Preface

INTRODUCTION

Innovation is associated with creativity and is defined as the successful exploitation of creative ideas (Amabile, Conti, Coon, Lazenby, & Herron, 1996; DTI, 2003). However, innovation and creativity are different in focus (Govindarajan & Trimble, 2013). Creativity implies coming up with, or bringing an idea to life, while innovation means successful implementation of the creative idea. Creativity can be created by individual and forms a necessary condition for innovation. Innovation, on the other hand, occurs within organisational context and forms a managerial process that requires “specific tools, rules and discipline” (Davila, Epstein, & Shelton, 2006). Innovation can be viewed, accordingly, as the systematic approach to creating an environment based on creative discovery, invention, and commercial exploitation of ideas (Bacon & Butler, 1998; Reddy & Reddy, 2014). This book, ‘Handbook of Research on Competitive Advantage through Sustainable, Lean and Disruptive Innovation’ aims to provide the theoretical and practical aspects of innovation.

Innovation strategy is one of the aspects considered in this Handbook. Innovation strategy focuses on the mechanism that drives organisations toward achieving sustainability and market’s requirements. Big data analytics, smart computing and knowledge discovery are among a large number of techniques and approaches that help organisations processing information flow necessary for innovation strategy. In addition, Social networks have an important role to play in understanding market and customer requirements, in highlighting the gap between the current and desired levels of innovation and in pushing organisations towards adopting a suitable innovation strategy (Taatila, Suomala, Siltala, & Keskinen, 2006). Further, recent research directed toward developing pathways that take advantages of both internal and external (other firms) innovation. This development in innovation is referred to as ‘open innovation’ (Chesbrough, Vanhaverbeke, & West, 2006).

In order to achieve competitive advantage, organisations require to sustain their existing markets and value networks with better customer value, that is, relying on sustainable innovation, and / or explore new markets, new values or new business process (Christensen & Overdorf, 2000). In order to achieve the second path, organisations should engage with disruptive innovation (Christensen, 2013; Christensen, Johnson, & Horn, 2010). Literature identifies three model types of disruptive innovation:

- **Radical Product Innovation:** This type of innovation tends to create products or services with radically new attributes or functions. Typical examples are the innovation of tablets and smartphones.
Business-Model Innovation: Unlike radical product innovation, business-model innovation does not discover new products or services. It only redefines the way in which products or services are provided to the customers. Typical example is Amazon.com.

Big Bang Disruptive Innovation: This is a reference to innovation that enters the market as a cheap substitute to customers. It is gradually increasing in quality and moving up the customer chain. An example is the free navigation application that can preload on smartphones, which disturb the navigation devices.

Innovation as a process consumes considerable resources, time and costs and may comprise of a large number of non-value added activities or ‘waste’ and, ultimately, negatively affects the customer value. Methodologies such as ‘Lean thinking’, ‘Design Thinking’, ‘Agile Soft’ and others, on the other hand, aim to provide what the customer wants, quickly and efficiently. It also aims to substantially smooth the flow and drastically reduce waste and process variations. In order to achieve the required innovation that creates uncontested customer and market values, lean thinking should be part of innovation strategy. We refer to the merger of innovation and lean thinking as ‘lean innovation’. Literature shows wide range of specific research areas on innovation related to product, services and process, among them innovation in organizations (Damanpour, 1992), innovation in marketing (Atuahene-Gima, 1996), technological innovation diffusion (Bradford & Florin, 2003; Rogers, 1995), process innovation (Davenport, 1993), innovation for information systems (Allen, 2000; Kim & Galliers, 2004), Social networks (Yongli, Wu, Luo, & Zhang, 2013), Healthcare (Christensen, Jerome, Grossman, & Jason Hwang, 2009), ecology (Rennings, 2000), renewable energy (IRNA, 2013), nanoscience and nanotechnology (Mehta, 2002).

