

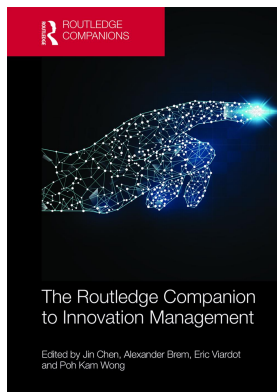
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6

INNOVATION AND INNOVATION MANAGEMENT IN AN AGE OF CHANGES

Jin Chen and Liang Mei

Innovation and innovation management in the ‘Internet+’ Age

In 2012, Alibaba Chairman Ma Yun and Wanda Chairman Wang Jianlin entered into a ¥100M VAM (Valuation Adjustment Mechanism) agreement to challenge the possibility of e-commerce grabbing a 50+ percent share of the Chinese retail market by 2020. In the following year, Gree Chairman Miss Dong Mingzhu entered into a ¥1B VAM agreement with MI Chairperson Lei Jun on Gree’s traditional marketing model and MI’s e-marketing model. Symbolizing the clash between the new and old thoughts of economic and industrial transformation, the two events provide an insight into how to innovate in corporate technology, markets, organizational management and business models in the Internet revolution. How to initiate new innovation and innovation management in an Internet era is emerging as the leading edge of research and practice.

Internet thinking

Innovation and innovation management in the ‘Internet+’ age focused primarily on a revolution in the business thinking model and resulted in Internet thinking, one that reviews the market, the user, the product, the corporate value chain and the entire business ecosystem with the continuation of technological developments, including mobile Internet, big data and cloud computing.

Embedded in the chain that links up products, production, service, marketing, strategy and business model design, Internet thinking represents the paradigm shift from linear thinking, oriented to traditional industries, to circular thinking, oriented to the Internet. Table 6.1 compares the two thinking models.

Considering the shift in business logic from linear industrial thinking to circular Internet thinking, Internet thinking is further dissected.

User-first

At the core of Internet thinking is the user, who plays an ongoing critical role in business operations and the value chain. To orient the products, services and business models of a firm to the user means to put the firm in the user’s place in addressing such problems as product innovation,

Table 6.1 Comparison between industrial thinking and Internet thinking

	<i>Industrial thinking</i>	<i>Internet thinking</i>
Mind-set	Linear thinking	Circular thinking
Characterization	Forward, irreversible, one-step	Cyclical, evolutionary
Risk characteristics	Massive, less change resistant	Staged, controllable
Visualization	Wool is shorn from sheep	Wool is shorn from pigs
Marketing model	Massive investment in advertising	Word-of-mouth marketing, social media marketing
Innovation model	Closed innovation	Open innovation
Innovator	R&D staff	User participation
Financial philosophy	Make profit from products	Products can be free

Source: Sun and Gang (2015)

pricing and brand promotion. Upmarket demand is developed, users are led to ‘vote by foot’ and competitive advantages are secured through organizational innovation. For example, the ‘user cult’ philosophy of Qihoo 360 placed user experience as the cardinal principle of product and service innovation. The development of free PC and cellphone antivirus and security packages assured Internet users of network security and emotional security to the greatest extent. That’s why Qihoo 360 succeeded in its business model in a highly competitive market.

Big data

The Internet as a tool enables a firm to accumulate countless market users as well as mass data on suppliers, partners and competitors that transfers into core corporate assets and sources for competitive advantages. When applied to the whole value chain of the corporate business model, big data analysis and mining contribute to matching supply precisely with demand, to locating markets and consumer preferences precisely to formulate systemic market strategy, to classifying cooperators’ information and allocating knowledge resources effectively and to optimizing logistics information and improving cost and operational advantages. Ultimately, big data infusion into the value chain creates competitive advantages for a firm.

Interdisciplinarity

Interdisciplinarity drives a firm to go beyond or restructure the bounds of the original business model with the assistance of Internet technologies and platforms. The increase to the business value of its products and services earns paybacks and competitive advantages. For example, Tencent and Alibaba use the Internet and the e-commerce platform to link WeChat and Alipay online payment tools with our everyday life. DiDi and KuaiDi are also popular apps that have won a wider user base and many more stickier customers. Interdisciplinarity based on Internet technology has therefore been realized.

