2004, without animation brands and production experience. It was recognized as an SME and late comer. (2) Since establishment, the company expanded fast with huge investment in technology. Now, it has full capability of design and production based on an open platform. Innovation is the key to success. (3) In addition to designing and producing animation cartoons, the company is in the early stage of animation character business development, seeking ways of further expansion. Its product innovation and business model can provide the details of the innovation system. (4) Its innovation system involves internal and external activities, demonstrating interaction among industry, university and government on a regional level. (5) Following the paths of growing from contract studios towards value-added innovation activities, the company strategy can potentially be implemented in other Chinese animation companies, who are facing similar problems. (6) The company data are assessable for the research.

As for data collection, we used semi-structured face-to-face interviews with the company general manager, product development manager and character business design team 4 times during 2014 and 2015. Questions included the company's R&D activities, technology management process, brand development process, internal and external innovation strategies and government policy support. To facilitate the interview, interviewees were guided along the supply chain of the animation industry, concerning: innovating activities during the conceptualization stage, technology innovation during production and the character business development strategy. Other open questions were asked regarding the internal innovation culture and external influences such as regional social-economic factors. Data analysis combines the findings with the conceptual framework, highlighting internal and external innovation activities at each stage.

Our data analysis links with the triple/quadruple helix approach by addressing the role and interaction of industry-university-government-user in the innovation system, focusing on knowledge creation, exchange, sharing and transfer. We analyse key decision making areas inside the company and the industry cluster, summarizing related government support policies and identifying university resources. In particular, we divide these factors into internal issues, meaning the innovation activities conducted inside the company, and external activities, meaning the innovation collaboration between the company and its partners, through the open platform or through government support.

To further capture the features of this Chinese company's innovation system, we also compared the case company with innovation patterns in Western and Japanese companies, which were already studied in secondary cases (Table 2). Disney and DreamWorks as world-leading animation companies demonstrate strategies of growth through product and service innovation and collaboration. Pixar and Studio Ghibli highlight an in-house innovation system either in technology or art design. From these cases, we then develop configurations of the innovation system, according to product/service innovation, namely diversity and the openness of innovation.

Table 2. In-depth case and secondary case company information.

Company	Innovation focus	Note
HD Art (Chinese firm)	Close and open innovation, government support	In-depth case study (company document review, interview)
Disney (USA firm)	Innovation in technology, character business, business model	Secondary case from published documents [13]
Pixar (USA firm)	Innovation in technology	Secondary case from published documents [11,44,45]
DreamWorks (USA firm)	Innovation in technology	Secondary case from published documents [12]
Studio Ghibli (Japanese firm)	Innovation in character business	Secondary case from published documents [14,46–48]

4. Case Study

HD Arts was established in 2004 in Wuxi. In 2006, its registered capital was 20 million yuan. Now, at the moment, the business ranges from original animation TV series design, to production to character business. In its early years, the company was engaged in animation projects, producing parts for foreign firms, known as service outsourcing or contract studio. Like many Chinese SMEs, it lacked design capability and therefore had limited innovation resources. Realizing the problem, the company decided to build its design team, by creating animation characters, original stories together with TV series production.

Though HD Arts originally focused on animation production, the company believed that technology innovation can be achieved through collaboration. Surrounded by 40 animation-related creative enterprises in Wuxi National Creative Industry Park, it started to form a partnership in design, animation games, CG special effects, copyright transactions and training. Starting from 2006, it took a radical step of innovation, not following the traditional in-house model as seen in leading Western firms, but through open source. The idea was supported by the local Wuxi government, who encouraged inter-firm collaboration and information sharing inside the industrial park. With further capital investment of five million RMB in 2016, HD Arts was able to build an IT infrastructure and technology service for self-developed products. Within a few years, it gradually developed a platform called the 3D Animation Creation Integrated Platform, to manage 3D animation projects through integrating hardware resources, software technology, human resource management and a database. The platform aimed to optimize the animation production process, allocating tasks, tracking progress and controlling cost. The efficiency of hardware and software usage increased by 60% from 2006–2015, while the cost of a single 3D animated film was reduced by 30%. The platform brought more than 30 million RMB in output value and provided 150 new jobs to the company within two

years. Along with the advance of content creation, the company also made revolutionary changes to the Chinese 3D animation industry. According to HD Arts, its innovation system was connected with two major modules of the system: the technology resource system and the employee performance evaluation system.