This book, ‘Handbook of Research on Competitive Advantage through Sustainable, Lean, and Disruptive Innovation’ provides some insights on the theoretical development of sustainable, disruptive and lean innovation. However, theories are no longer enough for achieving their purpose without the ability to convert these theories into practice. Such ability can be considerably enhanced by providing empirical studies and identifying the challenges and barriers facing the implementation of the theories. This book features research on barriers and challenges facing innovation processes and provides a number of empirical studies on the application of the three types of innovation; sustainable, disruptive and lean innovation. Further, the book also gives specific attention to the following to the following three interrelated directions;

- Consideration of social networking and social responsibility on innovation (Taatila et al., 2006);
- Taking advantages of both internal and external (other firms) innovation, ie., ‘open innovation’ (Chesbrough et al., 2006).
- Developing novel products, services, and process that significantly reduce environmental impact and risk, ie., green-innovation or eco-innovation (Sciederig, Tietze, & Herstatt, 2012).

We believe that this Handbook provides insights and support for:

1. High-degree research students dealing with various areas of innovation;
2. Consultant and professional researchers working in the field of innovation management;
3. Senior managers of manufacturing and service industries concerned with the management and implementation of the innovation process;
4. Decision makers who formulate the innovation strategies and policies at local and national levels.
Of 34 chapters submitting for possible inclusion in the book, only 25 chapters have met the criteria of a rigorous double-blind review process. A total of 35 researchers from 11 countries have been participated in this book. The accepted chapters have been organised into three interrelated sections; (1) ‘Theories, Strategies, and Emerging Concepts’, (2) ‘Barriers and Challenges’, and (3) ‘Empirical and Statistical Studies’. The following is a brief description of the sections and chapters included in the book.

SECTION 1: THEORIES, STRATEGIES, AND EMERGING CONCEPTS

The first section of the book comprises seven chapters dealing with the theories and strategies employed for adoption, diffusion, and implementation of innovation. The section also considers the emerging concepts on innovation such as lean innovation. Chapter 1, titled ‘Technology Innovation Adoption Theories’ is authored by Mr Ali and Professor Soar from the University of Southern Queensland, Australia. This chapter reviews the technology adoption and related theories, including diffusion of innovation theories (DOI) and technology acceptance models (TAM1 and TAM2), ‘Unified Theory of Acceptance and Use of Technology (UTAUT)’, ‘Theory of Planned Behaviour (TPB)’, ‘Theory of Reasoned Action (TRA)’, ‘Institutional Theory’, ‘Institutional Theory’ and Technology- Organization-Environment (TOE)’, and ‘Institutional Theory’. It explores various methodologies and frameworks developed in the literature with emphasis on IT/IS technologies. The chapter elaborates the barriers and challenges facing sustainable and disruptive innovation. It reviews the related empirical studies and concludes that most empirical studies at the individuals’ level are derived from the TAM, UTAUT, TPB and TRA. The other empirical studies at the firms’ level are derived from the DOI theory, the TOE framework and institutional theory.

‘Lean Thinking and the Innovation Process’ is the topic of the second chapter in the book. This chapter is authored by Mr Hurriyet and Dr Nakandala of the University of Western Sydney, Australia and focuses on how the innovation process is influenced by lean thinking based on the existing literature. It analyses the evolution of lean thinking from its initial application in manufacturing industries to other broader areas. It discusses the evolution of innovation process modelling and the applicability of linear process models with non-linear approaches and specific attempts to improve efficiency of the innovation process. Furthermore this chapter investigates the impact of lean thinking process on innovation process and discusses several approaches in practice in implementation of lean innovation processes in organisations.

The applications of business intelligence to innovation process appear to offer more accurate information to lean innovation process. However, little has been written regarding the integration of business process with the lean innovation. The third chapter in this book is an attempt to fill this gap in the literature. The chapter is titled ‘Lean Thinking via Business Intelligence Technologies and Innovation Process’ and is authored by Professors Firat, Ağlan, Şimşit, Bayram, and Erdem from Marmara University, Turkey, and Professor Ülkü, of Istanbul Kultur University, Turkey. This chapter emphasises that business intelligence and lean thinking concepts are compatible with each other, especially in terms of waste elimination, and accordingly, integration of these concepts results innovation decision making process becoming more effective than stand-alone applications. Four types of integration have been considered throughout this chapter.

