Guest editorial

Innovation with Chinese characteristics: theory and practice

1. Introduction

When China embarked on its reform and opening-up drive in 1979, the country made science and technology modernisation one of the four pillars of the new initiative. Forty years on, China has transformed itself from a poverty-stricken, economically backward country into the world's second largest economy and equally impressively from the backwater of global innovation to the world' hub of science and innovation (Li and Li, 2013). China's remarkable progress in innovation has been well documented (Ding and Li, 2015; Fu, 2015). Yet, what characterises the Chinese approach to innovation management remains an area where arguments are being contested. Over the years, a few exemplary arguments have emerged. Firstly, Chinese innovation management is framed from the evolutionary economics perspective. The argument contends that Chinese innovation has followed the catch-up pattern for latecomers that starts with learning from forerunning countries before moving up the innovation ladder, as suggested by the evolutionary economics theory (Nelson, 2008). From this lens, it is argued that China's successful catch-up can be attributed to the institutions of knowledge learning and creating as well as the access to foreign knowledge (Li *et al.*, 2018). For example, Lee *et al.* (2011) identify several unique elements of learning and access strategies of the Chinese catch-up model that are not found in the models of Taiwan or Korea. These unique features include the following:

- parallel (indirect) learning from foreign direct investment firms;
- forward engineering (the role of university spin-off firms) in contrast to reverse engineering adopted in Korea and Taiwan; and
- acquisition of technology and brands through international mergers and acquisitions (M&A) and going global (*zouchuqu*) at an earlier stage of economic development.

Along this line, Bound *et al.* (2013) referred to China as an absorptive state that was increasingly adept at attracting and profiting from global knowledge and networks.

Another argument attributes Chinese innovation management to the country's ability to compete on creativity and cost (Economist, 2010). This ability to make established products for dramatically lower costs is dubbed "frugal innovation" in broad terms (Zeschky *et al.*, 2011). In this model, innovation is primarily involved with redesigning products, using existing technology in imaginative new ways and applying mass production techniques across the value chain. Frugal innovation not only addresses the unmet or underserved market needs of customers at the bottom of the pyramid but also spurts innovation in other forms that is made possible by the expansion of markets.

While the phenomenon of Shanzhai innovation that emerged in China in the 1980s is seen as part of the "frugal innovation" model (Economist, 2010), more recent argument has considered Shanzhai to be much broader than just cheap copying goods. For example, Zhu and Shi's (2010) research points out that Shanzhai manufacturing is typified by the rapid production cycle of the products – concept to delivery is often achieved within weeks. Keane and Zhao (2012) view Shanzhai innovation as an example of rapid prototyping. Liu *et al.* (2015) emphasise the importance of modularisation and the evolution of value chain in Shanzhai innovation that significantly lower the technological threshold of entering the

Chinese Management Studies
Vol. 14 No. 2, 2020
pp. 325-333

1750-614X
DOI 10.1108/CMS-06-2020-796

mobile phone business, promote disruptive innovations and accelerate latecomers' accumulation of knowledge and technology. Specifically, the evolution of value chain leads to some firms in possession of better technologies to refocus their business on the design and production of chipsets and software, while others with other advantages such as market information reallocate their effort in cosmetic design, differentiation or marketing. For Maarten Beekers [1], a US technology commentator, the practice of Shanzhai represents an open-source approach to manufacturing, which enables factories to bootstrap new products and penetrate new markets, all in a highly efficient way. This is made possible because as the manufacturing industry in China developed, traditional contract manufacturers also grew in size, mainly catering to multi-national brands. Some young entrepreneurs saw this as an opportunity to start producing goods, in smaller volumes, for SMEs. As a result, a dense network of small manufacturing businesses emerged in China during the 1990s, one that involved component producers, traders, design houses, vendors and assembly lines.

Another interesting argument is to frame Chinese innovation management as the model of "alliance capitalism" (Higgins, 2015). This is referred to as a strategic approach to which government actors and firms develop embedded relational ties and collaborative R&D activity with other firms and economic and technological actors to engage in innovative upscaling and product development. The primary goal of such alliances is to anticipate future market and ecosystem requirements and to use this information to build a critical network of interdependent alliance partners that are focussed on achieving technological "convergence" and "interoperability" across the ecosystem platform.

