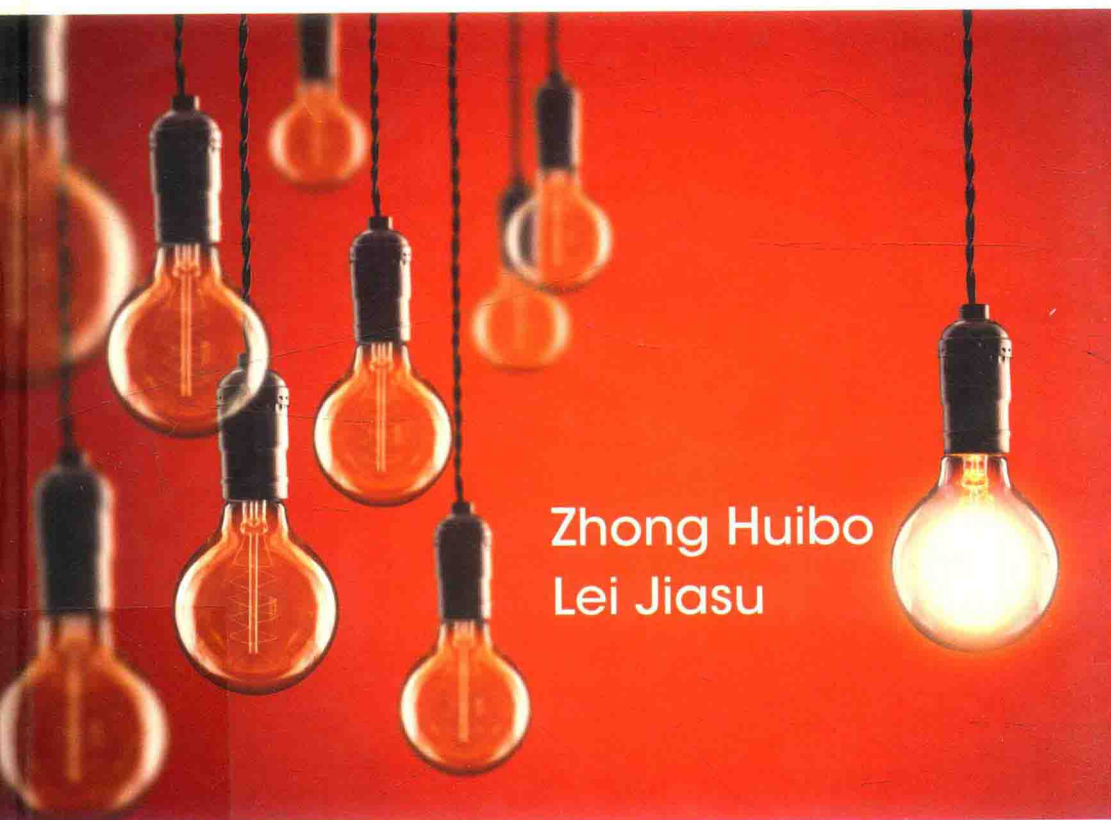


Series on Innovation and Operations Management
for Chinese Enterprises - Vol. I

INDEPENDENT INNOVATION IN CHINA

Theory and Cases



Zhong Huibo
Lei Jiasu



ZHEJIANG UNIVERSITY PRESS
浙江大学出版社



World Scientific

Series on Innovation and Operations Management
for Chinese Enterprises - Vol. I

INDEPENDENT INNOVATION IN CHINA

Theory and Cases

Zhong Huibo

Beijing Institute of Technology, China

Lei Jiasu

Tsinghua University, China



ZHEJIANG UNIVERSITY PRESS

浙江大学出版社



World Scientific

图书在版编目(CIP)数据

中国的自主创新: 理论与案例=Independent
Innovation in China: Theory and Cases : 英文/钟惠波,
雷家骥著. — 杭州: 浙江大学出版社, 2017. 7
ISBN 978-7-308-16401-6

I. ①中… II. ①钟… ②雷… III. ①企业创新—研
究—中国—英文 IV. ①F279.23

中国版本图书馆CIP数据核字(2016)第270734号

Copyright © 2018 by Zhejiang University Press and World Scientific Publishing Co. Pte. Ltd.

This edition is jointly published by Zhejiang University Press and World Scientific Publishing Co. Pte. Ltd. This edition is distributed by Zhejiang University Press only in China.