The technology resource system is open to external collaborators, not limited to partners inside Wuxi city, with the aim to facilitate open innovation with a diversity of ideas and knowledge. To ensure quality, HR Arts evaluates animation companies from the industry database according to their technology capability. This is an on-going selecting and screening process, with winning out companies and designers then given access to the HD Arts platform. Through the system, collaborators can work together virtually as a team. Each company or individual can upload 3D animation projects. The technical level gap between enterprises is narrowed, enhancing the animation production level of Wuxi city, and even across the whole country. The open innovation model has provided the company talent, experiences and knowledge from various backgrounds. It is also a good way of project management, as users can login to the interface to monitor the progress. Customization of the project scheduling and market information application has also been achieved now. For further expansion, the company wants to use global resources to solve technical problems.

The open system also encourages the companies' internal innovation culture, as indicated in its Employee Performance Evaluation System. It is a system for staff learning, real-time knowledge learning and performance evaluation. During the design stage, creators can share ideas with the team. Producers then put the ideas into reality, while HD Arts managers monitor the production process. The work atmosphere of post-production is synchronized and flexible, breaking the boundaries of stages, solving problems at early stages. For system maintenance and improvement, HD Arts collaborates with universities and hardware manufacturers. The company has built a long-term strategic partnership with Beijing Film Academy, Zhejiang University and Jiangnan University. While providing internship and project experiences to university studies, the company can achieve more knowledge and technical advancement. Besides, its collaboration with manufacturers such as DELL can effectively solve maintenance-related problems.

Apart from animation creation and production, the company has also considered character business including products and service. In 2006, the company designed an animation dog character called Jiwawa, meaning good luck in Chinese. One prototype was made into traditional Chinese Tang suits. The animation TV series Jiwawa was broadcast on the Internet, China Central Television Station (CCTV) and shown in the first Chinese 3D New Year Celebration Animation Film. With its trademark registered, HD Arts began to communalize the character. It plans to expand through films, pre-school education, animation theme parks and consumer products, marketing through IT and digital media. In 2008, HD Arts helped Wuxi government promote tax policies, using the Jiwawa character. With its good public image and the government's new funding of a cartoon museum in 2010, HD Arts now has found more business opportunities.

5. Discussion

From the case study of HD Arts, we can see its innovation system combining internal and external activities throughout the animation industry supply chain. It also highlights the interaction among industry, university, cluster and government. Based on this, data analysis explores the details of the innovation system and compares HD Arts' system with other companies from the secondary case studies (Table 2).

5.1. Internal and External Innovation Activities, along with the Supply Chain

HD Arts provides an example of technology management and brand management of the Chinese animation industry. To summarize key activities related to innovation, there are internal and external activities along with the supply chain of conceptualization, production, TV distribution and character business (Table 3).

Table 3. Innovation activities along with the supply chain.

	Internal Innovation	External Innovation (Collaboration/Open Innovation)
Conceptualization	<ul style="list-style-type: none"> Considering movie production and character business at the same time 	<ul style="list-style-type: none"> Using the open platform to generate ideas from external talent
Production	<ul style="list-style-type: none"> R&D into the technology resource system (software) Using the technology resource system to control the project Setting up different goals and the performance evaluation system for staff involved in each stage of production 	<ul style="list-style-type: none"> Selecting partners based on their production capability (on-going process) Using an external evaluation system based on international standards Collaborating with hardware manufacturers Collaborating with leading colleges and universities on technology-related issues Using the open platform to generate ideas and to solve technology problems during production (open innovation)
Distribution	<ul style="list-style-type: none"> Developing a multi-channel strategy (IT, mobile Internet, TV) 	<ul style="list-style-type: none"> TV broadcasting Internet distribution Animation festival, supported by the local government
Character business	<ul style="list-style-type: none"> Using the technology resource system to collect customer's requirements IP protection and trademark development Developing a market diversification strategy (aiming at consumer products, theme parks, etc.) 	<ul style="list-style-type: none"> Collaborating with the local government to promote the animation image Use industry park resources for character business (e.g., government-funded museum)

Inside the company, innovation is mainly conducted through training, technology development and performance evaluation. The company treats its employees as artists and engineers, who can contribute with advanced technological performance and creative ideas. The company sets up an employee performance evaluation system with rewards in the production process. The system clarifies job duties and the expected results from the employees, aiming to improve productivity and decision making. HD Arts formulates rules respectively for creators, producers and voice actors. During the earlier stage of animation creation and the post-production phase, creating a free and open working environment is essential to foster innovation and motivation; while during the production stage, it is necessary for the company to monitor the project and evaluate the performance.