Simplicity

Simplicity stresses minimalism in R&D, product design, production and service to maximize user experience to the greatest extent. The technological complexity of Internet technology is prevented from compromising user experience and satisfaction

Extremity

Ongoing investment of financial capital in the Internet age gave rise to fierce competition among firms. Focusing on developing customer demand deeply, and providing best experience by products and services for customers, so as to achieve customer stickiness.

Iteration

Thanks to Internet technology, innovation in products and services further improves information asymmetry and innovation efficiency for a firm while in the course of research, development and innovation. At the same time, intense competition and ongoing development of the user market further drive the demand for new, diverse individualized products and services. Under these circumstances, firms should not get into a rut, but rather pay attention to an iteration procedure as a means of evolving from old products and services to new ones. Fast iteration enables user demand to be met continually and dynamically.

Platform

The 'platform awareness', oriented to the organizational strategy, business model and organizational form, emphasizes a self-contained business ecosystem built on the Internet. It's an interactive platform involving competition and collaboration with the stakeholders in the business ecosystem in order to get an advantage. One example is Taobao, an online e-commerce platform that charges fees from countless small- and medium-sized enterprises (SMEs), startups and mini-shopkeepers. Taobao is renowned for its good service, network security, rules and a culture promoting both competition and collaboration. This e-commerce platform grabs the advantage due to the prosperity of SMEs in the business ecosystem as a whole.

Socialization

What the Internet emphasizes as interconnection among people is a web-like relationship in nature. Information communication, relationship introduction and word of mouth are similar in that they depend on interconnection. Interconnection is responsible for the externality of the Internet; that is to say, every new customer will create positive value to the whole Internet, resulting in a spillover effect at the society level. Firms should take notice of the spillover effect and use the Internet as an effectual socialization tool to introduce innovative models, such as crowd sourcing and crowd funding.

Network traffic

Network traffic concerns primarily service operations, such as specific marketing and service models. A firm should pay close attention to network traffic because it means financial returns and is key to the success of a business model. Take Qihoo 360, for example. At first its free anti-virus engine drew objections from investors and competitors. However, the free service enabled Qihoo 360 to accumulate a very large clientele and create a brand effect founded on a sense of identity. The company went on to pursue such core service modules as a search engine, earning handsome returns in the form of network traffic.

'Internet+'

To put it simply, 'Internet+' means the "Internet plus traditional industries". But it's not simply the addition but also the employment of IT and the Internet platform to apply the Internet to the traditional industries to create new development opportunities. Internet+ is characteristic of a new form of society where the role of the Internet in social resource optimization and integration is maximized since Internet innovations are introduced into the society, economy, etc. Internet+ enhances the innovativeness and productivity of a society to form a new economic model built on the Internet as a medium and infrastructure.

Prime Minister Li Keqiang stated with clarity in a 2015 government report that "the 'Internet+' Action Plan is intended to apply mobile web, cloud computing, big data and IoT (Internet of Things) to modern manufacturing, to accelerate the development of e-commerce, the industrial Internet and Internet finance, and to guide Internet companies in expanding into the international market".¹ Figure 6.1 analyzes Internet+ from three perspectives: connotation, philosophy and action plan.

National strategy drives industry, society, transport, finance, government, education, medical care and agriculture to press ahead with innovations in technological, service and business models in an Internet context. The Internet platform is joined by IT with the various traditional industries to create many new business models in both traditional and new areas. Table 6.2 lists some typical cases of innovative application of 'Internet+' to traditional areas.

Green innovation management

Beyond the innovation models driven by conventional technological feasibility and economic benefit, the environmental impact of innovation is beginning to gain attention as an important powerhouse for sustainable social development. New innovation paradigms, such as eco-innovation and environmental innovation, are proliferating in recent years.