All Rights Reserved.

Not for sale outside Mainland of China

此书仅限中国大陆地区销售

中国的自主创新: 理论与案例

钟惠波 雷家骥 著

策划编辑 朱 玲

责任编辑 陈丽勋 朱 玲

文字编辑 李 晨 曾 熙 葛 娟

责任校对 董 唯 仲亚萍

封面设计 俞亚彤

出版发行 浙江大学出版社

(杭州市天目山路148号 邮政编码 310007)

(网址: <http://www.zjupress.com>)

排 版 杭州林智广告有限公司

印 刷 浙江印刷集团有限公司

开 本 710mm×1000mm 1/16

印 张 27.25

字 数 540千

版 次 2017年7月第1版 2017年7月第1次印刷

书 号 ISBN 978-7-308-16401-6

定 价 228.00元

版权所有 翻印必究 印装差错 负责调换

浙江大学出版社发行中心联系方式: 0571-88925591; <http://zjdxcs.tmall.com>

INDEPENDENT INNOVATION IN CHINA

Theory and Cases

Series on Innovation and Operations Management for Chinese Enterprises

Series Editor: Wu Xiaobo (*Zhejiang University, China*)

Editorial Committee: Xu Qingrui, Chen Jin, Wei Jiang, Gu Xinjian,
Guo Bin, Huang Can

Vol. 1 Independent Innovation in China: Theory and Cases
*by Zhong Huibo (Beijing Institute of Technology, China) and
Lei Jiasu (Tsinghua University, China)*

Preface

(One)

Independent innovation as a very common phenomenon has existed throughout China's long history. The creation of the stone weapon during the stone age, followed by four great inventions and all of the technological innovations using modern technology and science during almost 40 years of the reform and opening up, all reflect the wisdom of the Chinese nation and show people the brilliant Chinese culture and its contribution to the world. No innovation, no progress of human society. No innovation from the Chinese nation, no advance of human civilization.

In the early 1990s, the concepts of "leading innovation" and "independent innovation" were put forward in China. However, not much attention was paid to them at that time in the Chinese society. Nowadays, it is independent innovation that calls much attention to China and not only represents a kind of confidence and determination in national development, but also has much deeper economic and political implications. The 17th CPC National Congress in 2007 clearly pointed out that "Enhancing the capability of independent innovation means constructing an innovative country"; and this Congress demanded that China insist on a policy of independent innovation with Chinese characteristics and that the country implement the concept of "enhancing the capability of independent innovation" in all aspects of the process

of modernization. The primary goal in building an innovative country is the ability to significantly enhance independent innovation, so that the contribution of scientific and technological progress to economic growth can increase sharply and China will make it into the group of innovative countries by 2020.

Why didn't we emphasize the importance and urgency of independent innovation in the past as we do today? It is easy to find an answer by looking back on the history of innovation in modern and contemporary China to see that our nation has not had any achievements to match the four great inventions of the past for a long time. Today, people feel that inventions are as remote as ancient history. Are there any modern Chinese inventions that can shout to the world with confidence that they have truly been invented solely by us Chinese? No, not indeed! We do not remember ancient history; we merely remember the recent history of the Qing Dynasty. Due to the weak and ineffective Qing policies, the West attacked China without any strong counterattack from the Qing government. A few national industries were equipped with imported Western capitalist goods. The Westernization movement had the policy of "adopting Western culture, but giving it the backbone of Chinese culture." Despite bringing new ways of thinking and vitality to the Chinese feudal society that promoted the fundamental development of the national industry, it did not bring wealth and power due to the age-old feudal force. The Chinese nation was devastated in the Republican period between 1912 and 1949 with the unending civil and foreign wars. Though in the meanwhile, to some extent, our national capitalistic industry developed, few innovations appeared. Our national industry had made no significant progress. The majority of machine equipment was introduced from foreign countries.

In the first 30 years after the foundation of People's Republic of China, all kinds of social programs were created and began to develop in the right direction. Our country had built a more comprehensive economic system, especially concerning its industrial system, for

example, electricity, the aeronautics and astronautics industry, the petrochemical industry, the auto and atomic energy industries had already been developed before 1978. Besides, the improvement of fixed assets and equipment also reflected the promotion of Chinese industrial technology. From the perspective of the industrial structure, it changed from mainly composed of primary industry to half primary, half secondary industry in about 30 years, from 1949 to 1978. The progress of industrialization changed the original situation of primary industry-dominant in China. The successful development of the atomic and hydrogen bombs, man-made satellites, modern aircraft, 10,000-ton hydraulic forging machines, and 10,000-tonners manifests the spirit of innovation of China.

