

Towards developing a holistic approach in managing inbound open innovation based high-tech SMEs.

Table of Content

Abstract

CHAPTER 1: Introduction to the Research Study.....	6
1.1) Introduction of the Global and Hong Kong Technology Landscape.....	6
1.1.1) The Global Trend of Technological Innovation.....	6
1.1.2) Technology Innovation Status in Hong Kong – a Research and Development Perspective.....	9
1.2) Background of Study – The Role of Industry 4.0 and Innovation in Hong Kong and Beyond.....	11
1.2.1) General Definition of Industry 4.0.....	12
1.2.2) Relationship between Innovation and Industry 4.0.....	13
1.2.3) Hong Kong Government’s Support for Technology Innovation under Industry 4.0.....	14
1.3) Purpose of the Study - To Enhance the Understanding of Inbound Open Innovation Adoption and its Management in Hong Kong High Technology SMEs.....	16
1.4) Statement of the Problem and Research Questions.....	17
1.4.1) Problem One.....	19
1.4.2) Problem Two.....	21
1.4.3) Problem Three.....	18
1.5) Theoretical Basis of the Study.....	18
1.5.1) Defining the Role of Open Innovation.....	19
1.5.2) The Importance of Inbound Open Innovation.....	21
1.5.3) The Importance of Understanding the Major Elements of Innovation Management.....	18
1.5.4) The Importance of Management Framework in Innovation.....	22
1.5.5) Leveraging 3H as an Inbound Open Innovation Management Framework for Integrating Various Innovation Elements in Our Study.....	25
1.5.6) The Role of Entrepreneurial Orientation, Transformational Leadership & Learning Orientation to enable Inbound Open Innovation.....	27
1.5.6.1) How Critical Management Elements Under Inbound Open Innovations Relates to 3H	
1.5.6.2) Transformational Leadership	
1.5.6.3) Entrepreneurial Orientation	
1.5.6.4) Learning Orientation	
1.5.7) Associating Personal Characteristics and Management Elements with Innovation through Technology Readiness Index	29
1.5.8) Utilizing Performance Measurement for Assessing Inbound Open Innovation Outcome.....	30
1.6) Hypotheses.....	32
1.7) Method.....	33
1.7.1) Sampling of Data.....	33
1.7.2) Measurements and Instrument Development.....	33
1.7.3) Survey Instrument Validation.....	33

1.8) Academic and Managerial Contribution the Study.....	35
1.8.1) Academic Significance of the Research.....	35
1.8.2) Managerial and Societal Relevance of the Research for Hong Kong.....	36
1.9) Summary.....	37

Chapter 2 - Literature Review

2.1) Defining Innovation and Its Implication in Sustaining Competitive Advantages

2.1.1) What is Innovation?

- 2.1.1.1) Viewing Innovation through the Lens of Evolutionary Economics
- 2.1.1.2) Potential modelling enhancement opportunities based on Evolutionary economic theories
- 2.1.1.3) Understanding Innovation from a Macro Economic Contribution Perspective
- 2.1.1.4) The Global Technological Innovation Investment Landscape – A Regional Comparison
- 2.1.1.5) Economic Implication of Innovation under Industry 4.0

2.1.2) Comparing Different Forms of Innovation and their Implication to Competitiveness of Firms

- 2.1.2.1) Definition of Open Innovation
- 2.1.2.2) Extending the Depth of Open Innovation by Leveraging Inbound Open Innovation
- 2.1.2.3) Disruptive Innovation as a Mean to Enter Established Markets
- 2.1.2.4) Composable Innovation – A Commercial Consultant Perspective
- 2.1.2.5) Summary

2.1.3) The Importance of Competitive Advantages in an Inbound Open Innovation Environment

- 2.1.3.1) Establishing Competitive Advantages for Company through Innovation
- 2.1.3.2) The Role of Inbound Open Innovation in Creating Competitive Advantages in Industry 4.0
- 2.1.3.3) Propagation of Organizational Competitive Advantage through Managing the Diffusion of Innovation
- 2.1.3.4) Importance of Inbound Open Innovation for SME from Growth & Technological Perspectives

2.2) - Key Elements in Inbound Open Innovation and How they Interact

2.2.1) Identifying the Essential Elements for Operating an Effective Inbound Open Innovation Management Framework

2.2.1.1) Role of Learning Organization

- 2.2.1.1.1) Importance of Learning as the Executing Hand in Inbound Open Innovation Management Framework
- 2.2.1.1.2) Characteristics of Learning Organization
- 2.2.1.1.3) Learning Management under an Inbound Open Innovation Context

2.2.1.2) Role of Transformational Leadership in Delivering Impact under an Inbound Open Innovation Management Framework

- 2.2.1.2.1) Transformational vs Transactional Leadership as Predictor of Organizational Performance
- 2.2.1.2.2) Transformational Leadership drives learning orientation
- 2.2.1.2.3) Transformational Leadership creates positive organizational culture
- 2.2.1.3) Role of Strategy through Entrepreneurial Orientation as Thinking Head in the 3H Based Inbound Open Innovation Management
- 2.2.2) Positing the possibility of a coherent relationship between Entrepreneurial Orientation, Learning Orientation and Transformational Leadership in innovation management
 - 2.2.2.1) Intertwining of Entrepreneurial Orientation & Learning Orientation
 - 2.2.2.2) Enhancement of Entrepreneurial Orientation & Transformational Leadership
 - 2.2.2.3) Bring Learning Orientation and Transformational Leadership to Work Together
 - 2.2.2.4) Exploring the Possibility of Creating a Self-Sustaining Inbound Open Innovation Cycle
- 2.3) How can Inbound Open Innovation be Managed and Deliver Organizational Performance
 - 2.3.1) Why do We Need to Manage Innovation
 - 2.3.1.1) Challenges of Innovation Management
 - 2.3.1.2) Innovation as a Process
 - 2.3.1.3) Benefit of Deploying a Management Framework for Inbound Open Innovation
 - 2.3.1.4) Characteristics of a Framework that is Relevant to Inbound Open Innovation Management
 - 2.3.1.5) Relating 3H to Management Elements identified for Inbound Open Innovation Management
 - 2.3.1.6) How the 3H Framework Fits into Inbound Open Innovation Management

Chapter Three - Research Methodology

- 3.1) Establishing Assessment Instruments for Measuring the Current and Predicting the Future Organization Performance
 - 3.1.1) The Validity and Possibility of Using the Technology Readiness Index Lens to Predict Organizational Performance in an Inbound Open Innovation Environment
 - 3.1.1.1) Understanding the Strategic Decision Making Process
 - 3.1.1.2) The Role of the Individual
 - 3.1.1.3) Technology Readiness Index and Entrepreneurship
 - 3.1.1.4) Relevance of Using TRI as a Measurement Tool for SME
 - 3.1.1.5) Relationship between TRI Elements and Inbound Open Innovation Management
 - 3.1.1.5.1) Innovativeness and Inbound Open Innovation
 - 3.1.1.5.2) Optimism and Inbound Open Innovation
 - 3.1.1.5.3) Risk Taking-Insecurity and Inbound Open Innovation
 - 3.1.2) Respondent Profiling and General Background Consideration
 - 3.1.2.1) Age Group Segmentation in Profiling Participants
 - 3.1.2.2) Education Level of the Respondent in the Company
 - 3.1.2.3) Experience in the Current and Similar Industry to Company

- 3.1.2.4) Role of the Respondent in the Management Hierarchy within the Company
 - 3.1.2.5) Tenure of Management in Company
 - 3.1.2.6) Size of the Company
- 3.1.3) Organizational Performance Measurement under the Context of Innovation Management
 - 3.1.3.1) Evolution of Performance Definition and Measurement
 - 3.1.3.2) Selecting Organizational Performance Measurement Metrics Relevant to Inbound Open Innovation
 - 3.1.3.3) Sustainable Organizational Performance Improvement with Progress Tracking through 3H & TRI – An Longitudinal Approach
- 3.1.4) Achieving Inbound Open Innovation Success through Operationalization and Optimization of Key 3H Elements
 - 3.1.4.1) Accomplishing Innovative Strategies through Flexible Organizational Structure
 - 3.1.4.2) Resources and Capability Alignment to Support Execution under Inbound Open Innovation
 - 3.1.4.3) Building an Internal Environment for Inbound Open Innovation with Transformational Leadership
 - 3.1.4.3.1) The Role of Leadership in High Technology SMEs under an Inbound Open Innovation Context
 - 3.1.4.3.2) Creating the Right Attitude and Culture for Inbound Open Innovation Adoption
- 3.1.5) Uncovering the Evidence of Coherence Existence
 - 3.1.5.1) Proposed Relationship between Different 3H Elements by Previous Studies
 - 3.1.5.2) Observed Relationship between Inbound Open Innovation and Different 3H Elements
- 3.2) Research Design and Instrument Development
 - 3.2.1) Reference Model for our Study
 - 3.2.1.1) Understanding Inbound Open innovation Adoption Questions
 - 3.2.1.2) Establish General Background Context
 - 3.2.1.3) Independent Variables
 - 3.2.1.3.1) External Environment Management
 - 3.2.1.3.2) Entrepreneurial Characteristics
 - 3.2.1.3.3) Mediating Role of Entrepreneurial Orientation, Learning Orientation and Transformational Leadership
 - 3.2.1.3.4) Entrepreneurial Experience and Attachment to the Organization
 - 3.2.1.4) Dependent Variables
 - 3.2.1.4.1) Organizational Performance
 - 3.2.2) Instrument Development Methodology
 - 3.2.2.1) Survey Introduction and Confidentiality Declaration
 - 3.2.2.2) Increasing Survey Response Rate
 - 3.2.2.3) Survey Scale Development
 - 3.2.2.4) Instrument Validity

- 3.2.2.5) Optimization Procedures Taken for Survey Instrument
 - 3.2.2.5.1) Phase One – Initial Verification
 - 3.2.2.5.2) Phase Two – Refinement Interview
- 3.2.2.6) Questionnaires Summary

Chapter Four – Data Collection and Results Analysis

- 4.1) Approach Used for Data Sampling
- 4.2) Demographic Background of Respondents
 - 4.2.1) Participant Role in the Company
 - 4.2.2) Tenure in the Company
 - 4.2.3) Age Distribution of the Respondents
 - 4.2.4) Industry Experience of Respondents
 - 4.2.5) Experience in Current and Similar Management Role
 - 4.2.6) Years of Company Establishment
- 4.3) Validation of the Proposed Model
 - 4.3.1) Unreliable Data Identification and Removal
 - 4.3.2) Descriptive analysis
 - 4.3.3) Independent Variables Reliability Verification through Cronbach Alpha Analysis
 - 4.3.4) Correlation Matrix Result
 - 4.3.5) Validation via Principal Components and Confirmatory Factor Analysis
 - 4.3.5.1) Confirmatory Factor Analysis (CFA)
 - 4.3.5.2) Principal Component Analysis
 - 4.3.6) Model Construction Using Path Analysis
 - 4.3.7) How Fitting is the Proposed Model
 - 4.3.8) Final Model Configuration and Weighting
 - 4.3.9) Summary of Hypothesis Validity

Chapter Five – Discussion

- 5.1) Successful identification of personal and managerial characteristics that can explain organizational performance under an inbound open innovation context
- 5.2) Predicting the likelihood of future organizational success by combining impactful elements into organizational management framework
- 5.3) Possibility of different management factors working coherently to support inbound open innovation
- 5.4) Sustaining coherence through a balanced and continuous optimization approach
- 5.5) Enable the deployment of tools that can conduct longitudinal study periodically to review the status and likelihood of continual success of inbound open innovation
- 5.6) Organisational Performance Outcome (OP) as Suggested 3H Framework OP
- 5.7) Possibility of Self Reinforcement

Chapter Six - Conclusion and Limitations

- 6.1) Conclusion
- 6.2) Limitation

Appendix One - Detail of Questions used in Survey

List of Tables

Table 3.1 Proposed Relationship between Different 3H Elements by Previous Studies

Table 3.2 Observed Relationship between Inbound Open Innovation and Different 3H Elements

Table 3.3 High Level Summary of Survey Instrument Composition

Table 4.1 Descriptive Analysis Summary

Table 4.2 Cronbach Alpha Analysis Summary for Independent Variables

Table 4.3 Cronbach Alpha Analysis Summary for Management Variables

Table 4.4 Correlation Matrix Analysis for Variables Collected

Table 4.5 One Factor Confirmatory Factor Loading

Table 4.6 Inter-Component Correlations under Principal Component Analysis

Table 4.7 Principal Components Analysis Results Generated by Jamovi (Eigenvalues > 1)

Table 4.8 Parameters Weighting Details at 95% Confidence Intervals

List of Figures

- Figure 1.1: Medium & Small Enterprise Executives Approach to Digital Business Acceleration
- Figure 1.2: Global Innovation Index scores and GDP per capita in PPP US\$ (bubbles sized by population)
- Figure 1.3: Industry 4.0 architecture pattern
- Figure 1.4: Definition of Terms in Digitalization
- Figure 1.5: Researchers Density vs R&D Expenditure
- Figure 1.6: Global Innovation and Competitiveness Ranking
- Figure 1.7: Ranking by Subjects in Hong Kong Universities
- Figure 1.8: Research and Development Expenditure in Hong Kong from 2016 - 2018
- Figure 1.9: NMD - Northern Metropolis Development Strategy
- Figure 1.10: Innovation Strategy Map
- Figure 1.11: Model of Transition from Closed to Open Innovation
- Figure 1.12: The Evolution of Innovation
- Figure 1.13: Hype Cycle for Innovation Management Techniques
- Figure 1.14: 3H Holistic Management Framework
- Figure 2.1: Hierarchy of Terminology in Corporate Entrepreneurship
- Figure 2.2: Maturity framework of open innovation
- Figure 2.3: Network Organization
- Figure 2.4: Characteristics of Inbound Open Innovation Process
- Figure 2.5: Disruptive Innovation
- Figure 2.6: Traditional Versus Composable Approach
- Figure 2.7: Comparison of Business Performance
- Figure 2.8: Potential Extension of Existing Model Used by Evolutionary Economics
- Figure 2.9: Snapshot of R&D Intensity
- Figure 2.10: Estimates of total government support for R&D by Sustainable Development Goals -related cluster categories, 1990-2019
- Figure 2.11: Technology Diffusion from Existing Hubs
- Figure 2.12: Employment Growth of Firms by Digital Intensity in EU & US European Investment Bank, 2019
- Figure 2.13: Illustrative Contribution of Industrial Revolutions to Human Development: OECD Countries 1750–2017
- Figure 2.14: Illustrative Contribution of Industrial Revolutions to Human Development to 2050 (benefits realized)
- Figure 2.15: Technology/Marketing S-Curve Phenomena
- Figure 2.16: What Benefits are you seeing as a result of implementing IoT
- Figure 2.17: Sources of Competitive Advantage
- Figure 2.18: Porter's Value Chain
- Figure 2.19: Categorization on the Basis of Innovativeness
- Figure 3.1: Influence of Organizational Culture on Creativity and Innovation
- Figure 3.2: A Process Model of Absorptive Capacity, Its Antecedents, and Its Outcomes
- Figure 3.3: A framework linking learning orientation to firm innovation and performance
- Figure 3.4: Different Technology Assets Make Different Types of Contributions to the Growth and Competitiveness of a Company as it moves through its Lifecycle
- Figure 3.5: Conceptual Model for the Process of IT Innovation Adoption
- Figure 3.6: Four Models of Effectiveness Values
- Figure 3.7: Four Stages of Organizational Growth Cycle
- Figure 3.8: Innovation Framework Comparison Summary Management

Figure 3.9: The 7S Framework

Figure 3.10: Four Dimensions of Knowledge that Contribute to Organizational Capabilities

Figure 3.11: Desired skills composition in different types of teams

Figure 3.12: Structure of 3H Framework

Figure 3.13: People, Processes, and Philosophies in the World's most Innovative Companies

Figure 3.14: Entrepreneurship and the Concept of Fit

Figure 3.15: Developing Dimensions of Organizational Structure

Figure 3.16: Simplified schema of dynamic capabilities, business models, and strategy

Figure 3.17: A Model of Organizational Performance & Change – The Transformational Factors

Figure 3.18: How Strategy, Leadership and Execution Combine in Open Innovation

Figure 3.19: Desired characteristics of the firm's resources and capabilities

Figure 3.20: A Resource Based Approach to Strategy Analysis

Figure 3.21: Model of Innovation Orientation: Drivers, Actions and Outcomes

Figure 3.22: Blue Ocean - The Four Organizational Hurdles to Strategy Execution

Figure 3.23: Corporate Entrepreneurship, Knowledge, and Organizational Competence Development

Figure 3.24: Relationship and Interaction between Organizational Factors

Figure 3.25: An Overview of Knowledge Management Elements

Figure 3.26: Relationship between Transformational Leadership, Organizational Innovation, Learning and Performance

Figure 3.27: Organization and Market Driven Innovation

Figure 3.28: The Self Sustaining Cycle of Entrepreneurial Orientation, Learning Orientation & Transformational Leadership under the 3H Framework

Figure 4.1: Strategic Choice under Conditions of Bounded Rationality

Figure 4.2: Strategic choice under conditions of bounded rationality the executive's construct reality vision

Figure 4.3: Characteristics of Entrepreneurs

Figure 4.4: TPB Theory of Planned Behavior as Proposed by Ajzen

Figure 4.5: The Essence of the Learning Organization

Figure 4.6: TRI Elements Mapping Against Entrepreneurial Orientation, Transformational Leadership and Learning Orientation

Figure 4.7: Founder Age Distribution: All Start-Ups and High Growth Start-Ups

Figure 4.8: A Theoretical Framework for Analyzing Organizational Learning

Figure 4.9: Development of the performance measurement literature and global trends

Figure 5.1 Suggested Model for Framework Research

Figure 4.1: Role of Respondents in the Company

Figure 4.2: Tenure of Respondents in the Company

Figure 4.3: Age of Respondents

Figure 4.4: Industry Experience of Respondents

Figure 4.5: Experience in Management Role of Respondents

Figure 4.6: Years of Company Establishment

Figure 4.7: Final Model with Configuration and Weighting

Figure 7.1: 3H Based Management Model & Other Proposed Relationship

Abstract

Innovation interacts with the society as an evolutionary force as seen by evolutionary economists because the economic system is dynamic with uncertainty rather than rational and static. They also believe technological innovation is crucial in wealth creation and its distribution can happen any point in time and science-based entrepreneurs can succeed against incumbents as knowledge evolves since innovation is the key for high-tech industries and innovation adoption is the life blood of SMEs. Hence, organizations, big and small, are needed to constantly innovate to sustain their competitive advantages to remain relevant especially in a fast changing technological environment.