With the rising negative externalities of innovative and economic activities, the world is paying more and more attention to environmental and ecological issues and their challenges. Take China, for example. Over the past three decades, rapid economic reforms have caused and aggravated such social problems as environmental pollution and economic inequality. The move of national innovation and institutional transformation faces the dual objective of economic growth and environmental conservation. Beginning from the end of the 1980s, the policy of environmental conservation and sustainable development underwent five changes (Zhang and Wen, 2008):

- From environmental conservation as a fundamental policy to sustainable development as a national strategy;
- From pollution control to ecological protection;
- From end-of-pipe treatment to control at the source;
- From waste discharge points to regional environmental restoration;
- From regulatory measures to economic and legal steps.

Connotation of environmental and eco-innovation

This part deals with the significant environmental impact of four innovation concepts and their management models from a social perspective. These core concepts include sustainable innovation, ecological innovation (or eco-innovation), environmental innovation and green innovation.

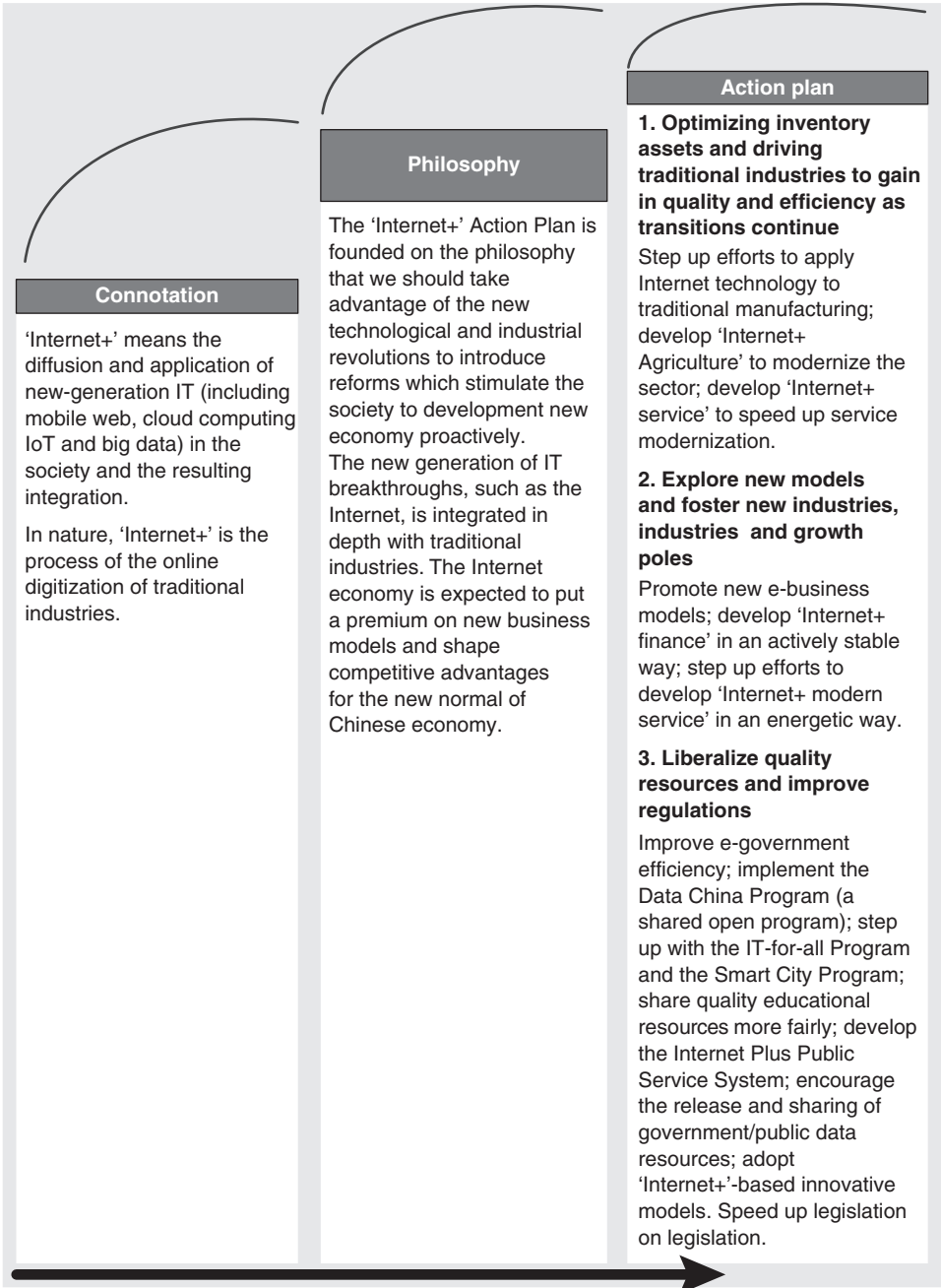


Figure 6.1 'Internet+': connotation and action plan

Table 6.2 Innovative application of Internet+ to traditional industries

<i>Internet+ (traditional industry)</i>	<i>Typical case</i>	<i>Description</i>
Internet+ communications	WeChat	Run on a smart terminal and provides instant messaging and free apps. Capable of instant messaging and people–machine interaction.
Internet+ retail	Taobao	An online retail, business and shopping platform supporting e-commerce models (e.g. B2B, B2C, C2C and O2O).
Internet+ home appliance	Haier U-home	A one-stop service platform providing home solutions in the IoT age. Oriented towards customer demand. Provides modularized products and services. Provides integrated solutions on the platform of products, services, suppliers and user experience.
Internet+ education	MOOC	A global online learning platform. It offers online education in the form of credit courses and integrates knowledge and educational resources at the global level.
Internet+ transport	Uber	An instant e-hailing software that provides a safe, comfortable and convenient urban transport service. Provides quality user experience, improves a sharing economy and optimizes resource allocation.
Internet+ personal devices	Nike+	Nike health tracker apps and wearable devices. Diversifies product functions. Improves socialization, human-factors engineering and user experience.

Source: Ning (2015)