Externally, there are long-term collaboration and open innovation. Innovation is based on the Internet by sharing ideas, information and projects. It shortens the time of product design and development, creating knowledge, reducing cost and risk along the supply chain. HD Arts independently established a technology resource system to achieve technical support from individuals, organizations and universities for 3D movie production. The company maintains a friendly and stable relationship with several leading universities in China, particularly in Jiangsu Province, which can guarantee the source of innovation in the long term. Furthermore, it is beneficial for the company

to capture updated research findings and have access to the high-level technical personnel from universities. Through partnership with leading universities, HD Arts can attract new graduates with knowledge and practice experience.

5.2. Interaction with the Industry Cluster and Government Policy

The growth of HD Arts shows a close connection with industry, university and government. The Wuxi local government issues policies to strengthen the development of scientific and technological innovation. With 40 companies entering the animation industry park, an industrial chain consisting of conceptualization, production, distribution, broadcasting, service and character business such as game production is gradually formed. The park is similar to an innovation ecosystem with the participation of companies, universities and local government. Companies including HD Arts provide movie, virtual reality and game production. The industry generates the economic growth of the ecosystem. Universities provide technology and knowledge through collaboration with companies and provide talents continuously. The government initiates the industrial chain, providing funding and favourable policies. It also helps to extend the product diversity by establishing museums or theme parks.

The features of Wuxi animation industry park innovation are shown in Figure 3. They overlap with triple helix innovation; however, no clear evidence of government interaction with universities is found from this case study. In fact, there is limited university resources in Wuxi, and HD Arts' collaborators are with universities from other cities such as Beijing. At the moment, the government still plays an important role in supporting the industry, yet in the future, a self-organized ecosystem may be maintained with sufficient innovation resources, as companies and universities play more active roles. To link the innovation system of Wuxi animation Industry Park with quadruple helix theory (Figure 3), the element of civil society is now emerging, as more Internet and mobile phone users begin to interact with the animation industry, and the government is holding more public events such as animation festivals. However, the case study shows limited impact of regional innovation culture on the industry, especially in the early stages of innovation. So far, the system has witnessed multi-nodal (different companies participation), multi-modal (internal and open innovation), some degrees of multi-lateral (university-government-industry) and potential multi-level (geographic transfer from Wuxi to other places) innovation systems.

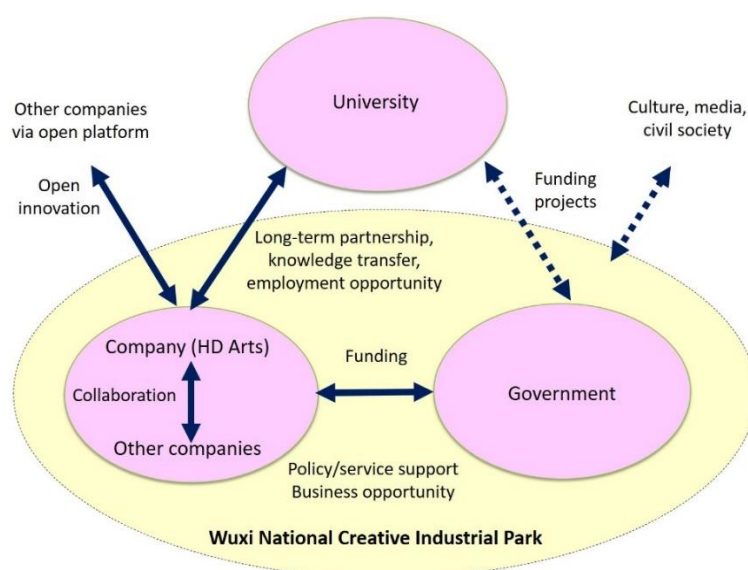


Figure 3. Interaction among companies, universities and the government.