As innovation ability is a key component in defining where company sits in the competitive landscape, it is vital to put innovation, operational excellence and an entrepreneurial spirit at the heart of the organization. This is crucial for Hong Kong high technology SMEs since the total number of such enterprises is large and offers significant contribution to Hong Kong GDP. However, it is also critical to understand how innovativeness will interact with existing management elements and how management framework can be adjusted to adopt these new insights effectively. This is because company performance was conventionally measured by financial metrics but due to the arrival of new technologies within a rapidly changing environment, financial performance is no longer the only benchmark. Instead, a multi-dimensional assessment, covering leadership, execution ability and strategic orientation should be considered as causal factors in providing a holistic reflection of the current and future company performance. To complete the investigation, we have chosen the 3H management framework as our research reference since it inspires us to add leadership to the lens of evolutionary economics alongside entrepreneurship and knowledge through continuous learning as sources of competitive advantage.

The result of our study contributed to the understanding of inbound open innovation by empirically confirming that entrepreneurial innovativeness is not enough to deliver good organizational performance by itself. Instead, although innovativeness of an entrepreneur is a significant factor in driving organisational performance, it should be mediated by three core management elements as shown by the 3H framework. Our result has demonstrated the reliability in forecasting organisational performance can be improved if the level of inbound open innovation acceptance is included. In fact, the best performance outcome is achieved when these five factors are working coherently. In addition, our study highlighted that strategy has to work through leadership and execution to achieve the desirable organizational performance within the context of inbound open innovation. The reliability in predicting organizational performance was further enhanced by including entrepreneurial tenure in the company and top management experience in the industry.

With its ability to categorize attitude of respondents towards new technologies, our study has also revealed the possibility of using Technology Readiness Index, which is a well-established instrument, as a consistent measurement instrument, so longitudinal study can be conducted for comparison. Our finding also provided entrepreneurs a method to continuously audit the status of innovation adoption and improve the delivery of organizational performance under an inbound open innovation driven environment. Our proposed model and instruments have shown continuous optimization of critical management elements is no longer a myth and can be done where necessary. This is an important tool for a technologically stagnant economy like Hong Kong and giving it an opportunity to succeed in Industry 4.0 by enlightening both entrepreneurs and policy makers with a new concept to plan and adjust their approaches for new technology adoption during the planning and implementation stages.

Chapter One – Introduction to the Research Study

1.1) Introduction of the Global and Hong Kong Technology Landscape

Economic development of any region is centered on seeking and achieving long-term sustainable development in the standard of living, which is driven by its level of productivity. Continuation of prosperity for a particular location depends on how productivity can be used and upgraded in that location. On the other hand, although productivity and its growth define competitiveness, it remains influenced by competitive advantage. While being one of the world's leading financial centers, Hong Kong is also embarking on a new journey in re-establishing its high technology leadership in southern China through the Greater Bay Area initiatives. Businesses in Hong Kong, Asia and the World have accelerated the pace of new technology adoption to improve operation efficiency that enables them to navigate the challenges posed by both the pandemic and Industry 4.0. For a location to prosper, local firms must be competitive and able to utilize sophisticated methods supported by the use of advanced technology to offer unique products and services. Companies will need to evolve from imitation to innovation and move away from cost based to be differentiation focus so the local economy can become an advanced economic entity (Porter, 2000).

1.1.1) The Global Trend of Technological Innovation

Significant developments in science, technology and the proliferation of internet and wireless data in the last two decades have driven the world economy driven and brought dramatic changes in almost every aspect of human activity. The pace of change has been increasing rapidly and becoming more and more unpredictable. The emergence of new business models, that often disrupt established sector leaders through the creation and adoption of new technologies, is providing opportunities to insightful leaders to establish new competitive advantages and corporate values at all levels within our society through the reshaping of the existing research, production, consumption, transportation and delivery systems. From a business perspective, innovation has become a novel way to focus commercial growth of the top line directly by developing new and different offerings rather than cost-cutting. This focus has also moved beyond the product itself, but covers everything enterprises can offer above and beyond.

As disruptors and innovators emerge from other industries and exert extreme pressure on established companies, existing companies and countries can only remain competitive at both a corporate and national level by staying at the forefront of innovation. Countries have to accept the need to focus on building innovation ecosystems to remain competitive at a global level. In demonstrating her awareness of the importance of Industry 4.0, German Chancellor Angela Merkel used the term 'Industrie 4.0' at the country's 8th IT Summit in Hamburg on 21st October 2014 and repeated this again when addressing the World Economic Forum in Davos in January to label the emerging world that combine the online and the industrial production world. With an intensive amount of high technology content, the era of Industry 4.0 also opens up many brand new opportunities through the application of innovative technologies.

As part of capitalism, business is also a form or method of economic change and drives creative destruction, which is an evolutionary process that is not only never but can never be stationary (Schumpeter, 1942). Klaus Schwab, chairman of the World Economic Forum, believes this current wave of technology revolution is part of Industry 4.0 and breaking the state of equilibrium. The fundamental and global nature of Industry 4.0 means it will impact and be altered by people, corporations and economies

from all nationalities where innovators will be one of the largest beneficiaries of innovation as they are the providers of intellectual and physical capital (Schwab, 2017).

Technological change, such as Industry 4.0, is a principal driver of competition by redefining competitive advantage and industrial structure. Its diffusion can potentially improve or erode industry attractiveness by affecting each of the five forces of competition (Porter, 2008). Schwab anticipated there are four main effects that Industry 4.0 will significantly impact business, including customer expectations, product enhancement, level of collaborative innovation, and on organizational structure. From a business planning and operation perspective, technological changes significantly impact competition, so forecasting the path of technological evolution is crucial for firms to maintain and improve its competitive position. However, top management will find it difficult to comprehend or anticipate surprises in the business environment due to the acceleration of innovation and the velocity of disruption, where entirely new economic and organizational structures will be required to succeed in the new environment. Strategies focusing mainly on cost reduction will be less effective than those that offer products and services in more innovative manners (Schwab 2017). Moreover, decisive cost or quality advantage can be generated through competing with new technology, while new type of organization that can discover new supply source and using new commodity can strike at the foundations of competitors instead of merely competing on price (Schumpeter, 1942). As such, there is a profound need for top management to stay alert, be receptive to, and be prepared to adopt through company strategies adjustment when internal and external innovation emerge because of the potential disruption it may bring.

In some cases, even though management can envision the emergence of new technologies, their complexity has far exceeded the know-how and capabilities of most companies, driving the need for technology innovation adoption from external parties as a practical way to incorporate new technology evolution. On the other hand, many companies can no longer afford to have all the human and technical resources required inhouse due to the depth and complexity of skill and knowledge involved (Acs & Preston, 1997). Moreover, top management may even fall into a habit of managing through inherited strategies. One possible solution was suggested by Chesbrough back in 2003, which covers technology innovation and its adoption. Better known as the Open Innovation framework, it has since been studied by many scholars and government officials especially in the area of small and medium enterprises. In an executive survey done in 2013, Chesbrough and Brunswicker (2014) concluded 78% of large firms reported they were already practicing of open innovation. This trend is not surprising since global competition pressure is forcing companies to advance the quality of their existing products through continuous innovation. With the acceleration of technology innovation and adoption due to Covid-19, many SMEs are also expediting their adoption of innovation to keep up with the pace of digital business transformation. This is aligned with a recent survey done by Gartner where 65% of executives reported that they accelerated the pace of their digital business initiatives and is shown in the figure below (Gartner, 2021).

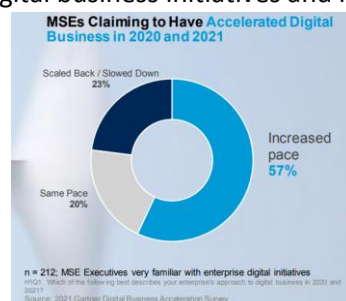


Figure 1.1: Medium & Small Enterprise Executives Approach to Digital Business Acceleration (Gartner 2021)

1.1.2) Technology Innovation Status in Hong Kong – a Research and Development Perspective

In ranking second (2019) and fifth (2020) in World Competitiveness Ranking (IMD, 2020), Hong Kong has always been one of the most efficient cities in the world. According to the World Intellectual Property Organization (Dutta et al., 2019), Hong Kong has similar innovative ranking as Korea, Japan and France as shown in figure below, making it a unique location in Asia to conduct an innovation and efficiency related study. In conducting their study in Hong Kong Science and Technology Park, which uses “Where Innovation Meets the Future” as its motto, Loon and Chik was able to access some of the most innovative small and medium-sized technology companies in Hong Kong (Loon & Chik, 2019).

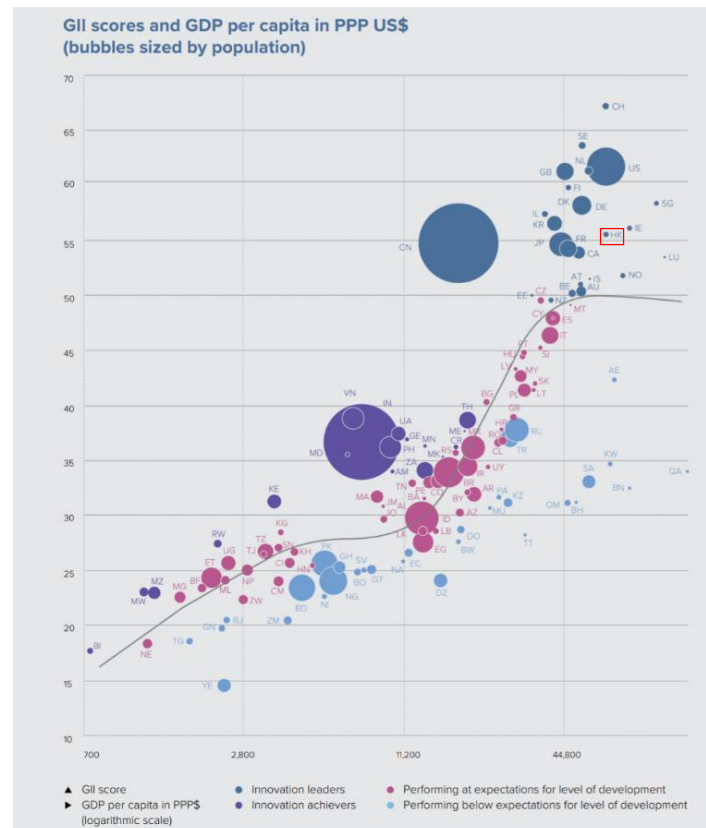


Fig 1.2 Global Innovation Index scores and GDP per capita in PPP US\$ (bubbles sized by population) (Dutta et al.2019)

In terms of innovation and competitiveness ranking, Hong Kong remaining among the top 10% globally and this has been reinforced by the continuous generation of human capital, especially in science and engineering, supplied by local universities which have been enjoying respectable ranking throughout the years according to the Times Higher Education and QS University Ranking.

Global Rankings	2016	2017	2018	2019
Global Innovation Index	14/128	16/127	14/126	13/129
IMD Digital Competitiveness	11/61	7/63	11/63	8/63
ITU ICT Development Index	6/175	6/176	N.A.	N.A.

Source: Global Innovation Index Reports, IMD, ITU

Figure 1.6 Global Innovation and Competitiveness Ranking (Yuen 2020)

Hong Kong Universities with Top-100 Ranking by Subject

Subject	University (Rank)
Electrical & Electronic Engineering	HKUST (22), HKU (30), CUHK (51-100), CityU (51-100), PolyU (51-100)
Computer Science & Information Systems	HKUST (26), HKU (33), CUHK (36), CityU (50), PolyU (51-100)
Mathematics	CUHK (28), HKUST (36), HKU (45), CityU (51-100), PolyU (51-100)
Chemical Engineering	HKUST (34), HKU (51-100)
Chemistry	HKUST (22), HKU (34), CUHK (51-100)
Medicine	HKU (29), CUHK (45)
Physics & Astronomy	HKUST (51-100), HKU (51-100)

Source: QS World University Ranking by Subject 2019

Figure 1.7 Ranking by Subjects in Hong Kong Universities (Yuen 2020)

Despite Hong Kong's Research and Development spending has been quite minimal, its researchers per million inhabitants still enjoy a high ratio, as seen in some developed countries (UNESCO, 2018). This offers hope that Hong Kong is still capable of developing its own niche position through technology innovation adoption to enter the era of Industry 4.0.

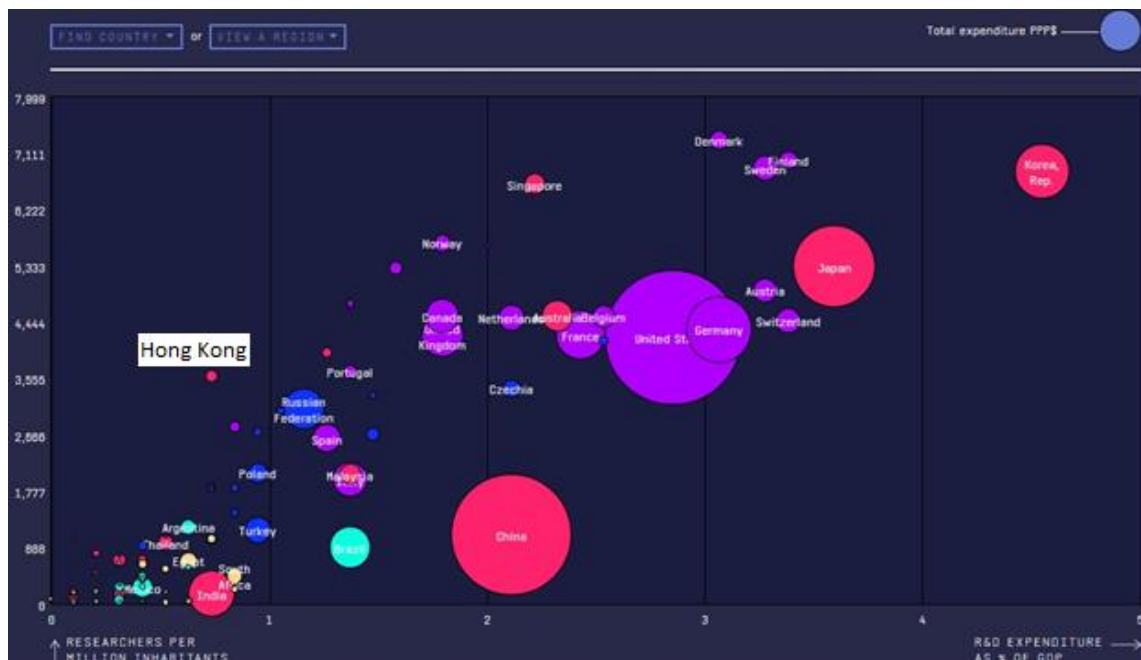


Figure 1.5 Researchers Density vs. R&D Expenditure (UNESCO Institute for Statistics Dec 2018)

Global Innovation Index 2019 rated the Shenzhen-Hong Kong technology cluster, which includes Hong Kong's innovation and technology sector, as the second largest in the world. On an individual basis, the total number of start-ups in Hong Kong in 2019 increased by 21% to 3,184 and the total employees grew by 31% to over 12,000. Major focus of research by Hong Kong start-ups includes information and communication technologies (ICT), Internet of things (IoT), data analytics, software as a service (SaaS), biotech, artificial intelligence (AI), robotics, virtual reality (VR) and augmented reality (AR), as well as new material. In terms of applications, financial technology, smart city and smart home, healthcare and big

data applications are among the most popular sectors (Yuen, 2020) and these applications fit nicely into the area under Industry 4.0.