The term ‘sustainable innovation’ first appeared in the 1980 IUCN *World Conservation Strategy*, meaning the combination of conservation with development to ensure the well-being of all human beings on the globe. At the same time, sustainability stresses that the development of modern people should not be at the expense of the interests of posterity. Therefore, sustainable innovation needs to be creative enough to realize sustainable social development and meet human demand. Similarly, the word ‘eco-innovation’ first appeared in a 1996 study made by Fussler and James, who held that research and practical experience should lean more towards new products and processes that create value for customers and operations while significantly reducing environmental impact. Famous scholars Kemp and Pearson took a further step by defining eco-innovation as the production, assimilation and development of activities that, while related to products, production processes, services, management and business models, can significantly reduce environmental hazards and negative pollution and resource externalities in the life cycle (Kemp and Pearson, 2007). Similarly, Oltra and Jean first put forward the concept of environmental innovation, a near-synonym of eco-innovation, proposing that the new and improved processes, innovation activities, innovation systems and products would ultimately have a positive impact on the environment and create ongoing value for environmental sustainability (Oltra and Jean, 2009). There is also green innovation, a concept put forward by Driessen and Hillebrand. In essence, green innovation does not imply that innovation activities oriented to sustainable development are meant to reduce environmental pressure, but that innovation activities in themselves create positive significance and value to the environment (Driessen and Hillebrand, 2002). Green innovation includes, for example, energy conservation, pollution

protection, waste recycling, green product design and environmental management improvements (Chen, Lai, and Wen, 2006).

Process management for environmental/eco-innovation

While implementing product and process innovation for greater competitive advantages, environmentally and ecologically innovative firms pay a great deal of attention to the environmental impact of innovation activities. From the perspective of innovation, environmental and eco-innovation mark a major change in the corporate innovation concept.

Take the automotive value chain, for example. From a traditional closed perspective, the value chain is a fixed one, beginning from the auto parts maker and the automaker to the dealer and the user. The concerns of a traditional automotive business include toxic substances, atmospheric pollution and environmental law compliance in the course of manufacturing. However, from the standpoint of environmental and eco-innovation, an innovative value chain integrating environmental innovation requires all the participants to be environmentally responsible. Auto parts/material suppliers, automakers, dealers, users and life terminals are put wholly under environmental monitoring and management.

Core dimensions of environmental and eco-innovation

Economists and management experts underline the complexity and multidimensionality of innovation. Environmental innovation extends the dimensionality of innovative activities and behavior beyond such traditional dimensions as product and process.