The fourth chapter in the book deals with the assessment of innovation performance. The chapter is titled ‘Multiplex Waves in the Planning of Innovation Processes in Business Systems’ and is authored by Professors Mokiy, Godin, and Gureev from State University of Management, Russia, and Professor Filonchik of the Russian Presidential Academy of National Economy and Public Administration. This
chapter develops an approach for assessing innovation performance and planning innovation processes, referred to as “Multiplex Waves”. Retrospective analysis of several enterprises confirms the effectiveness of the developed approach. An example of building an innovative chart for innovation development is presented.

Innovation literature confirms that the environment impacts firm’s behaviors and this leads to changes in their innovative strategies. Innovative strategies, in turn, impact on firms’ performance, which feedbacks the set of decisions on innovation strategy. The fifth chapter in this book emphasises that scant attention has been paid to the changes on the firm’s behavior, resulting from the outcome of innovation decisions. This chapter aims to contribute to this gap in the literature by providing a dynamic perspective to the firms’ innovative decisions. The chapter is titled ‘Innovative Strategies, Feedbacks, Leaning and Change’ and is authored by Professor Suarez, Universidad Nacional de General Sarmiento, Argentina.

This sixth chapter in this section of the book deals with the dynamic relational capabilities and elaborates in the relationship between dynamic capabilities, open innovation and competitive advantage. The chapter is titled ‘Competitive Advantage, Open Innovation and Dynamic Capabilities: Is Sanofi Employing an Open Innovation Strategy?’ and is authored by Professor Labrouche, IEP de Toulouse, France, and Professor Kechidi, Université Toulouse Jean-Jaurès, France. The chapter gives emphasis to pharmaceutical industry and stresses that open innovation strategies are the concrete proof of such capabilities. The pharmaceutical sector is considered to be a High-Velocity Environment characterized by a high rate of change. Such change, challenging firms’ competitive advantage, fosters the development of dynamic capabilities and open innovation strategies. These theoretical considerations are illustrated by reference to the innovation strategy adopted by the Sanofi group, particularly since 2008.

How can lean innovation be promoted in developing countries? The last chapter in the first section of this book proposes answers to this question. It includes an analysis of over 150 Mexican SMEs firms participated in a survey conducted during 2011-2013. The chapter considers the firm’s perceived technology needs, their openness to collaborate with actors of the innovation system and their abilities to identify goals. The chapter concludes that success of innovation policies in developing countries is highly dependent on previous experience and learning abilities of firms. The chapter is titled ‘Promoting Lean Innovation for SMEs: a Mexican Case’ and is authored by Professors Solleiro and Castañón of Universidad Nacional Autónoma de México, and Professor Gaona of Nacional de Ciencia y Tecnología, México.

SECTION 2: BARRIERS AND CHALLENGES

The second section in this book features nine chapters focusing on the barriers and challenges facing innovation process. Chapter 8 is the first chapter in this section. It is authored by Dr Nakandala and Dr Turpin of the University of Western Sydney. This chapter deals with the barriers to innovation diffusion of the genetically modified (GM) food taking into consideration the case of GM food in Sri Lanka. The chapter emphasises that a complete ban on GM products in 2001 in Sri Lanka was later relaxed to demand only GM labelling regulations, but GM food has not gained a prominent position in the Sri Lankan market. The attributes of GM food perceived by consumers, the communication system, government responses and broader social expectations have been unfavourable to GM food diffusion. The chapter concludes that case of GM food innovation in Sri Lanka demonstrates the very social nature of the process; involving far more than seed producers, growers and related commercial enterprises.
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Access to different internal and external knowledge sources and learning constitute key dimensions of firms’ innovation capabilities to the maintenance of their competitive advantage. The recent emergence of new modes of innovation involving a diversity of multi-stakeholder collaborations between industry, business, academy and civil society represents a challenge not only to firms’ collaborative behaviour but the way to organize, integrate and manage new innovative capabilities. In this context, Chapter 9 in this book (the third chapter in the second section), explores and characterizes the different types of innovation underlying in the current innovation known as ‘Tower of Babel’. It elaborates on its implications to the firms’ cooperative innovation strategy and knowledge governance. The chapter is authored by Professor Edwards-Schachter, Institute of Innovation and Knowledge Management, Spain, and is titled “Challenges to firms’ collaborative innovation facing the Innovation Babel Tower”.