Major Indicators	2016	2017	2018
Total expenditure on in-house R&D activities performed locally (HK\$ billion)	19.7	21.3	24.5
(% of GDP)	0.79	0.8	0.86
Expenditure on in-house R&D in the higher education sector (HK\$ billion)	10.3	10.8	12.4
R&D Personnel in Full-time Equivalent	31,282	31,447	33,576
Total expenditure on technology innovation activities in the business sector (HK\$ billion)	20.0	29.5	32.3

Source: HKSAR Census and Statistics Department

Figure 1.8 Research and Development Expenditure in Hong Kong from 2016 - 2018 (Yuen 2020)

Statistically, although Hong Kong spending on R&D in 2021 is just a mere 0.97% of GDP, it is still able to maintain a significant level of R&D knowledge due to its background as a technology transfer hub for China back in the late 1980s to early 2000s. With such a lower level of legacy investment in technologies, Hong Kong should embrace an open innovation approach, especially in SMEs within the emerging technology segments. Even though SMEs invest less in R&D in total than large firms, they are able to produce more innovations on a per employee basis. For example, in 1993, SMEs in U.S. received only 3.8 percent of federal R&D allocation but are responsible for 14.5 percent of industrial R&D output. This is because rather than surrendering their invention to the company, independent innovators from SMEs can maintain clear property rights, thereby providing additional reasons to adopt radical innovations (Acs & Preston, 1997).

According to Trade and Industry Department of Hong Kong government, SME employs 45% of the private sector workforce and constitute more than 98% of business establishment in Hong Kong, so it is an important segment for driving the success of industry adjustment. Countries or cities that have a high level of entrepreneurial activity can be more adaptable in seizing new opportunities and constantly generating new or improved products and services, as shown by the United States and more recently mainland China. Entrepreneurs had significantly higher attitudinal ranking in the area of innovation, personal control, self-esteem, and achievement than non-entrepreneurs (Robinson et al., 1991).

While R&D investment positively impacted firm performance in China and Korea (Xu et al., 2018), the characteristics of Hong Kong technology entrepreneurs are likely to be different from those in China and Korea. For instance, Chinese entrepreneurs strongly believe in taking risks, pushing ahead and reacting quickly to opportunities. They will constantly search for advantages, both small and large, because small ones will help them to advance ahead of their immediate competitors while larger ones will support their endeavour into new business area (Tse, 2015). On the other hand, in Korean companies are centered towards the upper management level while suppressing individualism, an important element of entrepreneurship (Chung et al., 1997). Hence, it is logical for Hong Kong to conduct its only attitudinal and perception analysis of local SME top management as a way to improve SME productivity and GDP contribution.

1.2) Background of Study – The Role of Industry 4.0 and Innovation in Hong Kong and Beyond

Besides driving the emergence of new products, services, systems and industries, Industrial 4.0 is impacting every part of the economy directly or indirectly through such items as the Internet of Things, Online Shopping, Social Media and Remote Education. Industrial 4.0 is a technological revolution that fits well into the Freeman and Perez's definition of "techno-economic paradigm" because it has pervasive effects throughout the economy. This paradigm combines interrelated product and process with organizational, managerial and technical innovations to drive the creation of a new and unique set of technological and economic advantages and produces a large potential improvement for most of the economy (Freeman & Perez, 1988). As such, our study of organizational and managerial innovation adoption under a technological SME context is very relevant within this paradigm, as SMEs play a significant role in driving economies forward.

1.2.1) General Definition of Industry 4.0

The key to Industry 4.0 is data and through Internet of Things (IoT) technology, data generated by every step of the production cycle can be gathered and analyzed in real time. Corresponding resources and production schedules adjustments can be made to produce high-quality products efficiently at low cost (Shan, 2018). IBM provides a snapshot of architecture for a typical factory operating under Industry 4.0 in the figure below and can be viewed as how the industrial world is transformed by the global digital revolution (Bonnaud et al., 2019).

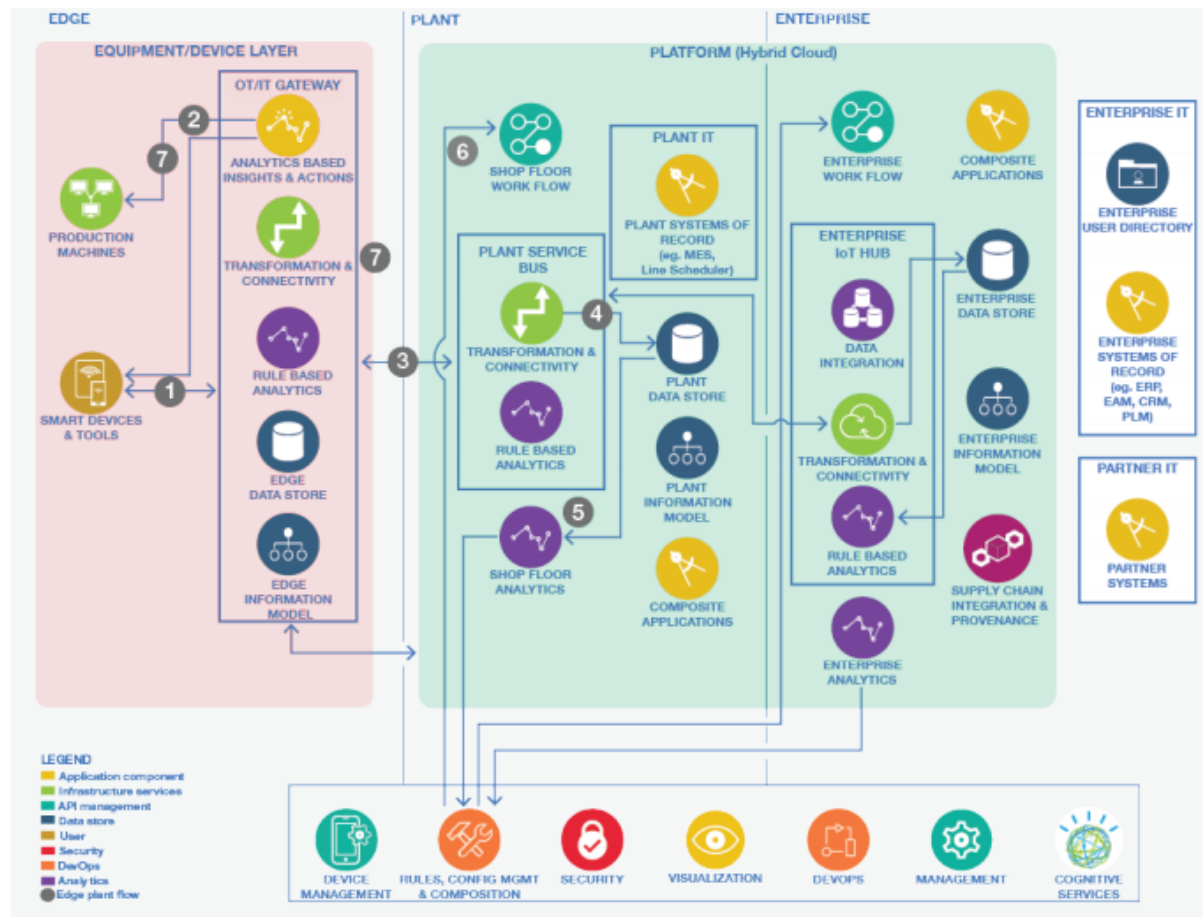


Fig 1.3 Industry 4.0 architecture pattern (Bonnaud et al., 2019)

Multiple disruptive technologies such as a massive increase in computing capacity through the cloud, big data and blockchain, connectivity with Internet of Things through mobile, wearable and 5G, advanced analytics driven by machine learning and artificial intelligence, augmented and virtual reality, cognitive Human-Machine Interface as well as natural language processing all plays a major role to enable the physical to digital transformation possible. The ability to master these technologies is essential for Hong Kong's local industries and from a high-tech jobs creation perspective. Many of these technologies can be applied to non-manufacturing business environment that require monitoring and control, such as building & facilities management, traffic management & even logistics management.

1.2.2) Relationship between Innovation and Industry 4.0

The impact of Industry 4.0 is far beyond simple manufacturing, as its label suggests, because smart, connected products offer capabilities that reshape industry boundaries by disrupting value chains. With the appearance of new competitive opportunities and threats, companies are forced to review nearly every element exists internally to deal with new products and entirely new industries which alter the nature of competition and industry structure (Porter & Heppelmann, 2015). Industry 4.0 is chosen to be the background of our innovation study because it aims at revolutionized the living and working environments and creates an unprecedented fusion of digital, physical, and biological factors with the goal of transforming and producing social, economic, and environmental advancements (Müller et al., 2018). Industry 4.0 also changes business approaches through digital technologies and related Internet of Things (IoT) networking to create new value. Increasing the amount of analogical information can be changed into digital data and be processed by information technology. Conceptually, Industry 4.0 is relying on the derivation of new application from digitalization and the internet of things and their relationship can be represented in the diagram below (Jovanovski & Maierhofer, 2020). From a personal experience perspective, it can also be easily conceptualized through its physical presence in such form as wearable, electronic devices such as connected meters supported by 5G, Wi-Fi Modems.

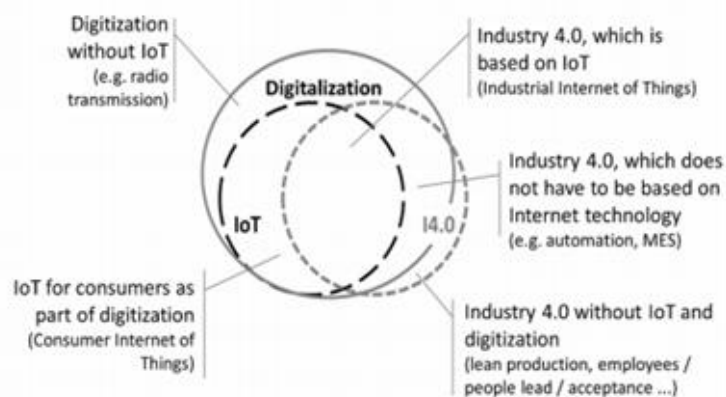


Figure 1.4 Definition of Terms in Digitalization (Jovanovski & Maierhofer 2020)

Although the shifting paradigm emerges under Industry 4.0 is exciting for entrepreneurs and technology companies, it is complex and is becoming increasingly challenging for management and companies to keep pace with such development and can surrender an early lead to a disadvantage. Competitive success will arise when a company can realistically produce a distinctive value proposition,

rather than just imitation (Porter & Heppelmann, 2015). This clearly indicates the need to enable technology adoption through open innovation and collaboration as a means to overcome such challenges.

1.2.3) Hong Kong Government's Support for Technology Innovation under Industry 4.0

Since managing risks and incubating new ideas often need prototyping as well as the willingness to invest time and resources for their evaluation, successful pilots and prototypes is often achieved centrally through legislation, or through the dissemination of evaluations which require government support. (Mulgan & Albury, 2003). In its recent 14th Five-Year Plan, the Chinese government already indicated its investment in technology will be significant and focus on frontier industries, such as artificial intelligence and integrated circuits, as they are essential elements in Industry 4.0. The speed of occurrence and the impact of these changes is resonating across the world, bringing both complex challenges and extraordinary opportunities (King & Wood 2021). This plan is also provides a significant opportunity for Hong Kong to participate and develop supporting and complementary technologies.

Even back in 1998, the Hong Kong government, through the Chief Executive's 1998 Policy Address, has the vision to focus on high value-added industry as a means to readjust Hong Kong's economy (HKSAR Government 2001). Since 2017, the Hong Kong government has invested over HKD \$130 billion in supporting research and development, nurturing talent and assisting the industry with infrastructure development as part of its plan to enhance the innovation and technology ecosystem in Hong Kong. Subsequently, gross domestic expenditures on R&D in Hong Kong has increased to around \$26.3 billion in 2019 from \$16.7 billion in 2014. The total employees working in the innovation and technology sector grew from around 35500 in 2014 to 44600 in 2019 while the number of start-up companies also rose from 1070 in 2014 to 3800 in 2021 (HKSAR Government 2021). In its 2022-23 budget, Hong Kong government will continue its commitment in innovation and technology by allocating an additional \$10 billion to set up a new strategic innovation and technology fund (HKSAR Government 2022), becoming the perfect recipe to reinvigorate the creation of more value adding industries in Hong Kong as part of Industry 4.0 ecosystem.

Furthermore, the Northern Metropolis Development Strategy, as shown below, was announced in October 2021, providing a planning vision and strategy leading up to 2030. It proposes the expansion of the Northern Economic Belt with innovation and technology industries being the economic engine and the entire area of 30000 hectares will be consolidated into a holistic metropolis. This was formulated and referenced against the Chinese Central government's policy to support Hong Kong under the Outline Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area in the National 14th Five-Year Plan. It is estimated that the Hong Kong-Shenzhen Innovation and Technology Park (HKSITP) alone, which is currently under construction and located within the Metropolis program, can accommodating about 50000 I&T jobs and provide about 87 hectares of land for innovation and technology use. The gross floor area of HKSITP planned is about three times of the existing Hong Kong Science Park. In addition, another 150 hectares has been identified in other part of the Metropolis project for innovation and technology related expansion if necessary. With an estimate increase of about 66000 to 68000 I&T jobs, innovation and development produced by this project can potentially drive technology upgrade in traditional industries, producing new job opportunities in the economy (HKSAR Government, 2021).

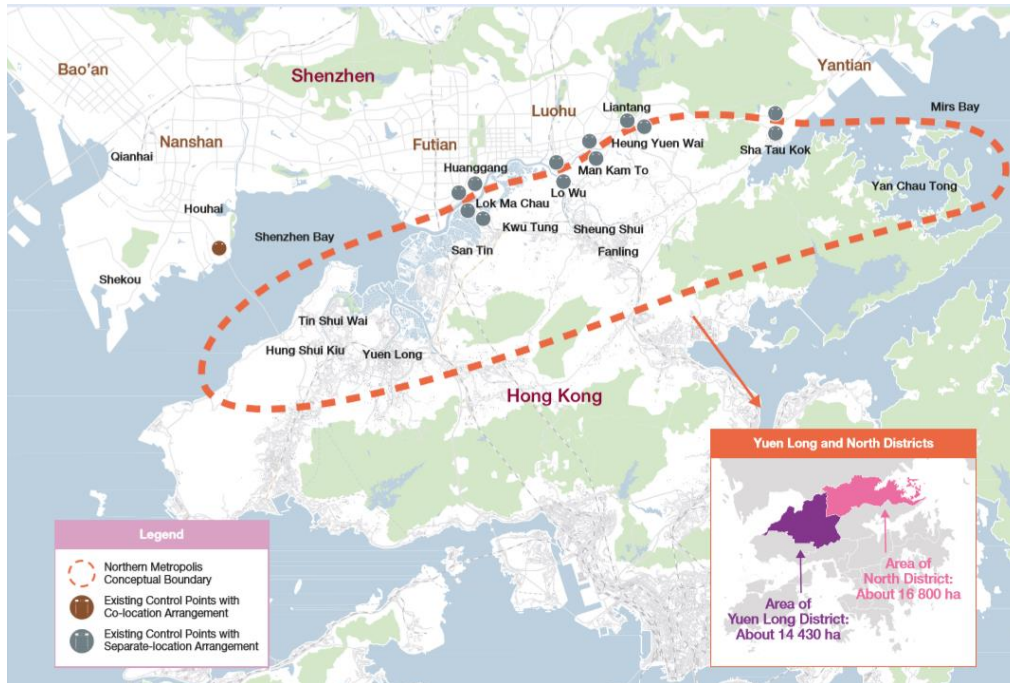


Figure 1.9 NMD - Northern Metropolis Development Strategy (HKSAR Government 2021)

1.3) Purpose of the Study: To Enhance the Understanding of Inbound Open Innovation Adoption and its Management in Hong Kong High Technology SMEs

In Hong Kong, even though most of the technology products designed and sold by local SMEs utilize and adopt external technology, not a lot of studies was done to understand relevant management factors, especially related to in-bound open innovation itself. Such study of open innovation adoption is important because although many have tried by engaging in pilot projects, most have failed due to the lack of knowledge on how to establish open innovation competencies and embed open innovation as a regular practice in the entire organization (Zynga et al., 2018). Institutions like HKSTP and Cyberport have been trying hard in recent years to identify and foster technology SMEs that can become winners in the innovation race, but how to pick those that are likely to succeed through innovation adoption remains unanswered. Hence, it is important for Hong Kong to conduct its own research aimed at identifying essential factors that create successful and sustainable technology business for local high-tech company.

To address this potential knowledge gap, our study will center on the small and medium enterprise segment in Hong Kong, which focuses on technology as their core business, since SMEs are significant contributors to local GDP. Our priority is to understand top management's attitude and receptiveness towards innovation and its adoption as they need to stay alert and be sensitive at all times to internal and external changes and disruptions due to the rapidly changing environment. By providing better understanding of the relationship between management attitude and innovation, our study will attempt to address the gap identified where knowledge on managerial innovation is in its infancy and quantitative reviews of the influence of managerial characteristics on organizational innovation have not been conducted (Damanpour, 2017:14). Our result should hopefully extend the findings where personal traits of key individuals has play important roles in innovation (Ahn et al., 2017) and why some firms are likely to adopt some open innovation practices more frequently than others (Theyel, 2013).