Design dimension

The design dimension of environmental and eco-innovation determines the impact of innovation activities on the environment throughout the life cycle. Design comprises three ingredients: component addition, subsystem change and system change.

Component addition means the development of additional functions or components in the course of developing an innovative product in order to enhance its environmental performance and minimize the negative environmental impacts from product, process and system innovations. For example, the catalytic converter was developed and embedded in the vehicle exhaust purifier to control NO_x/CO/hydrocarbon emissions. Subsystem change also improves the design to weaken environmental impacts while enhancing eco-efficiency and energy efficiency. System change involves a redesign of innovative products and processes so that they meet the requirements for eco-friendly development. Examples include waste reuse and recycling, dissemination of new-energy vehicle breakthrough innovations (e.g. new-energy vehicles) and innovations in and dissemination of solar products. All the steps are focused on the design concepts of environmental and eco-innovation when it comes to such system changes as energy use, energy conservation and emissions reductions, environmental friendliness and sustainable development.

User dimension

The user dimension covers two ingredients, namely, user development and user acceptance. User development highlights the important role of users in product definition, design improvement and R&D. The firm should attach great importance to the role of the users (especially lead users)

in the entire stage from creative idea generation to product commercialization. The firm should collaborate effectively with the users throughout the entire product development stage, since they concern both the development and use of the products. However, although user participation improves product efficacy, it may fail to adequately meet the firm's need for breakthrough innovations, for the user may reject such innovations because of the limits of thinking on current products and a deficiency of knowledge about complicated products and processes. Therefore, it is necessary to balance exploration and utility when the firm relies on the user to convert innovative ideas into commercial products. In this manner, the user is effectively stimulated as a source of innovativeness to create significant value, and user feedback on environmental and ecological issues is used in the interests of innovation management in an environmental context. User acceptance of the application of innovation has a revolutionary impact on user behavior and user practice. Usually, fast and mass user application features successive innovation, and user acceptance of an innovation depends greatly on the influence of social values and norms. One example is the society-wide pursuit of health trends (e.g. eating more vegetables), which contributed to successful innovation in niche markets.

Product-service dimension

The product-service dimension covers the change in the product-service deliverable and the change in the value chain process and relations. The change in the product-service deliverable stresses the interaction between the products/services and the user, as well as the changes in the perception of customer relations. Environmentalism incorporated as a philosophy and mode of life into the user's cognitive and consuming habits lends itself to market feedback on the firm's environmental innovation behavior while dynamically and strategically promoting ongoing environmental innovation. For example, a firm may turn from selling products to selling service packs, leasing products, maintaining a product operating environment and recycling waste. Users are therefore influenced by a sense of environmental protection and maintain a prolonged interaction with the firm.

The change in the value chain process and relations stresses primarily whether the value networks and processes of the products and services can create a green, positive and environmental resource cycle. In the context of environmental protection, innovative management is centered on the sustainable development of firms and stakeholders. For example, competent environmental companies may monopolize the niche market by publicizing the value of green products and services. In doing so, the companies switch from environmental and eco-innovation to ongoing competitive advantages.

Governance dimension

The governance dimension of environmental and eco-innovation involves all innovative environmental solutions at the institutional and organizational levels aimed at achieving the dual objective – competitive advantage improvement at the firm level and positive environmental benefit at the social level. Governance interventions (e.g. environmental law, environmental codes and environmental assessment standards), as well as incentives (e.g. environmental subsidies and environmental innovation-related preferences), are adopted to encourage the firm and the society to review and strategically emphasize green and environmental innovation activities.

Based on the core dimension of environmental and eco-innovation, Javier Carrillo-Hermosilla created an assessment system for the environmental and eco-attributes of innovation activities. See Table 6.3.

Table 6.3 Environmental and eco-innovation assessment dashboard

Main dimension	Ranking				
	1	2	3	4	5
Component condition					
Subsystem change					
System change					
User development					
User acceptance					
Product-service deliverable					
Value chain change					
Governance					

Responsible innovation

In the course of human evolution and social development, innovation has served a sustained role in driving economic growth, facilitating sustainable social development and improving the life and well-being of the populace (Owen, Baxter, Maynard, and Depledge, 2009). Take the technological and industrial innovations in the 20th century, for example. Atomic energy, the internal combustion engine, molecular biology, nanoscience and the information revolution have done their significant share of work to boost sustained social progress and revolution.