Despite the growing literature on Chinese innovation, consensus on the unique model of Chinese innovation management has yet to emerge. The papers collected in this special issue are intended to provide some research frameworks in various aspects of innovation in China.

2. Preview of the special issue

From the Chinese economic point of view, 2018 was celebrated as the 40th anniversary of reform and opening-up in China. To mark the significant milestone, Jilin University and Amsterdam Business School joined together to hold the 5th Global Entrepreneurship and Innovation Conference in Amsterdam on the theme of "Technology Entrepreneurship – The Driving Force of Contemporary Business" on 18 October 2018. To disseminate quality research, *Chinese Management Studies(CMS)* agreed to publish a special issue on "Innovation with Chinese Characteristics: Theory and Practice". The nine papers we presented in this special issue to the readers were selected from 49 submissions and were those that had gone through the journal's blind peer-review process. In Section 2, we provide a preview of the special issue. The articles in this *CMS* special section on innovation with Chinese characteristics highlight some specific aspects that manifest innovation in China. They address issues ranging from innovation subsidy, fiscal decentralisation, management behaviour to business model.

In the first article, Li, Zhou, Jung and Li provided an up-to-date review of the evolution of policies and practice of innovation in China over the past 40 years and identify six practices that underpinned the success of innovation in China over this period. Echoing Ding and Li (2015), they argued that good practices in managing innovation consisted of formulating successive policies to encourage innovation and planning strategically, giving space to the spontaneity of creativity and encouraging "grassroots innovation", and using both the "invisible hand" and the "visible hand" to support innovation. They also argued that Chinese innovation success also resulted from its effort to engage state-owned and privately owned firms in collaborative innovation to encourage internationalisation of innovation under the principles of "going out" and "bringing in" as manifested in the latest Belt and

Road Initiative and to release the entrepreneurial spirit of Chinese people and to embrace the culture of "common destiny" as a new win–win model in international relations and future innovation-driven development.

The next three articles focus on government policies related to R&D subsidy and fiscal decentralisation. Wang, Hu and Yang examined the effect of the government subsidies on China's regional innovation performance, using the Bayesian model averaging method. Subsidy is an important policy tool, as they show that China's R&D subsidies for high-tech industries increased from ¥3.910bn in 2006 to ¥210.183bn in 2015, with an average annual growth rate of 43.8%. They used the proportion of government funds in the internal expenditure of R&D funds to measure the degree of government R&D subsidies for high-tech industries and new product sales revenue of high-tech industries to measure regional innovation performance. Their empirical results show that government subsidies have a negative relationship with the regional innovation output. They interpreted the result as evidence of the crowding-out effect, meaning that firms used government subsidies to substitute for their own R&D investment.

Wang, Li and Sun examined the effect of government R&D subsidies on firm performance, using Chinese A-share listed companies' data from 2008 to 2016. They found a positive impact of R&D subsidies on return on asset (ROA) after controlling for a range of corporate characteristics, suggesting the positive effect of government R&D subsidies on firm performance. They also found that the relationship between R&D subsidies and ROA is non-linear, indicating that only when R&D subsidies are given within the moderate interval can firms perform better. They argued that R&D subsidies play a vital role in enhancing firm performance mainly via two mechanisms, namely, signal financing and innovation incentives. Finally, they found evidence that suggests that the effect of government R&D subsidies is greater in non-state-owned, young and large enterprises.