In addition, by using the well-established Technology Readiness Index as our lens for individual assessment alongside other benchmarking tools to measure the perceived company performance, our study will demonstrate how management perception towards innovation relates to leadership style, strategy orientation and capabilities development which is critical in the creation, adoption and execution of innovation rollout. The final expected outcome of our research is to assess if TRI can be an additional benchmarking tool for estimating the likelihood of organization success in the future, thereby improve the understanding of the role played by open innovation in creating first mover advantage to reduce performance gap so Hong Kong Technology SMEs can learn to build better organizations that lasts longer.

The outcome of this research should help local academics and officials to deploy new mechanisms to assess the readiness of local Hong Kong companies and economy to make a successful transition into Industry 4.0 by maximizing the use of locally produced technologies. Our study can hopefully generate a Hong Kong specific model to compare against the study done before investigating the human characteristics of CEO/Founders and the influence these characters have on Open innovation adoption under the Irish SME context. (Barrett, et al., 2021).

1.4) Statement of the Problems and Research Questions

From an innovation performance management perspectives, top managers need to analyse multiple stages of the innovation lifecycle, starting from antecedents and context and ending at actual performance output. Without understanding each of the critical stages and components, efforts spent on optimizing innovation process will be futile and inefficient. As such, we will try to formulate our research questions towards addressing different stages of the innovation cycle in order to help future scholars to obtain a better understanding of the dynamics of interactions.

1.4.1) Problem One

The multidimensionality of organizational performance is driving researchers to develop theory that helps management to understand how the dimensions go together. Similarly, as the link between the context and the measures is critical, researchers will need to understand how the specific performance matrices are influenced by the complex combination of context and actions over time (Richard et al., 2009:745). Unfortunately, a quantitative review of how managerial characteristics influence organizational innovation and knowledge on managerial innovation is lacking and the state of knowledge on management innovation is in its infancy (Damanpour, 2017:14). On the other hand, research on organizational innovation would need to move to a 21st-century paradigm in which continuous high performance pivots on the complementary effects of sets of innovation types guided by environmental demands and managerial aspirations (Damanpour, 2017:30). Although simplest models of open innovation assumed it would improve performance, getting a more complete picture of the exact antecedents, mediators, and moderators in open innovation processes will be beneficial (West & Bogers, 2017:46). Hence, research should be conducted to examine the use of open innovation by small, new, and not-for-profit organizations, as well as the linkage of individual actions and motivations to open innovation. Other opportunities for research include better measuring the costs, benefits, antecedents, mediators and moderators of the effects of open innovation on performance (West & Bogers, 2017:43). All these queries above lead us to raise our first research question.

Question One

Is it possible to identify a set of personal and managerial characteristics to explain organizational performance under an inbound open innovation context?

1.4.2) Problem Two

In addition, how different elements of inbound open innovation model should be integrated and explain how to commercialize innovations (West & Bogers, 2014:27) has not been addressed. It is vital to generate a holistic view of business performance assessment, management, and aspiration. Investigation should be directed toward the nature of association between path dependencies in strategic orientation and business performance. Complimentary studies using longitudinal methodologies and data envelopment should be included to provide a view on performance relationship (Morgan & Strong, 2003). Furthermore, current understanding about open innovation in SMEs is still preliminary (Lee et al., 2010) and a longitudinal approach to investigate the causal relationships under the inbound open innovation is not yet available (Brunswick et al., 2015; Popa, et al., 2017). Nevertheless, the process of innovation adoption is a dynamic and longitudinal data collection using observation and interviews in addition to questionnaires would provide a richer understanding of the process (Damanpour & Schneider, 2006).

To ensure successful execution, the firm's entrepreneurial vision must be conveyed at different levels of the firm in order to align organizational goals with business processes (Wang, 2008). Refining of factors affecting innovation system approach would need to be monitored and balanced regularly by top management. They will also need to collect for feedback from economic sphere to adjust the organizational and institutional setup because even though the concept of learning fundamental is central in innovation system, it is not the case in business system approach (Lundvall, B., 1999). As such, future research should include examining the end-to-end innovation commercialization process, and studying the moderators and limits of leveraging external sources of innovation (West & Bogers, 2014:31). Identifying a framework that manage and develop competencies defines and directs organizational strategies and actions toward the creation of competencies and processes that foster innovation (Siguaw et al., 2006) would be very beneficial to innovation management in the world of high tech SMEs. Hence, based on the elements identified in Question One, our research will try to answer a second question.

Question Two

Can the elements identified in Question One be placed into a management framework to predict the likelihood of future organizational success for high technology SMEs so longitudinal analysis can be conducted periodically and consistently?

1.4.3) Problem Three

Finally, it is important to ensure innovation management is sustainable in the longer term. Technological advance needs to be understood as an evolutionary process and evolutionary view of firm is organizational behavior stresses rationality. Evolutionary economics has open frontiers to work with other disciplines such as social science (Nelson & Winter, 2002:42). Furthermore, evolutionary theory is related to behavioral theory because firms possess certain capabilities and decision rules while also engaging in various 'search' operations, which combine to determine their behavior at any given time due to changing economic environment (Winter & Nelson, 1982). However, rationality is bounded and not

true for all human behavior so there is possibility to enhance evolutionary economic model. Hence, researchers need to look at area such as dynamic capabilities framework which suggests that company can dynamically create wealth in the midst of rapid technological change through the use of distinctive processes. Through such framework, which is responsible for coordinating and combining, management is able to refine internal technological, organizational, and managerial processes inside the firm to generate distinctive competitive advantages (Teece et al., 1997). This is important because innovation process outcomes lead to a greater increase in SME performance, underlining the importance for entrepreneurs and SMEs to manage the innovation process diligently (Rosenbusch, 2011)

Future studies should also inform practitioners on how to design and manage organizations for innovation, create and maintain a proinnovation culture and climate across organizational parts, drive continuous improvement of operations, systems, and human knowledge (Damanpour, 2017:30). The possession of an organic structure, the ability to respond quickly to changing market conditions, and pursuing planned, well-crafted strategies function are critical intervening mechanisms in the entrepreneurial orientated strategic learning capability relationship (Anderson et al., 2009). In addition, entrepreneurial firms must foster organizational learning to maximize the effect of entrepreneurial orientation on performance. On the other hand, learning orientation mediates and firm strategy moderates the effect of entrepreneurial orientation on firm performance (Wang, 2008). Furthermore, entrepreneurial values support the creation of new businesses within the existing business and the renewal or revival of ongoing businesses need transformation (Slater & Narver, 1995). Such complex environment requires a transformational leader to create a synergistic influence on learning and performance so entrepreneurship can be complemented by an appropriate climate that produce learning organization. Therefore, there is a need to look at how various elements and relationships, identified in previous questions, can work together is critical for effective and sustainable innovation management.

Question Three

Is it possible to for different management factors identified above to combine coherently to support Inbound Open Innovation?

In conclusion, to address these questions, the focus of this study is to investigate if it is possible to establish an instrument through a framework to identify antecedents related to management characteristics while assisting the determination of the likelihood of success for technology SME companies in Hong Kong. This tool should also be robust enough so longitudinal study can be conducted in a consistent manner over a long period of time.

1.5) Theoretical Basis of the Study

Innovation is one way for entrepreneurs to exploit change that may appear as an opportunity for a different business or a different service that can be practiced and presented as a separate discipline. From an economic perspective, evolutionary economics provides an interesting lens to view innovation as an element in driving economic development (Nelson & Winter, 2002). At the business level, organizational innovation is to create focused but purposeful change within the potential capabilities of enterprise to achieve economically or socially (Drucker, 2002). Hence, it becomes essential to analyse innovation from an economical, managerial and contextual perspective because new and external

technologies are revolutionizing different industries and force the affected industry to change its very mindset to learn, acquire and adapt rather than just gaining technical knowledge. In Hong Kong, this revolution is driven by the adoption of innovation, so our study will focus from an inbound open innovation perspective.

1.5.1) Defining the Role of Open Innovation

Innovation adoption has been a major driver of technology advancement in human history and represents an earliest example of open innovation. For instance, the spread of modern paper making technologies from China to the Middle East in the 8th century and the use of powder as firearms by the Mongolian in their conquest of Asia and Europe lead to major adoption and creation of new products that benefited the world. Open innovation is supported by a strategy which embraces openness as a mean to create more value for organizations and is an important approach for companies to excel and lead through innovation. Openness is where contributors of knowledge can access inputs of others and cannot exercise exclusive rights over the innovation outcome and ideally create value for public good (Chesbrough & Appleyard, 2007). At the heart of the migration from closed to open innovation is the concept of inbound open innovation which leverage discoveries from other organizations and is often recognized for acquiring competitive advantage for companies today. A comparison between traditionally closed and open innovation strategies was produced based on research discussion with top management of twelve multi-billion dollars companies across a range of industries and is summarized in the diagram below.



Figure 1.10 Innovation Strategy Map (Chesbrough & Crowther, 2006)

According to Porter, company must identify technology segments that it has the most product insight, possessing best opportunities for future innovation and competitive advantages so they can be developed and maintained in-house. Other elements that will become commoditized or advance too quickly should be outsourced to suppliers and partners. Most successful companies are those that can decide when to pursue custom development or just license off-the-shelf, best-of-breed solutions (Porter & Heppelmann, 2015). Companies should be managed to be flexible for rapid change so it can shift, adapt and innovate quickly to satisfy changing customer needs through alliances, partnerships and joint ventures (Drucker, 2012) which themselves are different forms of inbound and outbound open innovation.

Henry Chesbrough expanded the idea where open innovation is now becoming a type of organizational innovation that integrates external capabilities into the innovation processes of a firm rather than relying solely on its internal capabilities (Chesbrough, 2003). Open innovation has since become the label to identify the purportedly use of knowledge inflows and outflows to accelerate internal innovation, and expand the markets for external use of one's innovation, respectively (Chesbrough, 2011). This concept has since been institutionalized via the Open Innovation Community and widely used as the basis of various researches. New technology projects often expose many capability gaps within the organization, it is logical for top management to look beyond its own boundaries and into the larger environment in search of solutions. In fact, seventy percent of companies were expanding investment in their innovation units to address the need for continuous innovation for company to remain relevant. This is according to 121 interviews conducted by IESE with firms' chief innovation officers and others in related roles throughout the United States, Europe and Asia. One example of open innovation is through collaboration between innovative and disruptive start-ups with established corporations (IESE 2019). Another approach is through corporate venturing, where companies can benefit from the success of external innovation while also acquiring insights into non-core markets and access to external capabilities (IESE 2017). In either situation, open innovation has shown the influential role it can play in helping companies to succeed.

1.5.2) The Importance of Inbound Open Innovation

Open strategy acknowledged the existence of limits on traditional business models due to resources limitation so inbound open innovation is necessary to foster innovation through increase in adoption. New business models based on invention and coordination by a community of innovators is now made possible through open innovation and its sustainability is achieved through the balancing of value capture and value creation (Chesbrough & Appleyard, 2007). Empirical studies have consistently found companies conduct more inbound than outbound activities (Huizingh, 2011). This inbound open innovation process is where external knowledge is internalized. However, although many organizations using external knowledge, only a few provide it due to fear of losing competitive advantages.

In the case of SMEs, they are more likely to be a consumer of inbound open innovation due to the limited resources they have. In the quest for knowledge, the method of acquisition can be multi-faceted, ranging from drawing on existing knowledge available within the organization to learn from observing the surrounding environment, other organizations, and product or services sourced externally (Huber, 1991). This inbound open innovation approach is extremely important for SMEs with limited resources and Porter suggested one possible solution is through clustering of companies because it enables many potential advantages in innovation and upgrading compared to those companies that exist in an isolated location. Clustering can facilitate earlier perception of both the need and the opportunity for innovation in products or services and provide a flexible channel capacity to act on them quickly (Porter, 2000).

By adopting an open innovation approach, companies can improve their performance during the pursuit of innovation through sharing knowledge as well as allocation of resources and technological assets across organizational boundaries while open to adopt ideas from users and customers (Dahlander & Gann, 2010; West and Bogers, 2014; Chesbrough, 2003; Nambisan et al., 2019). The benefit of open Innovation is not just about cost reduction or outsourcing of the R&D function because leveraging external research can be a complement rather than a substitute in delivering the performance of internal R&D activities (Chesbrough & Crowther, 2006). Furthermore, open innovation has a positive effect on the

introduction of new products and services offering for SMEs by contributing to revenue and market share increase since SMEs lack the necessary resources to generate economies of scale (Spithoven et al., 2013).

When a company decided to use an outside-in process as its core open innovation approach, investing in co-operation with suppliers and customers and to integrate the external knowledge gained becomes its key strategy. Damanpour identified three antecedents of organizational innovation, namely environmental (external, contextual), organizational (structure, culture), and managerial (leadership, human capital). Furthermore, the intersection of innovation and organizational change is associated more closely with the adoption of innovation (Damanpour, 2017) which is more relevant to an inbound open innovation context. Damanpour also suggested a possible fourth dimension, which is the attributes and characteristics of Innovation which may affect the speed of diffusion. This suggests innovation has certain attributes and is driven by a combination of external factors, leadership and organizational elements. Through the adoption of innovation, organizational change is more like to happen so change management becomes an important element of success.

With the apparent need for inbound open innovation to support the continuous growth of SMEs globally and particularly those in Hong Kong, our study will focus towards the inbound open innovation context in an attempt to improve SMEs' performance. We will leverage the suggestions from Damanpour (2017) to analyze how characteristics of entrepreneurs, such as attitude and perception affect innovation by measuring the level of interaction between inbound open innovation, entrepreneurial orientation, transformational leadership and learning orientation within the high technology environment.

1.5.3) The Importance of Understanding the Major Elements of Innovation Management

Entrepreneurs create growth and changes in a market economy by accelerating the generation, dissemination and application of innovative ideas (Korunka et al., 2003). According to investment legends Warren Buffet and Charles Munger, human behavior can be swayed when multiple inherent bias and tendencies act together under the Lollapalooza effect and this can either drive business towards success or failure. Successful entrepreneurs are likely to possess the ability to drive different tendencies, such as organization structure, strategies and leadership in a positive manner to create synergy within the business. Under the normal operating condition of SMEs, its strategy formulation, execution capability and organizational climate are all significantly influenced by its owners and CEOs. Within the context of company operating in the Industry 4.0 era, even though adaptation does not require predicting the future, leaders need to develop a mindset that considers system-level effects and the impact on individuals for future orientation while dealing with the uncertainty brought about by rapid technological change (Schwab & Davis, 2018). Since it is critical for leaders to develop a mindset to tackle such technological change, measuring their attitude towards innovation can act as a predictor of the likelihood of technology adoption for their organizations. As such, analyzing the individual preference of SME CEOs towards innovation and in-bound open innovation will contribute to acquire a better understanding of how this technology SMEs in Hong Kong may perform in the era of Industry 4.0 where innovation is the key to growth and survival.

Moreover, to succeed in innovation, entrepreneurs need to identify the source of innovation, be able to organize in a systematic manner, and know how to apply knowledge so innovation can be replicated (Drucker, 2014). Strategic and novel combinations of scattered people, ideas and resources is

also part of the innovation process (Obstfeld, 2005). The endless emergence of technology breakthroughs demand technology companies to constantly upgrade itself with new knowledge through adoption and learning supported by internal sharing and a learning oriented culture. As such, innovation needs to be managed to achieve the expected outcome and top leaders need to clearly identify which elements or area of the organization are to be managed in order to deliver the required outcome. From Drucker's perspective, innovation clearly involves leadership ability to organize, the presence of an entrepreneurial strategy to turn the opportunity or ideas into marketable reality as well as the possession of knowledge which can be continuously refurbished through new skills and knowledge.

However, under their resources constraint, technology SMEs need to be proactive and innovative in generating new and sustaining their existing competitive advantages. Due to their size, SMEs are also likely to be more operation focused rather than carrying a long-term strategic approach. As such, the strategic direction of SMEs is likely to be dominated by an entrepreneurial orientation. On the other hand, since technology companies need to be forever renewing and often transforming their technologies and core competencies, they are in a constant state of transformation which is best managed by a transformational leader. Transformational leaders are essential for economic development because they are models in demonstrating behaviors that are mimicked by followers to become routine and be ingrained into all artifacts of organizational activities that emerge as organizational culture, serving the role of facilitating new learning and innovation for all members within the company (Bass, 1998). As such, the management characteristics of technology focused SMEs are likely to be innovative and proactive in generating new ideas but also more aggressive and risk taking due to the need to sustain their business. This clearly supports the idea of pursuing innovation management through capable leadership, entrepreneurial orientation and learning orientation and some studies have also established such a relationship between entrepreneurial orientation, learning orientation (Wang, 2008) and absorptive capacity (Lau & Lo, 2015).

Finally, rapid advancement of technology in recent years are pushing companies to continuously work on creating new competitive advantages through innovation. However, the wide range and diversity of technologies available today not only stretches the resources and knowledge of large corporation but also forces smaller organizations into constant strive for innovation through internal and external scouting. Adoption of new ideas and innovation through an inbound open innovation strategy become one major method to maintain and renew the competitive advantages of corporations so apprehending how the level of inbound open innovation adoption acts as an antecedent in impacting company performance is an important area for management to address. Unfortunately, Neo-Schumpeterian have not succeeded in developing a behavioral theory associating firm strategy to operation routines on the whole (Freeman, 1994). Hence, by proposing transformational leadership as an extension to the evolutionary economic lens, our study, utilizing a management framework such as 3H, may provide scholars and evolutionary economist an alternate path to manage innovation from a new perspective. Through our study, we hope to expand the understanding of how scholars can manipulate various components, especially through their interaction, to enable organizational success for companies in Hong Kong and beyond.