The transition to low carbon economy requires deep changes in the energy systems in the developing countries. Literature, however, shows that only a small group of these countries is engaging significant efforts to develop renewable energies. Chapter 10 is titled ‘Low Carbon Energy Innovations Systems in Natural Resource Rich Developing Countries: the case of Brazil’, and is authored by Professor Furtado, University of Campinas, Brazil. The chapter stresses that the success in the diffusion of renewable energy technologies requires dynamic systems of innovation. The chapter analyses the Brazilian sugarcane innovation system that was pioneering in the development and diffusion of bioethanol. This system is increasingly challenged by the acceleration of the technological regime, which is provoked by the energy crisis and the transition to the low carbon economy. The chapter emphasises that Brazilian innovation system has different capacities to cope with this challenge. This chapter differentiates the agriculture subsystem, which function in a STI (science, technology and innovation) mode from the industrial sub-system, which operates in a DIU (doing, using and interacting) mode. The chapter concludes that the agricultural subsystem has demonstrated a better ability to cope with the technological challenges of the new biotech research methodologies while the capital goods industry has much less propensity to deal with the second generation technologies for bioethanol. The chapter describes also the present ethanol supply crises and its probable causes.

Low Carbon Development (LCD) implies to reduce carbon emissions into the atmosphere and to foster inclusive development. This requires systemic innovations, which can lead to disruptive changes, and the build-up of capabilities to enhance the innovations. LCD offers opportunities to reduce energy costs and to export low-carbon solutions. This is the subject of Chapter 11 which is authored by Professor Walz, Fraunhofer Institute of Systems and Innovation Research, Germany, and is titled ‘How Do LCD Innovations Differ? Challenges and Specificities of Low Carbon Technologies and Energy Systems’. The chapter states that various specificities constitute a lock-in into the existing fossil fuel based energy system, including technological specificities of grid based infrastructure systems, dependence on regulation to overcome market failures, and the political economy of the energy innovation system. The chapter concludes that there is considerable heterogeneity among countries with regard to their starting positions to overcome the various obstacles and to build the comparative advantages which will enable them to supply the global markets with low carbon technologies.

Chapter 12 of the book discusses the small-scale agricultural activities in sub-Saharan Africa and undertakes a qualitative assessment of the success factors of the palm oil sectors in Nigeria. The chapter is titled, ‘Building Innovation Systems for Small-Scale Agricultural Activities in Sub-Saharan Africa: Key Success Factors’ and is authored by Professor Adejuwon of Obafemi Awolowo University, Nigeria.
The chapter proposes framework for innovation process and undertakes a qualitative assessment of the successful Cassava and the not-so-successful palm oil sectors in Nigeria to highlight the importance of the framework and the differences between successful and ineffective innovation systems.

Developments in nanotechnology have drawn the attention of governments, industry, academia and the public for their potential industrial benefits and their future trends within the innovation domain. Nonotechnological system is the subject matter of Chapter 13. This chapter is titled ‘Identifying Nanotechnological Systems of Innovation: Developing Indicators as a Tool to Support Nanotechnology Innovation Policy in Brazil’ and is authored by Professor Peixoto, Brazilian Institute of Statistics, Brazil. The chapter stresses that nanotechnology innovation process represents a crucial element for designing and implementing relevant, coherent and adequate innovation policy. This study proposes an analytical framework to investigate nanotechnology paths. It attempts to contribute for the development of nanotechnology innovation indicators aiming to provide policy-makers with helpful data to support innovation policy design and foster nanotechnology development in Brazil.

As a contribution to the open debate regarding the effect of intellectual property rights on innovation, Chapter 14 of this book postulates that the adoption of strong intellectual property rights is not a necessary condition to foster innovation in the plant breeding industry. The chapter is titled ‘Innovation and Intellectual Property Rights: The Case of Soybean Seeds in Argentina and the United States’ and is authored by Professor Campi, University of Buenos Aires, Argentina. The chapter studies the evolution of the soybean breeding industry in the US and Argentina and shows that regardless the level of intellectual property protection, if there is an attractive and profitable market, firms may search for different appropriability strategies rather than changing their innovative behavior. The chapter finds that the growth rates of new soybean varieties are similar in both countries and the adoption rate is faster in Argentina where the intellectual property rights system is weaker.