After the Third Plenary Session of the 11th Central Committee of the Chinese Communist Party in 1978, we began to reform our economic system, and opened our domestic market to the world. Plenty of advanced foreign ways of thinking, technologies, and equipment were successively introduced. Thus, the whole national economy underwent a great transformation and was boosted. In the meanwhile, new problems appeared. Many foreign products have obtained a larger and larger share of our market since it opened up to foreign merchants. The market strategy and policy for technology do not bring us advanced international core technologies in every industry, therefore, China has become the processing base for industrialized countries and most profits flow into foreign pockets. For example, the price of our national DVD is less than 30 dollars, but two-thirds of the 30 dollars go to the patent fee of the foreign merchants. Our corporation gets only 1.5 dollars. We have a huge market with so many people, but our national corporations are not capable of taking the lead in the share of our domestic market. Lots of our national corporations are trapped in a vicious cycle, namely "introduction-imitation-incompetence-reintroduction." Therefore, we regret that we do not make exchanges with the advanced Western core technologies on our market. The year 2005 called on us to create a national strategy of independent innovation. All of the above are the

reasons why the concept of “enhancing the capability of independent innovation, constructing an innovative country” was clearly put forward in the report of the 17th CPC National Congress in 2007.

(Two)

It deserves to be emphasized that there is no common view concerning the concept and theory of domestic independent innovation, though the words “independent innovation” have been written into relevant governmental documents for many years, and the whole society emphasizes and focuses on it persistently. Thus, the Chinese Ministry of Education has decided to support the Research Center for Technological Innovation of Tsinghua University to carry out theoretical research on Chinese independent innovation. This book is a main result of that theoretical research. This research has analyzed 9 cases of enterprises and 1 case of industry involved in independent innovations based on discussions of the fundamental problems of independent innovation, followed then by a summary.

This book has 6 chapters. The first chapter is an introduction, which explains the concept of “independent innovation” and the various ways it can be implemented. This chapter interprets some concepts related to independent innovation and introduces the outline of the entire book. The second chapter discusses the emergence of Chinese independent innovation, and then states that China must insist on the strategy of independent innovation, which is based on the practical enlightenment that we use our market to exchange for technology, that Japan established the fundamental practice through imitation, followed then by improvement, innovation, and development, and that the Republic of Korea has a kind of independent innovation based on introduction. Moreover, restraining factors of independent innovation are also pointed out in this chapter. The third chapter discusses the efficient path towards independent innovation based on the analyses of relevant cases. From these cases the path towards independent-innovation is concluded at the enterprise level from low-end to high-end (implementation, adoption,

and re-innovation), the path towards independent innovation is concluded, based on the concept of knowledge-integration-innovation, and the path towards independent innovation goes from high-end to direct innovation (original innovation). The fourth chapter discusses the ability to construct, the potential mode, and the track to follow in order to reach independent innovation. This chapter involves the ability to innovate and the ability to innovate independently, the path towards enterprise innovation, and the way to achieve industry innovation, as well as how to achieve enterprise independent innovation and the ability to construct, the path towards industrial independent innovation, and the ability to construct. The fifth chapter discusses technology integration and the mechanism for enterprise independent innovation. Finally, this chapter discusses the relationship between technology integration and independent innovation, the content of and the procedure for achieving technology integration; it also talks about technology integration in two perspectives and introduces a feasible mechanism for enterprise technology integration. The sixth chapter discusses the institutional support for independent innovation, namely the construction of a system of innovation. This chapter involves the historical evolution of the Chinese system of innovation and the relevant institutional problems of constructing our country oriented towards independent innovation, as well as industry and enterprise innovation.

(Three)

The appendix to this book includes all enterprise cases and industry cases which are analyzed in the case-study research “the theoretical research of Chinese independent innovation.” The enterprise cases are Huawei, CIMC, BYD, Tencent, Xunlei, Mindray, CHINT Group, Nuctech, Chery, etc. The industry case is the equipment manufacturing industry.