Yang, Li and Li examined the impacts of fiscal decentralisation on city innovation performance in China, using a panel data of China's 278 cities from 2003 to 2016. They used the ratio of the city budgetary expenditure per capita to the sum of central, provincial and city budgetary expenditure per capita to measure degree of fiscal decentralisation. They estimated a patent renewal model and aggregated the forecasted patent's market value at the city level to construct the index of city innovation. Their research finds that fiscal decentralisation significantly inhibited city innovation and that the inhibition demonstrated characteristics of "V" type variation. They argued the reasons behind this negative effect are twofold: fiscal decentralisation weakened the central government's ability to guide local governments to implement its innovation-driven strategy; and fiscal decentralisation weakened the central government's ability to restrain local governments' preference for self-interest investment of emphasising production and neglecting innovation. They further showed that the influence of fiscal decentralisation on city innovation present clear spatial and temporal heterogeneity. Geographically, the inhibition of fiscal decentralisation on city innovation in eastern China is significantly weaker than that in central and Western China. Temporally, after the implementation of China's innovation-driven development strategy in 2013, the negative impact of fiscal decentralisation on city innovation disappeared.

The focus of the next three articles shifts to firm behaviour and impacts. Hai, Yin, Gao and Chen analysed the impact of R&D volatilities on market value and the moderating effect of executive overconfidence, using a panel data set covering 902 Shanghai and Shenzhen A-share manufacturing listed firms. R&D volatilities indicate the firm's shift of innovation strategies between exploratory innovation and exploitative innovation in terms of changes in R&D expenditure away from the firm's historic trend. They found that positive R&D volatilities have a significant positive impact on market value, suggesting that the shift of

innovation strategy to exploratory innovation helps firms change the trajectory of technological development and acquire competitive advantage which in turn enhances their market value. They also found that negative R&D volatilities have a significant positive impact on market value, indicating that the shift from exploratory innovation to exploitative innovation helps firms to consolidate competitive advantage and achieve better performance. Finally, they found that the relationship between R&D volatilities and market value is moderated by executive overconfidence.

Dai and Taube explored the functionality of long tail markets (LTM) in new products and business development through two Chinese cases: the fintech sector and low-speed electric vehicles. They argued that the alternative approach to leveraging LTM for new business models and technologies rather than competing head-on with powerful incumbents in the mainstream markets promotes the introduction of new technologies and business models. Their research identifies three strategies to explore LTM for businesses, i.e. identifying a specific customer base, being aware of localisation products and playing skillfully with regulations.

Zhao and Vinig investigated how guanxi and guanxi intensity may affect reward-based crowdfunding success and project performance in the Chinese context, using research data of 989 crowdfunding projects collected from zhongchou.com, the largest reward-based crowdfunding platform in a one-year period (2014.1–2014.12). They found that project developers' guanxi-building behaviour displayed before launching their own projects such as being fans of other projects and being supportive of other projects are positively related to project success. In addition, the intensity of guanxi-building behaviour positively influences project performance in a significant way. Besides, the establishment and maintenance of project developers' guanxi with funders during the fundraising process are also positively associated with project success and fundraising performance.

Sun and Ai investigated the effect of home political connections on the cost implications of Chinese multi-nationals. Framing their research on the social exchange theory, they argued that the costs of home political connections arising from reciprocity commitment to the government in outbound M&As of Chinese multi-nationals outweigh the benefits. The costs are higher for lower-level political connections. Using a sample of 225 M&A deals, they tested and confirmed the negative effect of home political connections on the internationalisation of Chinese multi-nationals. Also, the negative impact of lower-level political connections is stronger than that of their higher-level counterparts.

The final article of this special issue is a systematic literature review of research on innovation performance covering the period of 2000–2018 in Chinese and English literature. Based on the systematic literature review, Zhu and Fang identified three characteristics of research in this specific domain. Firstly, the momentum of research on innovation performance in the English literature was increasing, whereas it in the Chinese literature has declined in recent years. Secondly, research in both Chinese and English literatures covered similar streams such as "innovation system/elements", "innovation activity/ability" and "innovation network/social capital". Thirdly, although the directions are the same, the specific contents of research were different. The hot topics in the English literature were "sourcing knowledge" and "culture value" in the "innovation system/elements" stream, "supply chain management" in the "innovation activity/ability" stream and "licensed-knowledge attributes" in the "innovation network/social capital" stream. On the contrary, the hot topics in the Chinese literature were "technology transfer" in the "innovation system/elements" stream, "resource acquisition" and "external innovation search" in the "innovation activity/ability" stream and "cooperation experiences" in the "innovation network/social capital" stream. Using insights obtained from the literature review, they proposed three

directions for future innovation performance research: expanding research in hot topics, connecting research streams to extend research scope and exploring new fields of innovation performance.