Challenges for innovation due to firms size is the subject matter of Chapter 15 of the book. The chapter considers the case of Brazilian firms and is authored by Professor Zucolotto, of Instituto de Pesquisa Econômica Aplicada, Brazil, and Professor Nogueira of Instituto de Pesquisa Econômica Aplicada, Brazil. This chapter analyses the innovative capacity of small firms compared to medium and large firms in Brazilian industry. It elaborates on the role of small and large firms as inductors of innovation and discusses the barriers and opportunities for innovation faced by small businesses, particularly in developing countries. Based on the Brazilian Innovation Survey, this study finds that large companies predominate in the creation of new products and processes, while small firms perform in innovations associated with processes improvement.

The last chapter in the second section of the book, Chapter 16, is titled ‘Higher Education, technological change and local development: Experiences and challenges in Cuban context’ and is authored by Professors Jover, Alfonso, Quiñon and Marrero of Technology and Innovation University of Havana, Cuba. This chapter demonstrates the manner with which higher education institutions in Cuba have directed their efforts toward innovation in order to identify effective practices for alternative energy production, food production and the echo-materials production for housing. This “innovation turn” intended to increase the role of higher education in the economic recovery of the country and the solution of significant social problems. The chapter stresses that, in dealing with those socio-technical systems, Cuban higher education institutions pay attention to social inclusion, cohesion and social integration goals.
SECTION 3: EMPIRICAL AND STATISTICAL STUDIES

The third section in the book focuses on the empirical and statistical studies on innovation. It comprises nine chapters, including four qualitative studies and three quantitative, (based on large surveys) and two statistical studies. The first chapter in this section, (Chapter 17), discusses how financial services organizations can take advantage of Big Data analysis for disruptive innovation through examination of a case study in the financial services industry. The chapter is titled ‘Data Science and Big Data Analytics in Financial Services – A Case Study’ and is authored by Dr Behari, Professor Cater-Steel and Professor Soar of the University of Southern Queensland, Australia. The chapter discusses the popular tools for Big Data Analysis and explores the challenges of big data as well as how these challenges can be met. The work of ‘Hayes-Roth’ in Valued Information at the Right Time (VIRT) and how it applies to the case study is examined. Boyd’s model of observe, orient, decide and act (OODA) is explained in relation to disruptive innovation in financial services. The chapter explores the future trends in big data analysis in the financial services domain.

Learning and innovation for multinational companies from emerging economies is the subject of Chapter 18. The chapter is authored by Professor Vargas of Universidad Autónoma Metropolitana, México, and Professor Villazul, Universidad Nacional Autónoma de México, México. This chapter considers a large multinational Mexican cement company known as CEMEX as a case and illustrates the importance of learning trajectories and technological capabilities for competitiveness of multinational firms from emerging economies. The case study shows that the emergence of this company into the global markets is the result of a mix of assets and capabilities developed over a period of nearly eight decades, at whose base are productive, technological and organizational capabilities. Findings substantiate that multinationalization through mergers and acquisitions have strengthened the technological and innovation capabilities of CEMEX.

Chapter 19 of this book seeks the answers to the following research question: Which are the challenges facing high tech R&D collaboration involving firms both from established and emerging economies? To answer this question, the Turkish jet fighter program is used as a case study. The chapter is authored by Professors Karabag and Berggren of Linkoping University, Sweden, and is titled ‘International R&D Collaboration in High Tech: The Challenges of Jet Fighter Development Partnerships in Emerging Economies’. The chapter shows that the chances to succeed are highly uncertain in this sector, which is dominated by USA. Although Turkey acquired some level of R&D capability in previous defence R&D programs, the complexity of jet fighter development poses new challenges. Previous experiences indicate that technical capabilities are not sufficient. Equally important is the formation of management capabilities. During the pre-development (concept) phase, Turkey chose to collaborate with Swedish SAAB. The chapter discusses several challenges in this type of collaboration for a full-scale jet fighter development program. These challenges concern intra- as well as inter-organizational management, the organization of the technical development projects, and the design of appropriate industry governance structures.