1.5.4) The Importance of Management Framework in Innovation

For many high technology SMEs, moving from closed innovation to an open innovation context will require a lot of adjustment. Even in the case of incremental innovations which bring relatively minor changes to existing structure, services or processes within or between organizations, the adoption process is complex. As a company or industry matures or is transformed by changes in its social or technical environments, various aspects within the technologies domain may also require balancing over time. Hence, there is a need to have some mechanism or framework to control, co-ordinate and adjust different aspects to work together. Driving innovation streams require multiple organizational architectures inside one business unit (Tushman, 1997). The complexities faced by any innovation management framework is highlighted by a Gartner research which defined open innovation as part of the enlightenment process in their innovation management cycle as shown in the figure below.

Hype Cycle for Innovation Management Techniques, 2021

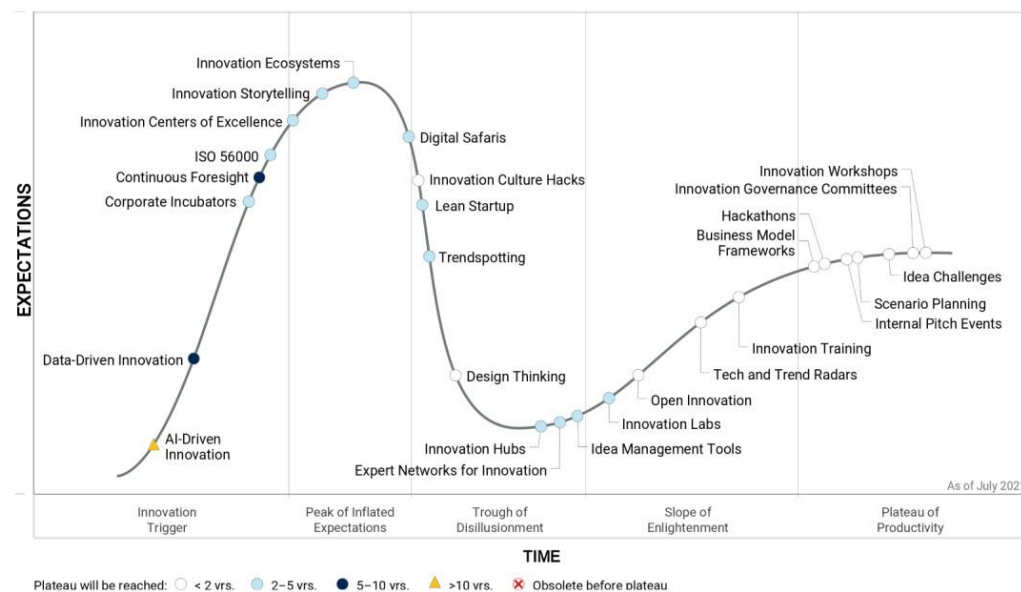


Figure 1.13 – Hype Cycle for Innovation Management Techniques (Beale, 2022)

Curley and Salmelin have provided an interesting concept of innovation as an evolution by placing closed and open innovation as well as the end point within a context where innovation becomes part of the overall ecosystem. The growth journey of evolving from a closed system to become an enlarged ecosystem, where all related elements, including customer, can be used as input to innovations is shown in the figure below (Curley & Salmelin, 2013). This model is well aligned with Chesbrough's vision, where the ecosystem becomes completely opened so all parties within the product chain, from suppliers to end customers, can provide their valuable contribution to the development of ideas and innovation.

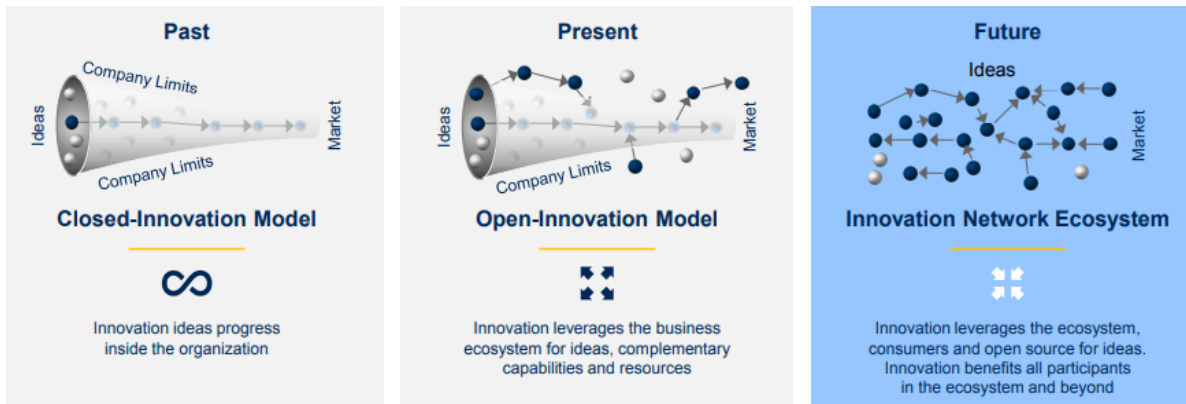


Figure 1.12 - The Evolution of Innovation (Curley & Salmelin, 2013)

Hence, innovation should be managed as a corporate function and management need to know how it is done rather than simply doing and it should be managed like any other corporate function (Drucker, 2002) as it produces an outcome with a process (Crossan & Apaydin, 2010). To master the discipline of innovation, management needs to be conscientious and must stay focus on the mission, define the results being after and have the ability to assess what and how it is being done (Drucker, 1998). Only through professional management, the premiums generated for innovative products, such as differentiation from competitors, customer loyalty and the additional entry barriers created for potential imitators, can outweigh the costs (Rosenbusch et al., 2011). Unfortunately, even after studying 12 existing measurement and 6 frameworks that measures entrepreneurship, a technical report on digital entrepreneurship published by the Joint Research Centre under the European Commission concluded that a large majority of these frameworks have no or weak links with innovation (Bogdanowicz, 2015).

Management capabilities needed to support open innovation are built up gradually through a transition journey so it becomes a sustainable business practice, as listed in the figure below. It involves clear leadership to make open innovation a visible commitment for the entire organization, top management must also build up capabilities through knowledge management, establishing process, structures and routines in conjunction with the acquisition, dissemination and adoption of external capabilities to improve and establish existing in house process and collaboration so open innovation can be institutionalized (Zynga et al., 2018). This journey towards open innovation clearly requires a transformational leadership that can drive change, supported by a clear learning orientation setup to enable sustainable knowledge development as well as a clear strategy to move the organization from closed to open innovation.

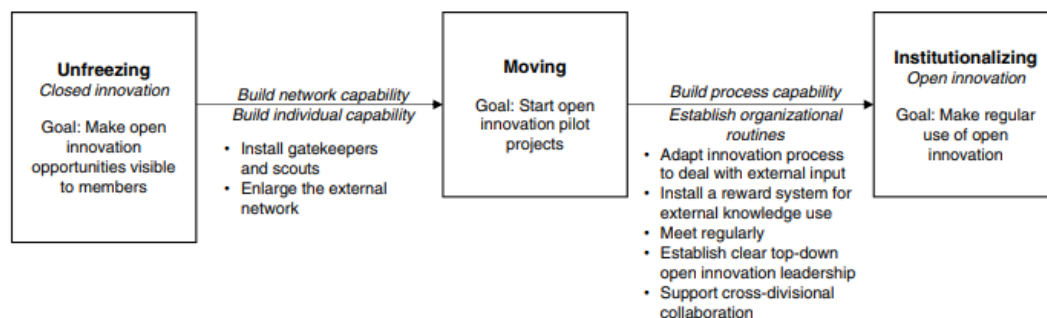


Figure 1.11 – Model of Transition from Closed to Open Innovation (Zynga, et al., 2018)

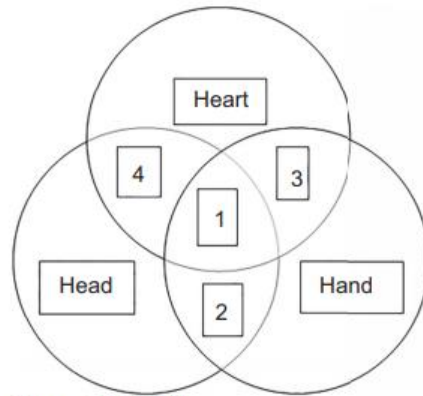
In addition, although inbound open innovation is a positive contributor, over-searching may indeed hinder innovation performance because it does incur some cost and going overboard can impact innovative performance negatively (Laursen & Salter, 2006) so this must be managed properly. Moreover, key elements of technology may be implicit and be embedded in various elements, such as cognitive and physical processes, people, plant, equipment tools and materials used in a tacit manner (Burgelman et al., 2008). Hence, innovation needs to be managed as it involving making choices that requires supportive climate and culture, enabling structure, processes, systems as well as financial and human resources. This is also mirrored to the management of organizations through goals and priorities setting, and the design of processes and structure to conduct their activities (Damanpour, 2017).

Hence, the success of organization innovation in an open innovation environment will depend on the balanced management of organizational strategy, purposeful leadership and the capability to acquire and disseminate new and external knowledge. This corresponds to using entrepreneurial orientation, transformational leadership and learning orientation, respectively, as the most relevant and effective approach to deliver the expected outcome from a strategy, leadership and execution perspective. As such, there is an essential need for Hong Kong to develop its own framework to perform its own open innovation assessment and optimization methodology because organization decision processes often deviate from basic rationality (Nelson & Winter, 2002).

1.5.5) Leveraging 3H as an Inbound Open Innovation Management Framework for Integrating Various Innovation Elements in Our Study

As highlighted by the Gartner hype cycle, open innovation management is part of a continuous evolution process and needs to be managed. The inbound open innovation process requires competent leaders to identify and select the best source of potential knowledge to effectively meet the firm's innovative strategies (Dahlander & Gann, 2010). For instance, to achieve the inbound open innovation process, corporate innovation strategy has to adopt a more flexible open innovation approach to remain competitive as skilled workers are now being more mobile, external suppliers are always enhancing their capability while external options are available for unused ideas since boundaries between companies are now more permeable (Chesbrough, 2003).

The answer to such management challenge may be found in 3H, which is an attempt to create a direct yet holistic framework for management by including three core elements of management, namely leadership (Heart), strategy (Head) and execution (Hand) in a simple yet easily extendible configuration as changes occur (Yu, 2022). The concept of 3H framework is to provide management a holistic view of the current company status with respect to these core elements so any deviation and area of improvement that arises can be identified quickly for remedial actions. Hence, 3H can be applied to extend the conceptual view of evolutionary economists by including leadership as a means (how) to close the gap between strategy and execution.



Source: Yu (2020)

Figure 1.14 – 3H Holistic Management Framework (Yu, 2021)

In the case of implementing inbound open innovation, the introduction of proper process and strategies (Head) through the selection of entrepreneurial orientation is quite suitable because it is a strategic construct that includes management-related preferences, beliefs, and behaviors as expressed among a firm's top-level managers and certain firm-level outcomes (Covin et al., 2006). Subsequently, innovation diffusion can take place by executing the right strategy, with the right people, who possess the knowledge either through appropriate talent retention, training or acquisition program (Hand) and led by the leaders with the right caliber and intentions in transforming all area involved with the support of the employees (Heart). From that perspective, inbound open innovation provides an appropriate context where 3H framework could be used as the reference for the generation of assessment and measurement instrument.

Finally, open innovation and the related business models are changing practice and creating strategic positions that had not been clearly articulated and can differ across technologies and industries (Dahlander & Gann, 2010). In addition, open innovation acts as a set of practices for profiting from innovation and a cognitive model for creating, interpreting and researching those practices (West et al., 2006). Hence, establishing a flexible management framework like 3H for open innovation management is critical for the success of SMEs because one important advantage offered by 3H is its ability to see how each of the three core elements interact and help top management to address different practices and attend to the barriers and limits by highlighting useful insights through straight forward indicators.

1.5.6) The Role of Entrepreneurial Orientation, Transformational Leadership & Learning Orientation to enable Inbound Open Innovation

Innovation is multi-faceted and complicated so it is always difficult for management to visualize the variation and deviation in an objective manner. A summary of the role of individual management elements advocated by 3H framework is examined below while more detail is provided in Chapter Two.

1.5.6.1) How Critical Management Elements of Inbound Open Innovations Relates to 3H Framework

As the innovation environment is highly uncertain, the corresponding strategy is likely to be changed constantly as opportunities arise. Entrepreneurial orientation, as one of the strategic orientations, is a key concept related to a strategy making and decision-making process when it comes to

strategy selection (Lyon et al., 2000). Hence, entrepreneurial orientation can play an interchangeable role with the Head (Strategy) element within the 3H framework. For instance, the moderating effects of contextual factors on the entrepreneurial performance relationship may be much stronger than the main effect of entrepreneurial orientation on performance. In such case, it is important to adjust the strategy to cater for the changing environment. Managerial focus on identifying and implementing appropriate strategic processes supported by the establishment of a framework may be a useful first step in the pursuit of entrepreneurial orientation effectiveness and performance (Covin et al., 2006). This dynamic strategy formulation process actually works best for companies operating under an entrepreneurial orientation because it tries to proactively match the unique requirements of acting entrepreneurially.

Transformational leadership is particularly appropriate for top management of SMEs to foster innovation because this leadership style addresses the intrinsic motivation of staff in product development and provides visions, leading to a positive direct impact on innovation, growth and profitability (Matzler et al., 2008). This happens because transformational leadership is also more effective, productive, innovative, and satisfying to followers than is transactional leadership and authentic transformational leaders provide followers with identity images of trustworthiness, credibility, moral worth, innovativeness, esteem, and power (Bass & Steidlmeier, 1999). As such, transformational leadership fits well into the core belief of 3H where leadership should be heartfelt to win the support of employees from a leadership quality perspective.

Finally, the essence of organizations is their ability not only to make themselves competitive but also to maintain their competitive position through innovation and continuous learning (García-Morales et al., 2006). Based on the knowledge-based view, it was shown the effective use of inbound open innovation through external knowledge resource acquisition and technology scouting has positively influences the innovation deployment as well as performance of the organization (Wang et al. 2015). Therefore, learning orientation can enable effective execution of innovation which corresponds to the Hand element of 3H. In conclusion, it is apparent that organization performance under an innovation based environment, such as Industry 4.0, is driven by entrepreneurial orientation, transformational leadership and learning orientation so they will form the basis of 3H management elements in our study.

1.5.6.2) Transformational Leadership

Transformational leadership is linked to the promotion of innovation in organization and they also initiated more influence attempts than others through a greater variety of influence and articulation tactics. By displaying innovative actions to achieve goals, transformational leaders are also more likely to become champions of entrepreneurship (Howell & Higgins, 1990). These champions of projects exhibited higher risk taking and innovativeness which are empirically related to entrepreneurship and theoretically associated with transformational leadership and such characteristics should also appear in the personal characteristics of the entrepreneur him/herself. Hence, it is clear that transformational leadership is closely tied with entrepreneur orientation and acts as a good predictor of innovation and creativity.

Organizational innovation often involved transformation, which is the process of developing and implementing major change programs, to ensure organization is ready to tackle new demands and continue to function effectively in its operating environment. Significant and far-reaching developments

are planned and implemented during a transformational change in both corporate structures and organization-wide processes (Armstrong, 2006). Since it will involve activities such as radical changes to the structure, culture and processes of the organization, transformation will also require competent leadership to detect area needing transformation and adjust the organization accordingly throughout its evolution. Transformational leadership co-exists with increased motivation, effectiveness, innovation, and the ability to cope with change (Antonakis, 2001).

Transformational leadership also predicted higher project quality due to the ability to inspire a sense of mission, encourage members to do more than normal and stimulate them intellectually with new ways of problem solving and learning experiences (Keller, 1992). This is because transformational leadership also serves the purpose of facilitating new learning and innovation for individuals so they can be proficient in continually improve their learning and performance in understanding and adapting to work-related environment (Bass, 1998). In fact, transformational leadership aligned better with a more educated work force who is more eager to apply and develop its abilities on the job (Hater & Bass, 1988). Moreover, while desirable follower behavior should include a learning orientation for a learning organization, transformational leadership was found to be the preferred leadership approach for such organization (Coad & Berry, 1998). Therefore, transformational leadership appears to be strongly related to both entrepreneurial orientation and learning orientation and should be reflected in our modeling.

1.5.6.3) Entrepreneurial Orientation

In dynamic market environments that demand aggressive product development and highly adaptable product processes, such as those experienced by the current paradigm shift under Industry 4.0, a strong entrepreneurial orientation may be essential to succeed (Slater & Narver 1995). The heart of entrepreneurship is innovation (Drucker, 2002) and entrepreneurship is the practice or activity of creating or innovating (Drucker, 2014). Entrepreneur is an agent driving the equilibrative forces of the market through competition due to his/her ability to grasp perceived opportunities. This ability is based on noticing changes that have already occurred, detecting inconsistency between existing relationships and the conditions required for equilibrium earlier than other before the market is driven back towards a new equilibrium (Mises 1949). Such aggression and adaptability can be achieved by innovation, as innovation is the central concept of entrepreneurship (Schumpeter, 1934).