On the other hand, despite the accompanying social progress, technological innovation is giving rise to increasingly hazardous social paradoxes, such as atomic energy development vs. nuclear security, genetic modification vs. bioethics and biosecurity regarding humans and other living beings, industrial innovation vs. environmental hazards, financial innovation vs. financial crisis, and IT vs. information security and privacy protection. These dual-nature challenges concern both social progress and social hazards and divert the attention of researchers and doers to ‘responsible innovation’.

Under the Smart Growth strategy where knowledge and innovation drive economic growth, the Horizon 2020 Framework Program introduced the concept of ‘responsible innovation’, highlighting its global strategic importance. From the perspective of responsible innovation, research and innovation should be effective in reflecting social demand, social willingness, social values and social responsibilities. Policy makers are obligated to erect a governance framework on which to encourage responsible research and innovation activities (Mei, Chen, and Sheng, 2014).

To achieve this goal, innovation is supposed to be morally acceptable and socially intended, safe and sustainable (Von Schomberg, 2013). Based on the fundamental vision of the 2020 Smart Growth Strategy, responsible innovation requires research and innovation activities to review two basic questions: Are humans able to delineate the social impact and results on innovative activities? Will the support for an innovation cause it to evolve in a direction that is satisfactory to society?

In this case, the developed countries have tried out many responsible innovation programs at the national and regional levels. See Table 6.4.

Basic connotation of responsible innovation

Responsible innovation revisits the positive process of the traditional innovation paradigm from the viewpoint of idea creation and commercialization. By predicting the potentially negative

Table 6.4 Responsible innovation policies and activities conducted by developed countries

<i>Policy and activity</i>	<i>Key goal and content description</i>
The Netherlands Responsible Innovation Program	<ul style="list-style-type: none"> • Focusing on the design of innovation processes and integrating innovation research with social analysis and ethics study in order to ensure the coordinated development of science and technology
The Germany Action Plan Nanotechnology 2020	<ul style="list-style-type: none"> • Reducing the negative impact on the environment and health, exploring the potential value of nanotechnologies on sustainable development and improving the supportive public policies on the development of nanotechnologies. • Analyzing the potential risks for nanomaterial on the environment and human beings • Developing the approaches and proposals for responsible innovation of nanomaterial
The UK EPSRC Nanomedicine Public Dialogue	<ul style="list-style-type: none"> • Defining the focus and priority of nanotechnology on medical research • Describing the direction and decisions of nanomedicine research • Listening to public feedback on the research
Research on European Nano-Science and Technology Regulation	<ul style="list-style-type: none"> • Formulating European nanoscience and technology regulations and values • Discussing the ethical norms, research activities, stakeholders and governance mechanisms of the development of European nanoscience and technology and achieving the responsible innovation of nanoscience and technology • Exploring nanoscience and technology governance regulations and the responsible innovation on emerging technologies
Responsible Innovation Framework at the UK's Engineering and Physical Sciences Research Council (EPSRC)	<ul style="list-style-type: none"> • Combining the purpose, vision, impact, motivation and open dialogue of responsible innovation and achieving ethics, reflexivity and responsiveness of innovation governance
The U.S. Social-Technology Integration Research Program	<ul style="list-style-type: none"> • Integrating the technological research in labs with societal expectations and needs • Comparing and evaluating innovation activities in labs with public opinions • Conducting interdiscipline collaborative research on responsible innovation and relevant responsiveness mechanisms
The Hippocratic Oath for Scientists	<ul style="list-style-type: none"> • Scientists' responsibility in terms of both science and technology and other humanistic aspects involving care, respect, legitimacy, justice, love and avoiding harm
BASF Dialogforum Nano	<ul style="list-style-type: none"> • Formulating seven criteria of responsible innovation in nanotechnology
European Commission ETICA Project	<ul style="list-style-type: none"> • Discussions on ethical issues of emerging information and communication technology (ICT) involving technology classification, ethical observation, evaluation and practices of ICT • Introducing a multistakeholder reflexivity approach and promoting ethical discussions by multistakeholders

Source: Liang, Jin, and Weizhong (2014)

impacts of innovation activities, more heterogeneous stakeholders should be included and more responsive institutions should be constructed so as to lead innovation processes in directions that are satisfying socially and ethically acceptable, achieving the maximum public values (Mei and Chen, 2015).