Chapter 20 discusses the main findings of five empirical studies focusing on local health innovation systems in Brazil. Its title is ‘Innovation in the Health System: Evidences from Brazilian Local Production and Innovation Systems’, and is authored by Professors de Matos, Soares, and Cassiolato of Federal University of Rio de Janeiro, Brasil, and Professor Queiroz of Fundo Brasileiro para a Biodiversidade, Brasil. The chapter focuses on the articulation of service and manufacturing segments within the Health complex and discusses the learning, capacity building and innovation processes and their effective and potential impact on the local territory. The findings suggest that the types and intensity of interactions
are closely related to the characteristics of what can be called a local cognitive territory. The directions of capacity building and scientific and technological evolution are directly influenced by conflicts among individuals and groups.

Based on the Diffusion of Innovation theory, Chapter 21 in this book considers the shared electronic records as innovation and addresses the following research question: Whether the factors of diffusion of innovation theory influence care providers’ willingness to adopt shared electronic health records? The chapter is authored by Dr Pullen of Queensland State Archives, Australia, and Associate Professor Al-Hakim, University of South Australia. Data was collected through a self-administered questionnaire distributed to over 5000 members of the Australian Medical Association of Queensland. A total of 588 valid responses were received from currently active care providers in Queensland. Multiple regression analysis and Chi-Square analysis were conducted to test the research hypotheses and answer the research question. The data revealed that while 72% of those surveyed were willing to adopt shared electronic health records, significant differences existed between public and private sector care providers and across the various tiers of the health system. In relation to the factors influencing future willingness to adopt, the variables comprising relative advantage were shown to have a significant impact upon future willingness to adopt shared electronic health records.

Chapter 22 is titled ‘Antecedents of Collaborative Arrangements in the Innovation and Production System’ and is authored by Professors Shou, Li and Wu of Zhejiang University, China. This chapter regards R&D cooperation and production cooperation as two key dimensions of collaborative arrangements in the innovation and production systems. Different from prior studies focusing on performance outcomes, this chapter emphasizes the antecedents which have impacts on firms’ decisions of R&D cooperation and production cooperation. Based on statistical analyses on survey data of 93 valid responses from Chinese manufacturing firms, this study finds that technology ‘clockspeed’ and asset specificity have significant effects on firms’ decisions on R&D collaborative arrangements for the innovation systems.

To compete through disruptive innovation, organisations allocate part of their resources as buffer resources to support their capability of disruptiveness or to face potential challenges created by competitors. Literature refers to the buffer of resources as organisational slack. Chapter 23 is titled ‘The Effect of Organizational Slack on Innovation Performance: An Empirical Study of High-Tech Industry in China’, and is authored by Dr Pan and Professor Wei of Zhejiang University, China, and Associate Professor Al-Hakim of University of South Australia, Australia. This chapter considers high-tech industry in China and investigates the relationship between the characteristics of the organisation’s governance body, organisational slack and innovation performance. This chapter analyses data from 233 high-tech organisations listed in Chinese stock market. The results indicate that the interaction of the organisational slack of an organisation with various characteristics of the governance body partially moderates the innovation performance.

Chapter 24 in this book explores the impact of university-industry linkages on the innovative performance of Mexican firms. The chapter is authored by Professors Rodríguez and Bielous, of Metropolitan Autonomous University, Mexico. Using data from a survey of 382 firms, the outcomes of analysis indicates that university-industry linkages have significant but mixed effects on firms’ innovation. A significant influence on product innovation was found, but not on process novelties. Results also indicate that larger and younger firms innovating more than small and older ones.

The last chapter in this book, (Chapter 25), employs descriptive and comparative approaches and uses the definition of national systems of innovation used in the literature to examine the characteristics (strength and weakness) and implications of the national systems of innovation in the Arab countries.
The chapter is titled ‘Characteristics of Innovation in the Arabic Countries’, and authored by Professor Nour of University of Khartoum, Sudan. This chapter finds that the national systems of innovation exist in Arabic countries but characterized by serious weaknesses compared with other world countries. This chapter concludes that R&D activities are mainly within public sector while the contribution of the private sector in R&D activities is limited.

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