On the other hand, while driving organizational innovation, entrepreneurial orientation is likely to be influenced by the entrepreneur's ability and willingness to adopt new ideas and new technologies which is essential for inbound open innovation. Evolutionary economists believe a system promoting a variety of experimental solutions to economic problems may perform better than one in which the same imperfect rationality guides every firm (Nelson & Winter, 2002). This interpretation is clearly supportive of an entrepreneurially oriented regime complemented by a continuously learning culture, where experimentation is part of the practices and entrepreneurs are likely to adopt strategies that embrace innovation with their entrepreneurial orientation. Nevertheless, the choice and level of adoption will base on the personal characteristics of the entrepreneur and his understanding of such ideas or technologies. As such, learning and entrepreneurial orientations must be intertwined together to ensure the achievement of successful outcome in innovation.

1.5.6.4) Learning Orientation

Firms that can learn more effectively than their competitors possess the basis for more rapid improvement, which can translate into superior new product success, profitability, market share, and, perhaps, sustainable competitive advantage (Day, 1994). This is because innovation requires knowledge and in an entrepreneurial society, knowledge will have to be replaced or at least refurbished by new learning, new skills and new knowledge (Drucker, 2014). This requirement arises even when a strong knowledge base exists in organization for advancing technology because the process of learning, understanding and practice tend to advance together. In part of the economy where growth is driven by technological changes, such as Industry 4.0, behavioral foundations are built upon a cumulative learning-based view of organizational competence and its emphasis on the development of capabilities (Nelson & Winter, 2002).

Furthermore, the ability to learn needs to be managed so it can flourish under a learning organization and produce innovation. This is because in innovation, there is talent, ingenuity and knowledge but more importantly, innovation requires hard, focused, purposeful work supported by diligence, persistence, and commitment. Otherwise, talent, ingenuity, and knowledge are of no use (Drucker, 1998). Through training and goal-setting intervention programs, a learning organization can provide a platform for developing better transformational leaders because their behaviors can be changed in the expected direction through these programs (Barling et al., 1996). This clearly demonstrates the defining role of learning orientation in supporting any innovation driven industry and organization.

1.5.7) Associating Personal Characteristics and Management Elements with Innovation through Technology Readiness Index

Technology readiness index was originally developed to measure people's propensity to embrace and use cutting-edge technologies. Through the use of the questionnaire, TRI expanded researchers' understanding of how technology influence customers from a marketing and service perspective (Parasuraman, 2000). Since the introduction of various revolutionary technologies such as mobile commerce, social media, and cloud computing now becoming mainstream, TRI has also been updated to version 2.0 to be a more concise and robust tool in understanding respondent behavior when served by new and emerging technologies. In fact, TRI 2.0 was developed as a robust predictor of technology-related behavioral intentions as well as actual behaviors, aiming at accelerating scholarly investigations in understanding the link between perceived benefits of a new technology (e.g. innovation) and its actual adoption and use. The use of TRI 2.0 was also recommended for decision-oriented research in contexts where technology-based innovation plays an important role (Parasuraman & Colby, 2015).

As Technology Readiness is an individual-level characteristic that does not vary in the short term nor does it change suddenly in response to a stimulus, it gives our study important insight into the personal preference and propensity of the respondents towards innovation. This is because higher TR levels are correlated with higher adoption rates of cutting-edge technology, more intense usage of technology, and greater perceived ease in doing so. By looking at four independent dimensions, TRI 2.0 acts as a multivariate framework and helps to explain different dynamics between variables in a technology influenced context. Hence, through a consistent set of questions, TRI 2.0 will be used as an instrument in our study to assess the Technology Readiness levels within a group of top management and entrepreneurs to facilitate the understanding of the dynamics behind their decision on the adoption of

various technologies. In addition, activities related to pre-adoption, adoption-decision and post-adoption as well as innovation acquisition of innovation are evaluated from an organizational perspective while user related items such as user acceptance and actual use of innovation are part of the individual level examination (Hameed et al., 2012). This distinction actually supports our research structure, which assesses organizational factors through the performance of organization as a whole while the individual level examination is being collected in parallel by TRI.

Finally, within an inbound open innovation context, entrepreneurial orientation, learning orientation and transformational leadership demonstrated commonality in proactiveness, innovativeness, trust and efficient communication, corresponding to the factors measured by TRI. Entrepreneurial orientation is revealed through an organization's exhibition of risk taking, innovativeness, and proactiveness (Covin et al., 2006). It was also found that technology motivators corresponded to themes in the optimism dimension while technology inhibitors emerging from the forum corresponded to themes in both the discomfort and insecurity dimensions in the form of a lack of confidence in using technology, risks and perceived costs, concerns with security and privacy (Parasuraman & Colby, 2015). As innovation is both conceptual and perceptual (Drucker, 2014), TRI, a perceptual measurement tool itself, offers the potential to predict organizational performance operating in an open innovation environment.

1.5.8) Utilizing Performance Measurement for Assessing Inbound Open Innovation Outcome

Although open innovation has been a relatively new formal research topic, there has been a number of encouraging discoveries from different scholars. For example, knowledge sourcing through open innovation can offer direct performance benefits and is independent of a firm's internal managerial capabilities for innovation. It can either leverage the overall ecosystems for new ideas through deeply synergetic interactions with a diverse set of sources or taking an application-oriented approach which is more selective or just interact with distant partners along the value chain (Brunswicker & Vanhaverbeke, 2015). On the other hand, firms can simply involve external consultants in R&D outsourcing activities to directly acquire, embed and strengthen the impact of inbound open innovation on performance and reduces the level of influence by externally controlled inbound open innovation. This is particularly relevant for firms with relatively low level of R&D outsourcing expenditures and want to increase their product innovation performance on an ad hoc basis (Bianchi et al., 2016). Hence, the managerial approach taken by different firms could be reflected by the desired organizational performance outcome.

Nevertheless, engaging in external knowledge sourcing is a sensible move for SMEs as it offers performance benefits and can improve innovation performance through the success of launching an innovation and the appropriation of financial value from new products and services (Brunswicker & Vanhaverbeke, 2015). From an inbound open innovation perspective, it was found to have a mediating role in enhancing organizational performance because top management knowledge value indirectly and influences open innovation through knowledge sharing practices which enhances their organizational performance and benefits SMEs (Singh, et al., 2021). Networking was found to be another effective way to facilitate and enhance open innovation performance among SMEs as they can upgrade their innovatory capabilities through collaboration and inbound open innovation (Lee et al., 2010). Firms that are more open to external sources are more likely to have a higher level of innovative performance because

openness to external sources allows firms to draw in ideas from outsiders through inbound open innovation. This approach deepens the pool of technological opportunities available, enabling them to benefit from many external knowledge sources necessary to achieve innovation (Laursen & Salter, 2006).

Business performance, which is the outcome of strategic management, is a subset of the overall concept of organizational effectiveness. However, there is no single model that can encapsulate organizational effectiveness as a construct and this responsibility lies with the investigator to chart out the representation (Cameron & Whetten, 1983). The outcome of innovation is often measured by the organizational performance because performance is the time test of any strategy and managerial importance of business performance is clearly exhibited by the many prescriptions offered for performance improvement as the heart of strategic management (Venkatraman & Ramanujam, 1986). According to Man, Lau and Chan, firm's performance is the combination of effectiveness from three major entrepreneurial tasks. First, it is how entrepreneur's ability to perceive and conceptualize opportunity and identify relationships through the setting of appropriate vision. Second, his/her ability to organize resources to build capabilities such as innovative ability, quality, cost effectiveness and create and maintain flexible, organic organizational structures. Third, the ability of entrepreneur to set the right goal and strategy. All these competencies are tied together by the leadership ability of the entrepreneur through the setting of the firm's processes (Man et al., 2002). Therefore, performance, once again, is a product of leading and organizing resource, having the right strategy in place, identification of opportunity and building capabilities which is similar to the innovation management approach proposed by the 3H model.

Hence, our innovation performance assessment must include multiple dimensions because it is unlikely that any single corporate element could sufficiently capture the performance dimension, so our organizational performance is likely to be driven by a composition of dimensions. Financial measures are necessary but not sufficient to capture total organizational performance. Collection of several critical control variables, such as company age, size and risk, are particularly relevant to new ventures and small businesses (Murphy et al., 1996). Besides including financial metrics such as sales growth, profitability indicators like return on investment and return on sale or equity, we will expand our metrics collection to capture operational parameters such as new product introduction, product quality, staff stability and other measures of technological efficiency or value-added features to broaden the coverage of business performance (Venkatraman & Ramanujam, 1986).

By selecting a management framework which is consistent, easy to understand and not too complicated, core elements of innovation can be monitored so the implementation of innovation process can remain smooth (Yu, 2022). Therefore, our study will focus on using organization performance as our dependent variable to measure inbound open innovation as it is the causal result of the leader's ability to integrate our three independent variables of that organization, namely transformational leadership (Heart H1), entrepreneurial orientation (Head H2) and learning orientation (Hand H3). The causal relationship between entrepreneurial orientation, learning orientation and organizational performance is supported by research findings that either learning orientation (Wang, 2008) or organizational learning capabilities (Alegre & Chiva, 2013) positively mediates the EO-performance relationship especially for more entrepreneurial prospectors. In addition, a longitudinal study confirmed that transformational leadership

directly and positively predicted unit level performance and support for innovation moderated the relationship between transformational leadership and performance (Howell & Avolio, 1993). Hence, our 3H management elements, namely entrepreneurial orientation, learning orientation and transformational leadership, are causal relevant factors in determining organizational performance, justifying their role as our measurement variables.

1.6) Hypothesis

- 1) Managerial Optimism, as measured by TRI, has positive impact on Organizational Performance**
- 2) Managerial Innovativeness, as measured by TRI, has positive impact on Organizational Performance**
- 3) Managerial Insecurity, as measured by TRI, has negative impact on Organizational Performance**
- 4) Managerial Discomfort, as measured by TRI, has negative impact on Organizational Performance**
- 5) Positive Correlation exists between EO, Transformational Leadership, LO and Organizational Performance**

H5a – Entrepreneurial Orientation is positively related to Organizational Performance

H5b – Transformational Leadership is positively related to Organizational Performance

H5c – Learning Orientation is positively related to Organizational Performance

H5d – If Entrepreneurial Orientation, Transformational Leadership and Learning Orientation are all positive, organizational performance is also positive

6) Inbound Open Innovation Positively Related to 3 Core 3H Management elements

H6a –Entrepreneurial Orientation is positively related to the Level of Inbound Open Innovation

H6b –Transformational Leadership is positively related to the Level of Inbound Open Innovation

H6c –Learning Orientation is positively related to the level of Inbound Open Innovation

1.7) Method

1.7.1) Sampling of Data

The data of this study were gathered using Google survey form as the primary tool for respondent feedback collection. By offering participants an anonymous questionnaire, the survey was not only protecting the privacy of the respondents but also enable them to have a direct channel to provide results to the researcher and help to reduce common method bias (Podsakoff et al., 2003). The sampling period ran from mid-August till mid-December 2022.

1.7.2) Measures and Instrument Development

The entrepreneurial part of the survey is based on the instrument used by Wang (2008) which was originated from entrepreneurial orientation study by Miller (1983) and extended by subsequent studies (Covin & Slevin, 1986, 1989; Naman & Slevin, 1993) with the refined scale that is now known as the Miller/Covin and Slevin scale (Brown, Davidsson, & Wiklund, 2001). Wiklund (1998) identified at least twelve studies based on this scale, and these studies suggested that this measure is a viable instrument for capturing firm-level entrepreneurship. Proactiveness is assessed by asking managers about the firm's tendency to lead, rather than follow, in terms of developing new procedures, technologies, and new products or services (Covin & Slevin, 1989; Miller & Friesen, 1978). Firm risk taking is assessed by asking managers about the firm's propensity to engage in risky projects and managers' preference for bold versus cautious acts to achieve firm objectives (Lumpkin & Dess, 1996). Lumpkin and Dess (1996) innovativeness instrument was used to measure attitude towards innovation. In total, eight items were included in the entrepreneurial orientation scale. Details of the items are included in the Appendix One.

Our study also incorporated the learning orientation scale from Wang (2008) which was first developed by Sinkula et al. (1997) and retested by Baker and Sinkula (1999) who found further support for its validity and reliability. Nine items related to the learning orientation portion, which partitioned into three first-order factors (i.e., commitment to learning, open-mindedness, and shared vision), were used. Commitment to learning is measured through examining the extent to which firms place value on organizational learning and consider learning as an investment rather than expenses (Sinkula et al., 1997). Open-mindedness is measured through examining whether a firm critically reflects on existing assumptions and business processes (Sinkula et al., 1997). Shared vision is measured by examining the extent to which a firm holds a common goal at different levels and promotes a sense of direction (Baker & Sinkula, 1999)

For transformational leadership, instrument were adopted from findings of Avolio et al. (1999), Carless et al. (2000) Hitt et al. (1998) and Rafferty et al. (2004) while To measure the extent of inbound open innovation, we utilized established tools for Sisodiya et al. (2013) which has been utilized by Singh et al. (2021) and Popa et al. (2017) in their studies.

1.7.3) Survey Instrument Validation

Prior to finalizing the questionnaire design, two rounds of exploratory interviews were conducted. The initial survey instrument was reviewed by professionals in the high-tech industries but not founders or top management themselves. The updated instrument is then assessed by another seven top executives as part of Phase two design review to ensure all the questions are easy and appropriate understood. All feedbacks were subsequently incorporated in the final questionnaire.

1.8) Academic and Managerial Contribution of the Study

By positioning our study within the context of Industry 4.0, we are exploring how changes brought by technological advances drives inbound open innovation. At the same time, due to the moderating effect of cultural values found on the relationship between transformational leadership and leadership effectiveness (Spreitzer et al., 2005), the result of our findings should provide additional insight for top managers of Hong Kong companies when they need to consider how specific management elements may be affected due to the dynamic changes happening globally. On the other hand, by extending the evolutionary economic concept through the application of the 3H framework, our study will provide future scholars a credible yet simple view of how inbound open innovation may operate inside a high technology SME environment from an academic perspective.

1.8.1) Academic Significance of the Research

Although open innovation is very promising for management and proving itself to be a valuable concept for so many firms and in so many contexts, more integrated theories is needed so it can be absorbed and integrated into (innovation) management theories and existing management toolkits (Huizingh, 2011). The context dependency of open innovation is one of the least understood topics because it relates to both the transition towards open innovation, and the establishment of various open innovation practices within the organization. Initial studies focus on successful and early adopters may not be applicable to following firms because variations exist between those early adopters and the bigger follower populations so more research is needed to understand how the internal and external environment characteristics affecting performance (Huizingh, 2011).

On the other hand, Nelson and Winter observed that rapid technological advance in science based industries, where innovations are based largely on the work of one or a few individuals, offers potential breakthrough for entrepreneurial start-ups over larger competitors that may be more narrowly focus. Since ultimate dynamic for change comes from external forces such as new development of science or innovation by suppliers, the role of R&D within the industry is to identify, adapt and adopt new opportunities and innovation and commercialize them so even smaller firm could seize the new technological opportunity to beat bigger rivals (Nelson & Winter, 2002). This idea was also supported in the case of radical innovation, where the size of the firm appears to have no bearing on its innovative performance (Laursen & Salter, 2006). These observations are particularly encouraging for industries such as bio-tech, which is an emerging industry in Hong Kong.

In analyzing the importance of innovation at a national level, Acs and team concluded that at the country level, there is widespread acceptance that innovative processes exhibit systemic properties during their attempt to create a national entrepreneurship assessment index. Hence, it is likely the dynamics of entrepreneurship can also be categorized at the country/regional level since entrepreneurial performance is driven by complex, systemic interactions as well as regulated by unique contextual factors, such as culture, formal institutions and resource availability, which would likely vary across countries/regions and different time (Acs et al., 2014). Furthermore, international diffusion of SMEs innovations is becoming important for global economic welfare because startups and SMEs gain their comparative innovative advantage by exploring new technological area that may be overlooked by larger

firms so this helps to grow the diversity of technological innovation even though barrier related to cost and resources to expand is high (Acs & Preston, 1997). This existence of regional dependency supports our effort to address the need of conducting a Hong Kong focused entrepreneurship assessment.

Finally, formal economic models of evolutionary economists will focus on organizational learning, structure and co-ordination at an organizational level (Nelson & Winter, 2002). So far, evolutionary economics does not give a clear role of transformational leadership in driving innovation because business study theorists and economists have remained too far apart as Neo-Schumpeterian have not on the whole succeeded in developing a behavioral theory relating firm strategy to routines and rules of thumb (Freeman, 1994). Hence, through the coupling of transformational leadership, entrepreneur oriented strategy and execution supported by learning orientation, our study should contributed to the body of knowledge in evolutionary economics by including transformational leadership as part of their modelling consideration. This conceptual extension will bridge the knowledge gap, as highlighted by Freeman (1994), and possibly enable the convergence of evolutionary economists with management and entrepreneurial academics for future studies as suggested by the management model outlined by the 3H framework.