As an emerging research and practice innovation paradigm, the questions of responsible innovation mainly focus on aspects involving product, process and purpose (see Table 6.5).

The relevant concepts of responsible innovation include responsible research and innovation (RRI) and responsible development (RD), which originates from contexts in the EU and the United States. As an emerging paradigm, the main characteristics of responsible innovation include:

- Focusing on the needs and challenges of a societal ecosystem and ethics;
- Making inclusiveness and multistakeholder participation a promise and promoting mutual learning and decision-making mechanisms;
- Focusing on the prediction of potential problems of innovation, evaluating value appropriation and revisiting potential value, propositions, beliefs and norms of innovations;
- Proposing and constructing mutual participation and adaptive mechanisms of responsible innovation (Wickson and Carew, 2014).

Frameworks of responsible innovation

Stahl (2013) proposed a three-dimensional framework of responsible innovation, including the actor of innovation, the activity of innovation and the norm of innovation, and argued that responsible innovation was a meta-responsibility.

Stilgoe, Owen, and Macnaghten (2013) constructed four dimensions of responsible innovation, involving anticipation, reflexivity, inclusion and responsiveness (see Figure 6.2).

However, the previous discussions on responsible innovation were mainly from geographical contexts like the EU and the United States. Embedded in such developed countries' contexts, the relevant institutions advocate potential priorities of specific technological and societal issues, implying an inclusive, democratic and just relationship between science and

Table 6.5 Lines of questioning on responsible innovation

<i>Product questions</i>	<i>Process questions</i>	<i>Purpose questions</i>
How will the risks and benefits be distributed?	How should standards be drawn up and applied?	Why are researchers doing it?
What other impacts can we anticipate?	How should risks and benefits be defined and measured?	Are these motivations transparent and in the public interest?
How might these change in the future?	Who is in control?	Who will benefit?
What do we know about?	Who is taking part?	What are they going to gain?
What might we never know about?	Who will take responsibility if things go wrong?	What are the alternatives?
	How do we know we are right?	

Source: Macnaghten and Chilvers (2013)

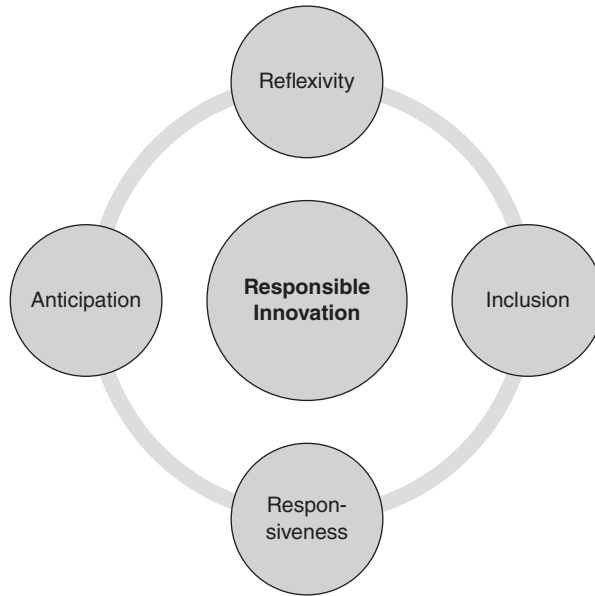


Figure 6.2 Four-dimensional framework of responsible innovation

society (Van Oudheusden, 2014). In contrast, responsible innovation in the developing countries' contexts is different. The relevant researches and practices require considerations of the heterogeneity of national, regional and organizational factors, as well as the relationship between science and technology, science and society and the influence of responsible innovation on poor regions in the context of constructing a framework of responsible innovation (Mei and Chen, 2014).