5.3. Comparison with Innovation System in Other Companies: Towards a Framework

Like many other industries, the innovation of the animation industry can be evaluated by product range, IP, patents and service diversity. The approaches of innovation vary from traditional in-house design towards inter-firm collaboration, as well as open innovation as seen in the case of HD Arts. To compare different innovation patterns, a framework was developed (Figure 4). As Figure 4 shows, the horizontal dimension refers to the company's preference for internal innovation (in-house), long-term strategic collaboration or open innovation as the main source of innovation. The vertical dimension indicates the performance of innovation in terms of its product and service range. A low degree in this dimension means the companies mainly do the most labour-intensive parts, known as service outsourcing or contractors/sub-contractors, without original design capability. A high degree means the company has expanded towards the character business, such as consumer products, services and theme parks, which is regarded as a value-added area in the industry. The arrows demonstrate the dynamic movements from one status to another, according to the companies' growth strategy.

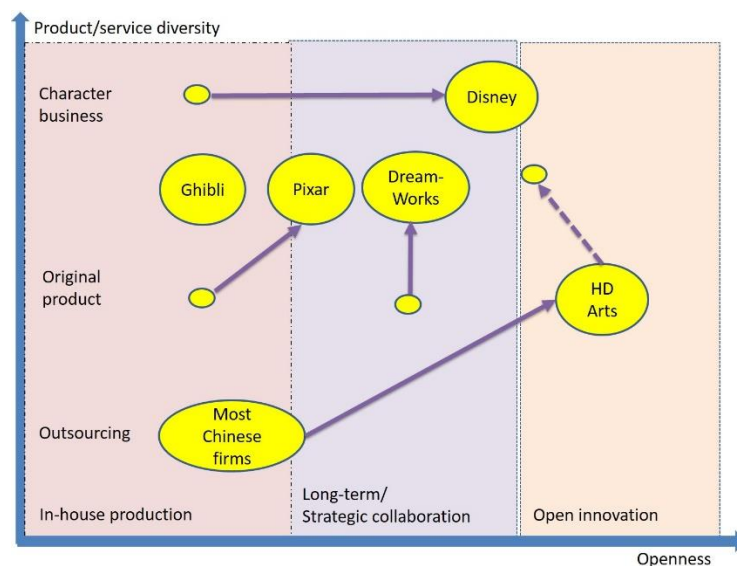


Figure 4. A framework to combine product/service innovation with the openness of innovation.

Disney has a wide business range and extensive collaboration network. It is a good example of such firms, who through a series of collaborations and acquisitions have strengthened design capability, as well as the brand image. Brand rationalization, relationship development and marketing strategies are the key success factors of Disney. As the arrow indicates, Disney has expanded internationally by collaborating with partners from different sectors, including animation studios, character designers and service companies. It has reached a high level of product and service innovation, covering the businesses of movies, TV broadcasting, consumer products and amusement parks. Pixar has demonstrated its unique visual and technical advancement. Pixar mainly focuses on technology development and producing animation movies. It has strong internal technical and design teams, promoting the innovation culture inside the company, through cross-department learning and collaboration. As the arrow shows, Pixar has moved from in-house production towards character business by collaborating with Disney (Pixar was acquired by Disney in 2006). Now, its success stems from both technology and an accurate development of characters. Another American company, DreamWorks has also achieved technology advancement through both internal creativity and collaboration. Its product used to concentrate on movie production, but now has expanded to consumer products and theme parks through collaboration, as described by the direction of the arrow. The Japanese firm Studio Ghibli focuses on building internal design capability. The innovation comes from its uniqueness of storytelling, character design and art style, with no advanced technology such

as CG effects involved. Vertically integrating resources, Studio Ghibli cover various business ranges, including production of animated films, television series and documentaries; character business; and music production. This requires strong investment and talent development, which now has brought a financial challenge to the company on its operating scale.