1.8.2) Managerial and Societal Relevance of the Research for Hong Kong

The uniqueness of Hong Kong as a global and regional innovation center located in Greater China will undoubtedly possess special characteristics which warrant an independent study rather than reusing previous studies. According to their research that examined the role played by technology and innovation in the design of business models in high technology SMEs in Hong Kong, Loon and Chik concluded that long-lasting business models must be both efficient and cost effective. Therefore, the use of sophisticated technology is an important way to increase the efficiency of business operations and this applies to both moderate and radical business models to enhance the ability to succeed (Loon & Chik, 2019).

However, facing new trends where global and national development are shifting towards a diversified and innovative economy, Hong Kong's traditional strengths, centering around financial services, trading and logistics, professional services and tourism, have been eroded under this new global economic landscape. While new engines of economic growth are yet to be developed, the employment prospects and career development of young people in Hong Kong are hindered. Hence, from a social and economic perspective, the re-industrialization of Hong Kong will serve both the social and economic goals for the new generations because it has never lacked scientists and business leaders but severely short of professionally talented workers required for reindustrialization. The diminishing manufacturing industry, that once flourished in the 1960s and 70s, has not only resulted in an imbalance in industrial structure in Hong Kong but also concealed damages, such as the loss or degradation of labor quality, traditional workmanship, craftsmanship, production expertise, supporting industries, and cooperative opportunities between academia and industrial sector.

Going forward, Hong Kong government policy will prioritize the use of technology, innovation and branding to enhance the capabilities of local companies. As such, our study is very relevant to the rejuvenation of the SME segment in Hong Kong as these enterprises have been relying heavily on its ability to reduce cost by innovating in the area of manufacturing, such as relocating to China, and marketing process rather than the use of technology. By understanding the attitude towards innovation, our study will contribute towards how policy can be adjusted by including more technology focused and value

adding components so more innovation can be fostered in Hong Kong to revitalize the local economy and business composition. Furthermore, the right policies, practices and measurements at the government level should create the proper attitude and provide the proper tools to foster entrepreneurship and innovation (Drucker, 1998). Hence, the collection of individual insight offered by the Technology Readiness Index should also aid the construction of a theoretical model that is capable of combining effective behavioral prediction into the forecasting of organization performance. By utilizing our model as the tool to identify and nurture an adequate amount of professional talents while the blue-collar work force is being revived through Industry 4.0, the economic landscape and success of Hong Kong can be re-established (Kan & Zhu, 2019).

1.9) Summary

Innovation itself is a multi-faceted process and requires understanding from a management, evolutionary economics and contextual perspectives. In our study, the contemporary context is Industry 4.0 and how it can be used as a vehicle by Hong Kong to rejuvenate its stagnant technology industries. On the contrary, evolutionary economists believe knowledge and entrepreneurial orientation are the key elements in driving corporate innovation success without suggesting how. This missing link can be addressed by utilizing the 3H framework, which introduces leadership as one possible and additional element to the evolutionary economic model. Hence, our study will utilize 3H framework which incorporates entrepreneurial orientation, learning orientation and transformational leadership as its core components during inbound open innovation perspective and try to address the challenges encountered by management, which have not been catered for by traditional evolutionary economics.

In addition, the productivity and prosperity of a location rest on how her industries compete. Firms can be more productive in any industry if they employ sophisticated methods, use advanced technology, and offer unique products and services. In fact, a study done by Chesbrough and Brunswicker indicated 78% of large companies were already practicing Open Innovation in 2013 and the trend was rising (Chesbrough & Brunswicker, 2013). Countries with relatively high levels of intrinsic learning capability and a small technological distance are more likely to catch up in the technological industry race. 'Intrinsic' learning capability depends on such variables as the education of the labor force and the quality of the infra-structure, and the technological distance between the technology receiving country and the technological leader (Verspagen, 1991). Since inbound open innovation can offer a step change solution (Chesbrough & Crowther, 2006) and the intrinsic learning capabilities of Hong Kong remains high, it is worthwhile to study the characteristics, management factors and related antecedents of inbound open innovation so it can be applied to enhance the long term competitiveness of Hong Kong. Therefore, our research will enhance the body of academic knowledge, especially in the area of open innovation, by exploring how major elements, such as strategy, leadership and execution, can be assessed through their antecedents and how they can be effectively combined and govern by a framework, such as 3H, under an inbound open innovation context to support organizational performance.

Chapter Two - Literature Review

2.1) Defining Innovation and its Implications

In recent years, rapid acceleration of technological development in such area as digital, material and energy are creating fundamental shifts in how product development happens in technology companies in general. Furthermore, due to the significant progresses in area such as Artificial Intelligence, 5G, Augmented and Virtual realities, it is becoming even more difficult for top management of SME technology companies to track and stay ahead of technological trends. In fact, the pace of technological innovation is still increasing, with more sophisticated software technologies disrupting labour markets by making workers redundant (Frey, 2017).

Although company may develop its own specialist knowledge as part of its competency, it will most likely utilize inputs from a wider range of expertise from other knowledge areas through the engagement of an inbound open innovation process. This is because development and production of modern industrial products must draw on a wide range of external ideas, component technologies and complementary capabilities due to the increasing complexity as it is becoming virtually impossible for any single firm to keep up to date of all relevant technological advances. Hence, it is becoming increasingly important for top management to understand the types of innovation exists today because organization specific choices of innovation strategy and business model may have to be made in a context of many unknown and unknowable factors (Christensen et al., 2005).

2.1.1) What is Innovation?

Innovation is the development and implementation of new ideas by people engage in transactions with others within an institutional order (Van de Ven, 1986). It is different from invention because invention implies bringing something new into being while innovation implies bringing something new into use. Innovation is important because organizations are interested in whether they can create something new for its own use or for exploitation by others. Innovation can also include the adaptation of pre-existing products or processes, or those created outside of the organization (Woodman et., 1993). Although organizational change can include innovation, much of organizational change is not innovation and creativity is also only a subset of innovation.

As a complex, multi-phased activity, innovation starts from initiation, adoption and concluded as the implementation of new ideas or activity in an organizational setting (Pierce & Delbecq, 1977). It is related to the search for, and the discovery, experimentation, development, imitation, and adoption of new products, new production process and new organizational set-ups (Dosi et al., 1988). Hence, innovation does not exist on its own and will constantly involve interaction in different manner or format and should be seen as a core activity to increase the responsiveness of services and products to customer needs and expectations rather than as an optional luxury or added burden. It happens when something new is introduced to marketplace with the potential to transform competitive environment or organization and usually occurs in conjunction with corporate venturing or strategic renewal. Innovation is a specific function of entrepreneurship (Drucker, 2002) and is also a core function within corporate entrepreneurship, driving both strategic renewal and how it exists is show in the figure below.

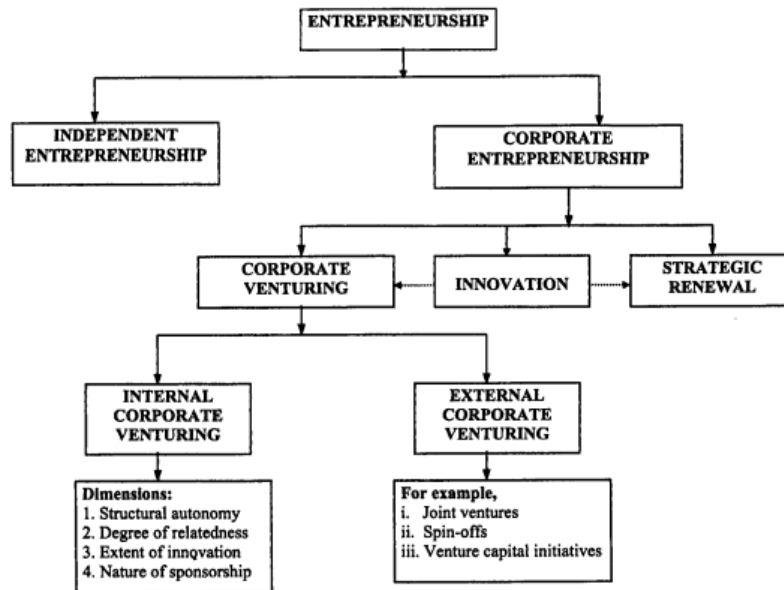


Figure 2.1 Hierarchy of Terminology in Corporate Entrepreneurship (Sharma & Chrisman, 2007)

Furthermore, innovation is the function of an interaction among the motivation to innovate, the strength of obstacles against innovation, and the availability of resources for overcoming such obstacles. It is also viewed as a multiplicative function of the motivation to innovate and the balance between the obstacles and resources bearing upon innovation (Mohr, 1969). Hence, in general, innovation can be seen as a product or service born out of an entrepreneurial vision to bring something new to the market, delivered by an organization that wants to transform the market through its unique capability and resource to create something different. As such to succeed in innovation, the organization must possess an entrepreneurial orientation, led by a transformational leader and supported by a learning oriented organization with a passion to acquire new ideas and execute changes.

2.1.1.1) Viewing Innovation through the Lens of Evolutionary Economics

Neoclassical models of growth assumes equilibrium exists and ignores such factors as structural changes in the economy, irrational behavior, information imperfection and selection of processes that may not be aligned to the equilibrium assumptions (van den Bergh, 2004). Through their study of the processes of adaptation, evolutionary economists, such as Schumpeter and Van den Bergh, suggested the evolutionary economics as an alternate path to study growth when changes occur because social and corporate optimum is no longer linking to market equilibrium. Corporation, industry structure, institution and society all evolve as part of the innovation system as technology advances (Nelson & Winter, 2002) and this is especially true under the landscape of Industry 4.0 because technology is the most significant factor in explaining the growth of output (Potts, 2000). Hence, rapid technological, organizational and institutional changes are now becoming the defining characteristics of the modern economy, making innovation an essential element in the lens of evolutionary economic theory.

In capitalist reality, competition and bombardment from new commodity and new technology is more effective than just price competition and innovation in the productive process is not likely to die out as long as the capitalist order persists (Schumpeter, 2010). Differential growth at the firm's level is the result of continuous interaction between innovation and selection of diversity by individual company

which itself creates a dis-equilibrating force, bringing alteration in structure and complexity with a non-equilibrium dynamic path of change. Therefore, economic development is the historical process of structural changes, substantially driven by innovation according to Schumpeter and successful innovation leads to both higher profit for the innovator and offers profitable investment opportunities. As the economy and company adapt to the environment and vice versa, economic and corporate growth is hard to occur without structural change which moves along with changes in the underlying distributions of technologies and firms. In a study of 400 Spanish firms, over 80% of respondents either adopt external innovation directly or combine their own with external ideas or imitation (Pérez-Luño et al., 2011). IBM and Polaroid are examples where management was being blindsided strategically as they fell into a habit of behavioral continuity and inherited strategies which only focus the internal elements within the organization (Nelson & Winter, 2002). Although Nelson and Winter suggested evolutionary economics could offer a framework, they failed to provide any further proposal. Eventually, through selection or reduction of variety, which can be considered an equilibrating and directive force, market will eventually settle back into a final steady state (van den Bergh, 2004).

There are five types of innovation according to Schumpeter including the launch of a new product or a new species of already known product, application of new methods of production or sales of a product, opening of a new market, acquisition of new sources of supply of raw material or semi-finished goods and the creation of new industry structure (Schumpeter, 1934) and all five types of innovation are part of mainstream product launching strategy today. The introduction of new commodities, new method of production or new commercial opportunities will revolutionize the industry and possibly create new industrial structure. This is because capitalist economy is not and cannot be stationary. Any existing structures and all the conditions of doing business are always in a process of change since economy does not expand in a steady manner (Schumpeter, 2010). As the processes responsible for generating new diversity, innovation and adoption is one of the five core elements and processes in evolutionary economics (van den Bergh, 2004), this implies inbound open innovation is part of evolutionary economics. The existence of ability in knowledge creation enables entrepreneurial organization to exploit new opportunity, launch new product or seize market share. In fact, evolutionary economists believe the heart of the economic development, that involves modern economies working together based on powerful technologies and effective modes of organization, is driven by the continuously evolving body of knowledge and related competence (Nelson & Winter, 2002).

Hypothesis 5c: Learning orientation enables better company performance

2.1.1.2) Potential modelling enhancement opportunities based on evolutionary economic theories

To neo-Schumpeterian economists, innovation varies enormously and is highly complex since the degree of variation is significant, depending on the industry, technology, type of system and process as well as the cost involved (Freeman, 1994). Furthermore, even though evolutionary economics offer a valuable lens for academics and management to analyze innovation under the dynamic business and technology environment brought by Industry 4.0 on a macro level, it leaves open the method of how entrepreneurs, their orientation, knowledge accumulation and development can work together to create sustainable competitive advantages for the organization. Managers should not create once size fit all solutions or routines for their operations but continually reconfigure or revise the capabilities they have developed when operating under an environment governed by evolutionary theory.

Evolutionary economics also enhance management appreciation of how technological progress and economic growth is driven by advancement in technology (Nelson & Winter, 2002). For instance, to retain end customers, product innovation usually comes from a firm's own R & D while process innovations likely come from the R & D done by suppliers and are embodied in their products (Nelson & Winter, 1977). As such, Nelson and Winter already acknowledging the value of inbound open innovation from a process innovation perspective. From this perspective, management need to understand the behavior of the firm, their capabilities and limits for adaptation in a changing environment so the right transformation can take place. Furthermore, economic system is not in equilibrium most of the time so explanations of observed configurations and their changes based on simple orthodox statistics, would be at best incomplete and probably misleading (Nelson & Winter, 1982). Hence, by seizing or discovering factors that can create dis-equilibrium, such as those occur during technological innovation, entrepreneurs can bring disruptions into the market and ultimately change the existing market order, achieving the wealth creation and distribution effect that can assist the advancement of our society.

Unfortunately, Neo-Schumpeterian have not be successful in developing a behavioral theory relating firm strategy to routines and rules of thumb because business studies theorists and economists have remained too far apart (Freeman, 1994: 486). This is because an entrepreneurial orientation alone may not be sufficient to dramatically improve strategic learning capability because the ability of creating an organic structure that can respond quickly to changing market conditions, and pursuing planned, well-crafted strategies function as critical intervening mechanisms is required to enhance the entrepreneurial orientation-strategic learning capability relationship (Anderson et al., 2009). Such structural change will need transformational leadership from top management who needs to be innovative enough to execute this vision through behavior changes within the organization.

Fortunately, in the case of innovation, selective development of certain capabilities based on decision rules of the firm corresponds to the inclusion of execution, strategy and leadership considerations while searching of knowledge itself is likely to result in external knowledge or ideas adoption similar to those demonstrated by inbound open innovation activities. This example of capabilities development through external knowledge sourcing is demonstrating one possible relationship between strategy, management behavior and innovation adoption which provides a reference to enhance the Schumpeterian model. Hence, tools that support the manipulation of interaction within the organization would be critical to ensure the success of innovation within the context of inbound open innovation. With its ability to analyze transformational leadership, execution and strategy, the 3H framework as shown below is one potential solution to drive changes within an inbound open innovation environment due to its simplicity and flexibility and the operating approach of 3H will be discussed later.

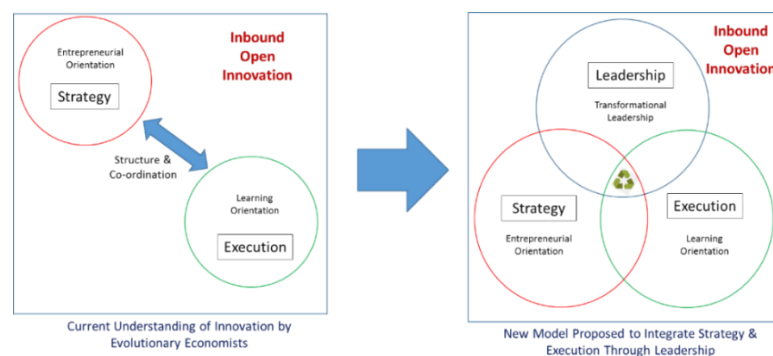


Figure 2.8 – Potential Extension of Existing Model Used by Evolutionary Economics

2.1.1.3) Understanding Innovation from a Macro Economic Contribution Perspective

The brutality of global competition is forcing many governments to rethink how innovation policies should be written to assist local industries to compete by including the diffusion, use and marketing of new technologies. In particular, the systemic version includes the concept of facilitating an innovation system which review and redesign the linkages between different parts of the system. This is essential because one cannot apply standard market assumption that all firms know what to pursue and governments need to acknowledge that competence is unequally distributed among firms because good work practice used for developing, absorbing and using new technology is not immediately diffused among firms (Lundvall & Borrás 2005). As such, inbound open innovation can act as an important approach to supply ideas and information for technology companies to survive and thrive because firm diversity is an essential aspect in creating economic progress since it can generate variety of new routines and shifts in resource allocation on which economic progress depends (Nelson, 1991).