At the time of the publication of this book, we thank the support from Department of Social Science of the Ministry of Education and the Research Center for Technological Innovation of Tsinghua University,

Humanities and Social Sciences Base of the Ministry of Education.

Zhong Huibo

Professor at Beijing Institute of Technology

Lei Jiasu

Professor at Tsinghua University

Aug. 10, 2016

Contents



Preface	V
Chapter 1 Introduction	1
1.1 The definition of the concepts related to independent innovation	3
1.1.1 The basic concept of independent innovation	3
1.1.2 The subjects of independent innovation	6
1.1.3 The dispute over the definition of independent innovation	10
1.2 Classification of the models and types of innovation	14
1.2.1 Foreign classification of innovation models based on different paths	14
1.2.2 Domestic classification of innovation models seen from different angles	16
1.3 Classification of independent innovation	19
1.3.1 Original innovation, integrated innovation, and re-innovation based on introduction, implementation, and adoption	20
1.3.2 Conventional and unconventional independent innovation	22
1.3.3 Breakthrough innovation of dominating design, core components, and product architecture	24
1.3.4 Independent innovation based on cooperation	27
1.4 The basic layout of this book	28
References	29

Chapter 2 The urgency for implementation of independent innovation strategy in China	33
2.1 The practical enlightenment of “market for technology” in China	35
2.1.1 Positive effects of “market for technology” on the innovation of Chinese domestic enterprises	36
2.1.2 Negative effects of “market for technology” on the innovation of Chinese	

	domestic enterprises	38
2.1.3	The effect of “market for technology” requires independent innovation	40
2.2	Japan: Imitation, improvement, and innovation	43
2.2.1	The experience of Japanese independent innovation	43
2.2.2	Japanese policy and measures of innovation	45
2.2.3	Typical cases of Japanese independent innovation	49
2.3	The Republic of Korea: Introduction and innovation	54
2.3.1	The characteristics of Korean independent innovation	55
2.3.2	The measures of Korean independent innovation	56
2.3.3	Typical cases of Korean independent innovation	61
2.4	China must insist on the national strategy of independent innovation	74
2.4.1	Independent innovation is beneficial to the sustainable development of the Chinese economy	74
2.4.2	Related practice shows that underdeveloped countries are likely to realize independent innovation	78
2.4.3	China has the basic conditions and environment to implement independent innovation	82
2.4.4	While insisting on independent innovation strategy, attention should be paid to its relevant restraining factors	87

Chapter 3 The efficient path towards Chinese independent innovation: Understanding through case studies 95

3.1	Case selection	97
3.1.1	Basic considerations and the principles of case selection	97
3.1.2	Brief information concerning the case enterprises and the case list	100
3.2	The path towards independent innovation from low-end to high-end (implementation, adoption, and re-innovation)	102
3.2.1	The connotation of introduction, implementation, adoption, and re-innovation	102
3.2.2	The evolution process from low-end to high-end	104
3.2.3	Gradual catching-up based on core components (taking Chery as an example)	109
3.3	The path towards independent innovation based on knowledge-integrated innovation (integrated innovation)	113
3.3.1	The connotation of integrated innovation	113
3.3.2	The inner structure of integrated innovation	115
3.3.3	Integrated innovation based on end products (taking FAW Car as an	

example)	118
3.4 The path towards independent innovation: Innovation (original innovation) directly from high-end	123
3.4.1 The connotation of original innovation	123
3.4.2 The realization path of original innovation	125
3.4.3 Market-oriented innovation based on technological breakthrough (taking Suntech as an example)	129
References	131

Chapter 4 The capacity, mode, and trajectory of Chinese independent innovation 133

4.1 The connotations of the capacity, mode, and trajectory of innovation	135
4.1.1 Innovation and independent innovation capacity	135
4.1.2 The mode of enterprise innovation and the trajectory of industry innovation	139
4.2 The mode and the building up of the capacity for enterprise independent innovation	142
4.2.1 The mode and the improvement of capacity in different stages of enterprise innovation	143
4.2.2 The selection of the innovation mode in different stages of enterprise growth	146
4.3 The construction of the trajectory of and ability for industry innovation	155
4.3.1 The selection of a generalized trajectory of industry innovation	155
4.3.2 The selection of a trajectory for industrial independent innovation: Taking the Chinese equipment manufacturing industry as an example	157
4.3.3 The inherent structure and construction of the industrial capacity for independent innovation	159
References	160