Currently, most Chinese companies are low in both dimensions, with limited innovation resources and design capability. They are looking for ways of expanding either vertically through character design or horizontally through collaboration. In fact, HD Arts is growing from an outsourcing studio towards a producer with original products. The key of its success is learning through open innovation. Now, it is targeting further expansion towards character business. With the achievements of its original image, the business expansion is in collaboration with toy companies and partners in Wuxi. The government support and the establishment of the animation industry cluster provide opportunities. According to HD Arts, the company eventually will consider Disney's style, identifying major long-term partners and achieving high service quality, as indicated with the arrow in Figure 4. Though the company does not apply the theory's framework of the business ecosystem, its strategy shows stages of expansion and convergence. The dynamic process of HD Arts innovation through external learning and sharing, an open platform, business expansion through collaboration and finally maintaining long-term collaboration can be an effective approach for other Chinese companies.

6. Conclusions

With emphasis on technology advancement and content creativity, innovation and brand development, animation-related products have gained popularity in the last 10 years. While leading Western firms have a mature supply chain and knowledge resources, the innovation strategy of late comers, such as SMEs in China, is still unclear. Based on the literature and industry review, this paper adopts the theory building approach by primarily deeply studying a Chinese company, HD Arts, and comparing its innovation system with other firms based on secondary documents. Key business models related to technology innovation and business expansion are identified, which contribute to the theory of open innovation, triple helix and innovation ecosystem. Findings can be summarized as four main aspects.

(1) Collaboration and open innovation can be adopted to acquire technical support from external resources, especially at early stages of development when companies lack knowledge and experience. (2) Internal HR management, including knowledge and performance management, can be combined with innovation to improve the overall performance and innovative culture. (3) Interaction with universities and local government can help companies to expand their product and service range. This is a useful guidance for Chinese companies who are aiming to upgrading to high value-added R&D activities. While triple helix and quadruple helix innovation provide the theory's framework, the case study reveals that government should better issue policies, providing funding and collaboration opportunities at early stages to form an innovation system on a regional level, as summarized in Figure 3. Clusters and industry parks are effective approaches for animation companies to grow in China, capturing internal innovation capability and external resources, gradually forming an ecosystem. (4) To further classify the configuration of the innovation system in the animation industry, Figure 4's framework is developed along with innovation sources and a diversity of product and service ranges. Many Chinese SMEs start with low degrees in both dimensions; however, they can achieve product innovation through open innovation and eventually identify long-term partners for character business expansion. Thus, network convergence can be a sustainable way of development in the future. In the end, a "so what" conclusion is needed, since there are much research regarding paradigm innovation.

The animation industry, as a sector combining IP creation, production and services, shares many common features with traditional manufacturing sectors. Its supply chain follows the steps of conceptualization, production, distribution and character business, whereas the design and production stage sometimes involves collaboration. For sustainable development, design, technology and character

design remain to be the most profitable areas. This industry in the past has not received enough research focus; however nowadays, as a blooming industry, its innovation system should draw more academic attention. Based on the findings, we contribute to the innovation theory from emerging economy and emerging industry perspectives. In particular, as most Chinese firms currently lack knowledge resources, policy support and open innovation can form an innovation ecosystem, which then can go through the stage of convergence, as a further extension towards product and service diversity. At early stages, the government plays an important role, by issuing policies and nurturing the innovation environment. As the innovation system becomes mature, it is the company who plays the leading role. Therefore, we enrich the theory of the innovation ecosystem and triple helix with the growth process and the dynamic role of local government.

Our case study has implications for practice and policy making for developing the animation industry in China, as a resource-scare region. To start with, local government can provide resources to form animation industry clusters, with clear aims of generating knowledge and bringing companies, universities and research institutions together. Then, the government can issue policies to support original design and IP creation, for example, with a rewarding and funding system. Learning from this case study, government can help companies to build a technology platform, or open platform, to facilitate knowledge sharing. Once the innovation system is formed, the local government can integrate resources, bringing more actors such as users and service providers into the system, enhancing the supply chain and promoting related service sectors.

There are some limitations of this research, as the findings are mainly based on one single case study, which cannot represent the whole industry in China. Western and Japanese cases are from secondary sources, which lack up-to-date details. To enrich the findings, more case studies are needed, in particular more details should cover the stages of innovation and the interactive mechanism among university, industry, government and civil society along with the innovation process. Other topics such as the international strategy and character business development strategy can also be valuable to both business practice and academic research in the future.

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