3. Some future research directions in the era of de-globalisation

The world has changed significantly since the global financial crisis of 2008. Slow global economic growth has become the new normal, global trade protectionism is rising, flow of cross-border trade, finance investment is reducing, global supply chains are dismantling and the current rules of the world trading system are being challenged. The unfolding of the retreat of globalisation is termed as de-globalisation. International trade policies that manifested Donald Trump's first three years' presidency in the USA spurted the pace of de-globalisation. All this will affect how China innovates. Specifically, the technology war that is part of the USA–China trade war will have a far-reaching effect on Chinese innovation. As The Economist commented, the trade conflict that matters most between America and China is a 21th century fight over technology [2]. With the USA's determination to deter China's rise to become a technology leader and China's resolution to move up the technology ladder, both countries could find it difficult to reconcile their respective national interests. There is a real danger that the technology war could lead to the decoupling of science and technological innovation between the world's two biggest economies, splitting the world's research and development chain into two parallel innovation ecosystems [3]. The new era of globalisation and the economic and social problems behind it require critical review of, and reflection on, theory, practice and policy of innovation in China and fresh thinking of new models of innovation.

Despite the rise of nationalism and retreat of globalisation, the underlying causes of open innovation in fact still hold true. On the one hand, good ideas and innovation will undoubtedly come continuously from connecting, fusing and recombining and will reinvent themselves by crossing conceptual, organisational and national borders. On the other, nobody can master it all in the light of the complexities of today's technologies and supply chains. Hence, the ongoing technology war between the US and China does not support the argument that China should turn its back to open innovation by reverting itself to self-sufficiency in technologies. China's scale of home market may indeed provide Chinese firms an indispensable cushion against the damaging forces released from the technology war for now. However, by focussing innovation exclusively on home market Chinese companies could fall into the trap of cutting themselves off from the wider world and the bigger ideas it contains. Nonetheless, the changing environment also suggests that the balance between internal and external resources has shifted, because possessing internal R&D capabilities can be argued to be more important when relying heavily on relationships with other actors. This calls for a greater understanding of different forms and practices of openness. In this context, we argue that management of internationalisation of innovation and management of efficient internal innovation are two important directions of research on Chinese innovation going forward.

3.1 Management of internationalisation of innovation

Three models have typified Chinese firms' internationalisation of innovation over the past decade. The first was to use business joint ventures and setting-up of research centres abroad to access and generate cutting-edge technologies from the host countries. For example, Huawei has set up 36 joint innovation centres and 16 research centres worldwide [4]. The second was to use M&As to obtain technologies critical for Chinese firms to advance in the value chain. The third was to use corporate venture funds to invest in technology start-ups in the USA and

Europe to have a stake in emerging technologies. Grant (1996) argues that there are at least two forms of cost emerging when the firm's collaboration with external partners, i.e. the costs of coordination and competition. Costs of coordination emerge from organisations that are different, where it may be difficult to bridge organisational boundaries. Costs of competition emerge from the risk that one actor would act opportunistically in bad faith. The America's recent ban on technology exports to Huawei indicates another form of cost emerging from the firm's deep dependence on external core technologies – costs of strategic control. Clearly, openness is beneficial only when the firm chooses the correct and concomitant configuration of both the open and the closed resource (Alexy *et al.*, 2018). In 2010, Dahlander and Gann (2010) asked: How open is innovation? The question remains relevant today.