Chapter 5 The method and mechanism of technology integration in enterprise independent innovation 163

5.1 The relative concepts of technology and technology integration	165
5.1.1 Definition of technology	165
5.1.2 Two kinds of technology integration	168
5.1.3 The relationship between technology integration and independent innovation	172

5.2	The content and process of technology integration	177
5.2.1	The content of technology integration	177
5.2.2	The process of technology integration	181
5.2.3	The problems enterprises face in the process of technology integration	184
5.3	Technology integration from two perspectives	193
5.3.1	Technology integration from the perspective of the construction of enterprise knowledge	193
5.3.2	Technology integration from the perspectives of internal and external resources	197
5.4	The feasible mechanism of enterprise technology integration	210
5.4.1	The participants in and the task boundary of enterprise technology integration	210
5.4.2	The mechanism of the three aspects of enterprise technology integration	217
	References	227

Chapter 6 The institutional guarantee of Chinese independent innovation: The construction of an innovation system 235

6.1	Innovation system, the institutional guarantee of independent innovation	237
6.1.1	The connotations of innovation system	237
6.1.2	The practices of building up a national innovation system (NIS)	239
6.2	The establishment of an NIS oriented towards independent innovation	244
6.2.1	The historical evolution of the Chinese NIS	245
6.2.2	The construction of the Chinese NIS oriented towards independent innovation	271
6.3	The establishment of a sectoral innovation system (SIS) oriented towards independent innovation	279
6.3.1	The connotations of an SIS	279
6.3.2	The framework of an SIS oriented towards independent innovation	281
6.4	The construction of an enterprise innovation system (EIS) oriented towards independent innovation	288
6.4.1	The connotations of an EIS	288
6.4.2	The framework of an EIS oriented towards independent innovation	290
	References	295

Appendix

Enterprise Case 1 Huawei—Independent innovation as the challenger's passport 299

1. The progress of Huawei's independent innovation 299
2. The four magic keys to Huawei's independent innovation 305
3. The trajectory analysis of Huawei's independent innovation strategy 309

Enterprise Case 2 CIMC—Independent innovation forging a world-class enterprise 313

1. Rapid development of CIMC 313
2. The characteristics of CIMC's independent innovation mode 318
3. Summary 320

Enterprise Case 3 BYD—From a battery king to an auto manufacturer 322

1. The miracle from 2 million yuan to 80 billion yuan 322
2. The experience of BYD's fast growth—Independent innovation 326
3. Learning from BYD's independent innovation 329

Enterprise Case 4 Tencent—Winning by “Q” 331

1. The history of QQ's development 332
2. The innovation path of QQ 336
3. The characteristics of Tencent's independent innovation 339
4. Summary 342

Enterprise Case 5 Xunlei—A dominator and pioneer in the downloading engine industry 343

1. The history of Xunlei's development 344
2. The enlightenment of Xunlei's innovation 346
3. Summary 348

Enterprise Case 6 Mindray—The leader of the Chinese medical equipment industry 350

1. Mindray's growth 350
2. Mindray's all-around independent innovation 355

3. The enlightenment from Mindray's innovation	357
4. Summary	359

Enterprise Case 7 CHINT—From a Wenzhou manufacturer to a world-class brand 360

1. The history of CHINT's development	360
2. The developmental trajectory from independent innovation to independent brand	364
3. Selecting the trajectory for CHINT's independent innovation	367
4. Summary	371

Enterprise Case 8 Nuctech—The clairvoyance of China 372

1. Company profile	372
2. The analysis of Nuctech's trajectory towards independent innovation	374
3. Summary	379

Enterprise Case 9 Chery—Creating the independent brand of the Chinese auto industry 381

1. Introduction	381
2. Chery's independent innovation	382
3. Chery's trajectory towards independent innovation: From introduction, integration, original innovation, then to full innovation	387
4. The features and implications of Chery's independent innovation	391
5. Summary	395

Industry Case The bottleneck and trajectory of the localization of the Chinese equipment manufacturing industry 396

1. The equipment manufacturing industry and its characteristics	397
2. The situation and problems of the localization of the Chinese equipment manufacturing industry	398
3. The analysis of the cause of low-level localization of the Chinese equipment manufacturing industry	402
4. The analysis of the trajectory of the localization of the Chinese equipment manufacturing industry	408

Index	414
--------------	------------