Thus, Liang Mei and Jin Chen (2014) integrated the three-dimensional and four-dimensional frameworks of responsible innovation and further complemented the contextual factor in a new theoretical framework of responsible innovation (see Figure 6.3).

The evaluation of responsible innovation

The lives of human beings and the development of society rely more and more on technological innovation. Responsible innovation triggers a consideration of the negative impacts and ethical concerns of innovation activities. Traditional innovation paradigms mainly focus on the two-dimensional evaluative criteria of innovation, involving the advance and feasibility of science and technology, and the economic efficiency and growth. With the evolution of responsible innovation, the criteria of innovation evaluation are extended. Previous responsible innovation literature argues that the research and innovation activities must meet two more basic criteria, namely ethical acceptance and social satisfaction. Based on the relevant academic discussions, the Chinese scholars Liang Mei and Jin Chen (2015) established the evaluative criteria of responsible innovation (see Figure 6.4).

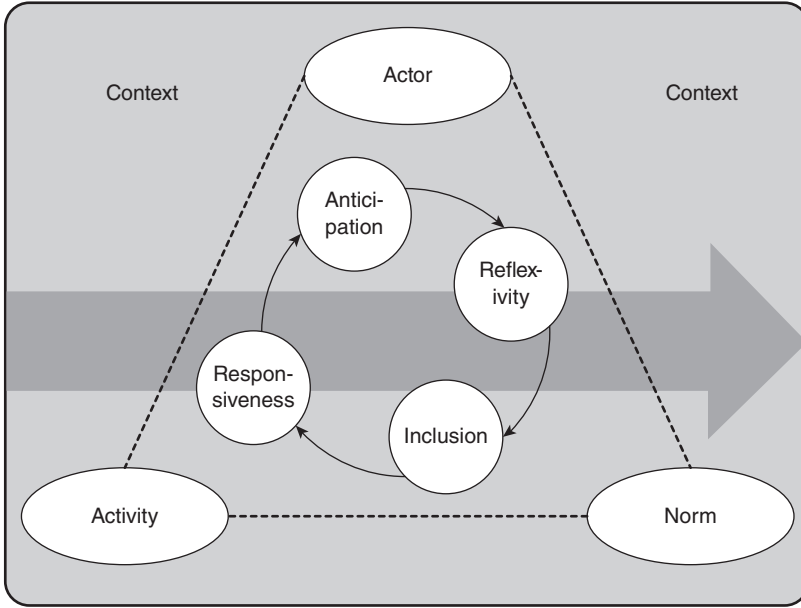


Figure 6.3 Research framework of responsible innovation

Source: Liang and Jin (2014)

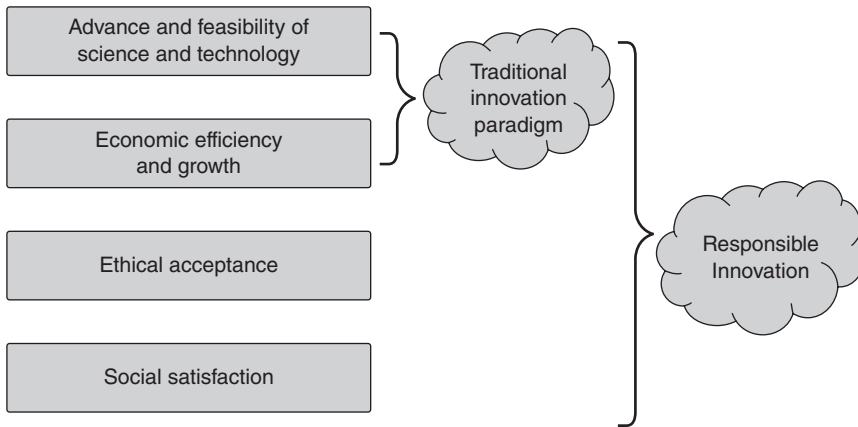


Figure 6.4 Theoretical framework of responsible innovation

Source: Liang and Chen Jin (2015)

Note

- 1 Report on the work of the government in 2015, People.cn: www.people.com.cn/n/2015/0305/c347407-26643598.html

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