In the face of the USA's ban, Huawei's response so far has been revealing. Firstly, in spite of facing the cutting off from American technology supply and being barred from joining the global research chain, for example, in the wake of the sanctions, Stanford University and MIT in the USA, and the University of Oxford in the UK cut funding ties with Huawei, the company maintained that it would still embrace American technologies so long as they are made available to them. It was also determined to keep their innovation system open. In doing that, the company has reallocated its R&D investment globally to mitigate the effect of the USA's ban. For example, it was reported that in October 2019, Huawei had bought a stake in Oxford Sciences Innovation that commercialises research at Oxford University, which would give the company access to some of the most promising early-stage technology developed by academics in the UK [5]. Secondly, the company quickly revealed that it had secretly worked on its own proprietary operating system named as HarmonyOS for nearly ten years and would install it in their smartphone products should the company's access to Google's android system completely stop. Thirdly, the company announced that it would invest $1.5bn to support application developers worldwide to nurture the development of its own innovation ecosystem [6]. The case of Huawei suggests a number of questions that future research on Chinese innovation need to tackle:

RQ1. What are firm- or environmental-level factors that may moderate the effect of openness on competitive advantage?

RQ2. How should firms in China balance generic, non-firm–specific R&D with strategic, firm-specific R&D? What could be a win–win approach to internationalising R&D?

RQ3. In internationalisation of R&D, how should firms in China manage intra-and inter-regional geographic diversification?

RQ4. How should Chinese firms develop innovation ecosystem?

RQ5. How could firms in China use government support to deal with the de-globalisation challenge?

RQ6. How could firms in China deal with the institutional pressure from the host country?

3.2 Management of efficient internal innovation

The new era of globalisation demands firms in China to balance between search for external sources of innovation and the development of internal innovation capabilities. While adapting internationalisation of R&D to the new era of globalisation is imperative, equally important for Chinese firms is to improve innovation efficiency. China's innovation drive

over the past decades has been supported by the unprecedented amount of funding to R&D. For example, China spent over ¥1.96tn (about US$293bn) on R&D in 2018, up 11.6% compared with that in 2017 [7]. In 2019, China established a new state-backed semiconductor fund worth $28.9bn to advance its domestic semiconductor R&D and reduce its reliance on US technology [8]. China's incentive for injecting more resources into its innovation system to support R&D in general and strategic industries in particular will be certainly strong if the technology war lingers on. Yet, the concern is that productivity of R&D investment in China has been overall unsatisfactory. There is consistent evidence that shows the low R&D efficiency of firms in China. For example, empirical research using data about 38 Chinese new energy enterprises from 2009 to 2013 finds that new energy enterprises are generally inefficient when it comes to innovating (Wang *et al.*, 2016). It is also found that state ownership enables firms to obtain crucial R&D resources but makes them less efficient in using those resources to generate innovation (Li and Li, 2013; Zhou *et al.*, 2017). As a result, the level of inputs is not consistently translated into successful innovation outputs. Kennedy (2017) characterises this low transformation of inputs into successful high-tech advancement as a "fat" tech dragon. It is not a surprise that a meta-analysis of the relevant literature on a large number of countries at different stages of economic development finds that the growth-enhancing effect of R&D spending in China has been significantly weaker than that of other countries (Ljungwall and Tingvall, 2015).

The underlying causes of innovation inefficiency in China are multi-faceted. At the innovation support system level, the problems are associated with the duplication of science and technology (S&T) projects, lack of transparency in S&T management and low efficiency in fund use (Ding and Li, 2015). At the regional level, the problems are found to be related with a mismatch between upstream public research organisation-centred research processes and downstream firm-centred commercialisation processes when the downstream commercialisation process plays a more important role in the whole regional innovation processes (Chen and Guan, 2012). At the firm level, the problems are found to be linked with the low absorptive capacity for the potential outputs of the increasing R&D inputs and the inefficiency of the technology commercialisation processes (Han *et al.*, 2017). Important research questions will be: How could government agencies work collaboratively to identify and support novel S&T projects? How could governments make the funding mechanism of S&T projects fair and transparent? How could S&T fund be used more efficiently? How could regional innovation systems align upstream public research organisation-centred research processes and downstream firm-centred commercialisation processes more closely? How could firms improve their absorptive capacity? How could firms enhance the efficiency of technology commercialisation processes?

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Notes

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