In addition, the exponential opportunities for innovation presented by Industry 4.0 through smart, connected products, together with the huge expansion of data they create about almost everything, will be a net generator of economic growth. New industries, new services, and new roles will be created that can allow more people to meet their aspirations (Porter & Heppelmann, 2015). New routines may subsequently emerge as new services or products and seen as innovation which may disrupt the entire market and rebalance the economics as evolutionary economists advocate, making innovation an essential element in economic progress and the betterment of mankind. Furthermore, innovation can also contribute to sustainable economic growth by commercializing productivity-enhancing inventions and processes to make better use of labour and capital. It also expands the number and value of new products and services that people around the world are willing to buy (Rossle, 2015) which aligns well with the core of evolutionary economists from a global progression perspective.

2.1.1.4) The Global Technological Innovation Investment Landscape – A Regional Comparison

Technology innovation is becoming increasingly important in accounting for differences of growth performance and economic divergence between countries in the world (Fagerberg & Verspagen, 2002). At a global scale, innovation requires economic restructuring, and markets often do not manage such restructurings well (Stiglitz, 2014). In a macro level, innovation is critical for the long term conservation of resources and improvement of the environment in countries. Innovation goes beyond simply accelerating and sustaining the rate of economic growth but also to change the direction of economic advance and improving the quality of life of individual countries (Freeman, 2013). Without proper access to innovation, it will be difficult for any market or companies to stay in control of its own destiny and will only be devoured by the broader global environment. Hence, individual companies and industries in different countries need to make their own decision in the time of change and innovation. To emphasize the importance of digital Innovation at the individual level, the Joint Research Center of the European Commission conducted a study in 2015 on digital entrepreneurship and defined digital entrepreneurs as persons who can identify and exploit new ICT or ICT-enabled products, processes and corresponding market that generate value, through the creation or expansion of economic activity (Bogdanowicz, 2015). This is undoubtedly extending the definition of entrepreneurship into the age of Industry 4.0 where digital transformation is a major and dominating component.

Nonetheless, the pace and direction of innovation are the result of collective decisions made by firms even though they may not aware or take into account the general equilibrium effects. This change

will ultimately affect the evolution of wages and unemployment, resulting in patterns of learning and innovation choices that lead to more inequality and higher unemployment. Stiglitz has even created an economic model to show various possible outcomes due to innovation, including “elasticity of substitution” among skilled and unskilled labor, “labor augmenting technological progress” and innovation driven by capital investment known as “capital augmenting technological progress” (Stiglitz, 2014).

As an example on how to respond to such global change, the UK Government has committed to allocate £22bn through its R&D Roadmap by 2025 to support innovation (GovGrant, 2020). In China, an initiative called “Made in China 2025” was pledged by the government to secure China’s position as a global powerhouse in high-tech industries by investing towards technological innovation and smart manufacturing. These are examples of how different governments are acting to assist entrepreneurship and innovation through policies, practices, measurements that remove or reduce possible impediments while also provide rewards, incentives and compensation. As shown by the level of R&D spending as the percentage of gross domestic product, Western Europe, US and China has a definitive advantage in terms of investment in innovation (UNESCO 2020). In assisting the adoption and development of innovation, they are doing what Porter viewed as bringing in technology change through investment to bring in a structural change to create a competitive advantage at a national level.

Gross domestic expenditure on R&D as a percentage of GDP, 2018 or latest year available

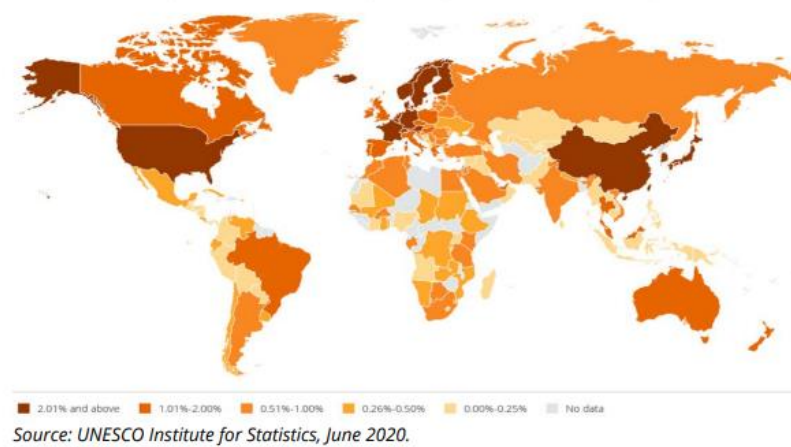


Figure 2.9 Snapshot of R&D Intensity (UNESCO 2020)

In their submission to the British government in 2003, Mulgan and Albury concluded that innovation should be a core activity of the public sector as it offers opportunities to improve performance and increase public value by responding to the expectations and needs of citizens, thereby increasing overall service efficiency and minimize costs. They further defined successful innovation as “the creation and implementation of new processes, products, services and methods of delivery which result in significant improvements in outcomes efficiency, effectiveness or quality” (Mulgan & Albury, 2003:3). Governments around the world are also supporting innovation activities either through direct tax incentives or various programs. According to OECD, indirect tax-based support measures offered by governments, which are not part of R&D budget estimates, have been increasing steadily in recent years and often exceeding direct government support. Support for “industry and knowledge” which includes industrial production and technology, has been the fastest growing category, reflecting greater emphasis on non-directed forms of R&D support (OECD, 2021). The ultimate goal is to create a structure that allows people to be entrepreneurial and devise relationships that center on entrepreneurship (Drucker, 2014).

Estimates of total government support for R&D by SDG-related cluster categories, 1990-2019

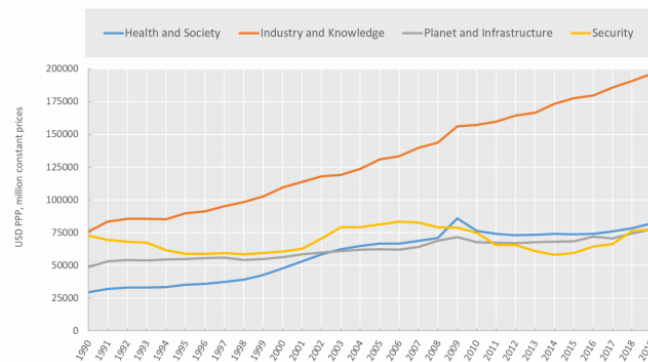


Figure 2.10 Estimates of total government support for R&D by Sustainable Development Goals -related cluster categories, 1990-2019 (OECD, 2021)

By studying 4000 innovative firms in the U.K. over four decades from 1945 to 1983, it was shown that the average size of innovative firms is increasing, but the average size of divisions within those firms is decreasing. The size of innovating divisions has diminished sharply over the period. Formation of division improves the “goodness of fit” between the core business of innovating divisions and the innovations themselves (Pavitt et al. 1989). Hence, it appears that large innovative organizations are forming smaller and more specialized divisions to create the required agility, flexibility and autonomy needed for innovation while maintaining the advantages associated with large size (Damanpour 1992). This is encouraging for Hong Kong SMEs as it proves the rise of Google, founded 1998, and Amazon, formed in 1994, from small to giant companies are no accident and can be replicated as key success factors of innovation are routed in smaller size teams or organizations as long as the right condition is available.

Finally, in a study of diffusion amongst 29 disruptive technologies across firms and labour markets in the US, the locations where such technologies arise are highly concentrated around those existing technology hubs. They also plotted against the speed of technology diffusion over time years and indicating existing hubs are still likely to remain relevant even after a few years of technology diffusion.

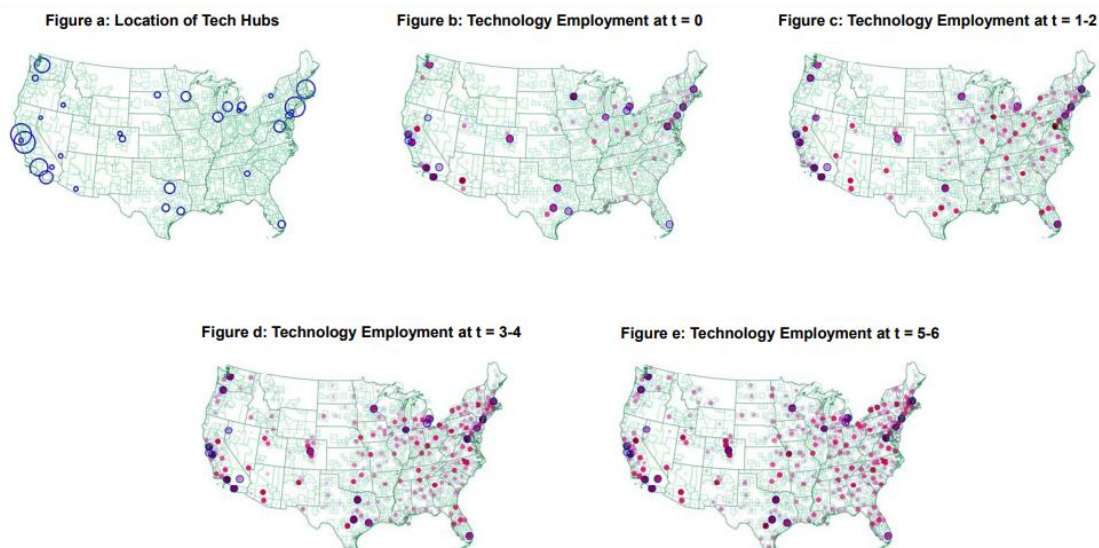


Figure 2.11 Technology Diffusion from Existing Hubs (Bloom et al., 2021)

As a particular technology matures and gradually spread across the country over time, the speed of diffusion for lower-skilled hiring is faster while higher-skilled hiring spread much slower from the locations where initial discoveries were made over the same period. This enables more innovative locations to retain their leading positions among high-paying positions for decades (Bloom et al., 2021). The existence of these individual clusters enable connections across firms and industries which is fundamental to competition, to productivity, potentially driving the direction and pace of new business formation and innovation. The advantages of a cluster in new business formation can also play a major role in speeding up the process of cluster innovation either through the establishment of new companies or spin-off from larger companies (Porter, 2000). For an economy like Hong Kong, which virtually has no natural resources, higher order, complex and intangible resources such as organizational culture, knowledge, competencies and superior innovation serve as the key to its success (Hunt & Morgan, 1995). Hence, it is critical to create such technology cluster environment based around Hong Kong so she can remain as an innovation hub in order to protect its higher paying jobs as we move further into the Industry 4.0 era.

2.1.1.5) Economic Implication of Innovation under Industry 4.0

Viewing global economic growth through an evolutionary lens suggests that radical innovations are important for economic growth especially for changes in trend growth (Fagerberg & Verspagen, 2002). A lack of business innovation may also stifle technology innovation (Dyer, Gregersen & Christensen, 2011). This is exactly the situation facing the high technology SMEs globally today under Industry 4.0 which is a significant opportunity for those entities that can innovate successfully. However, evolutionary process and variety would be at a maximum during the early stage of an industry since the majority of issues related to the technology and design is under optimization or unresolved (Nelson & Winter, 2002). Through the emergence of new technologies, major innovations develop and sometimes transform sectors, resulting in the creation of new workforce structures, new types of organization, new relationships between organizations and step-change in overall performance (Mulgan & Albury, 2003).

The economic potential of creating new industries with additional efficiency while giving everyone a more convenient and comfortable life through Industry 4.0 is also well publicized by research organization and commercial firms such as World Economic Forum, Deloitte, Ernest and Young, Vodafone Group, Cisco, Microsoft and McKinsey (Porter & Heppelmann, 2015). Industry 4.0 is just another example of modern technology disruption and similar to how wireless services disrupted broadcasting by intensifying competition in broadcast industry through the creation of new entrants enabled by technological innovations (Grimm et al., 2006). The economic importance of innovation within Industry 4.0 as seen by famous investor Catherine Wood is the “convergence between and among innovation platforms and technologies seems to be throwing economic and company forecasts for a loop, particularly in the developed world which is saddled with mature infrastructure” and “staying on the right side of change will determine success and failure not only in investment portfolios but also in careers, companies, and countries” (C. Wood 2020). Historical support for her statement can be drawn through data provided by the UN Human Development Index for OECD countries in the figure below which shows the extent to which different industrial revolutions have contributed to growth, health and education outcomes, supporting the rising quality of life since the first Industrial Revolution (Schwab & Davis, 2018). This is well aligned to the summary provided by World Economic Forum which stated each phase of industrial revolution is going to create new industries and new technologies that may not be visible previously.

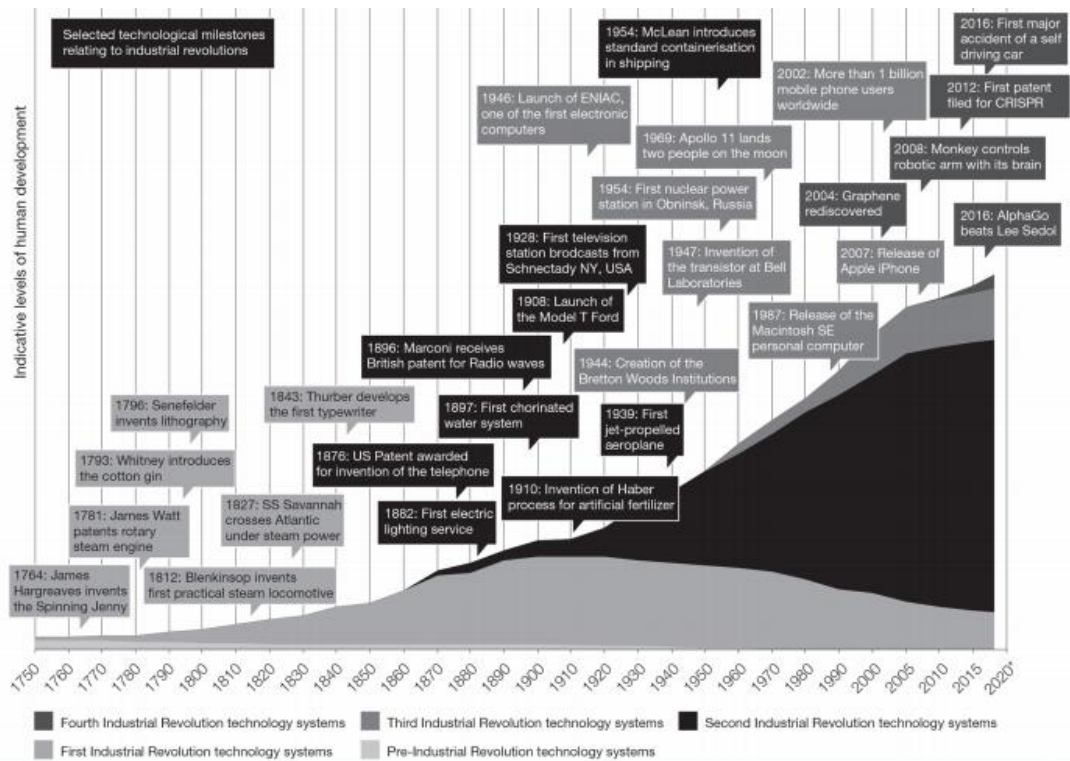
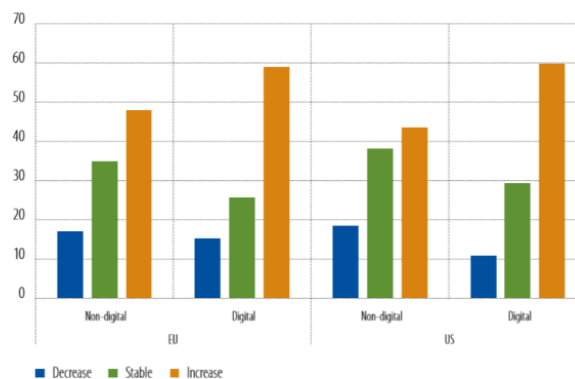


Figure 2.13: Illustrative Contribution of Industrial Revolutions to Human Development: OECD Countries 1750–2017 (Schwab & Davis, 2018)

In addition, products will evolve into intelligent, connected devices and become increasingly embedded in broader systems to radically reshape companies and competition due to the technological advances in Industry 4.0 (Porter & Heppelmann, 2015). Technologies will scale exponentially, emerge physically and embed themselves in our lives, challenging human to adapt to its disruptive impacts due to the complexity of technologies involved plus the speed new technology scales (Schwab & David, 2018). Moreover, digitization in Industry 4.0 translates into innovation productivity gains, increased regional entrepreneurial activity, and broader economic and social gains which no country or region can overlook (Kenney & Zysman, 2016). The benefit of digital adoption is higher employment growth rate over the 3 years prior to 2019 in both EU and US (European Investment Bank, 2019).

Share of firms with negative, stable and positive employment growth over the past three years (in %), by digital intensity



Source: EIB calculations based on the EIB Investment Survey (EIBIS wave 2019).

Figure 2.12 Employment Growth of Firms by Digital Intensity in EU & US European Investment Bank, 2019

From a social responsibility perspective, the conservation of resources itself is a mean to extend the competitive advantage of any company or country through cost and/or environmental preservation so innovation is supporting a cycle of national competitiveness. It appears inbound open innovation hold the key because economic innovation performance was found to positively correlate with sustainability innovation performance and both are positively associated with higher open innovation collaboration intensity with external customers (Rauter, et al., 2019). It was predicted that the Fourth Industrial Revolution offers further opportunities for mankind to enjoy the existing benefits of three prior industrial revolutions and continue the upward climb in human development, as illustrated in Figure 2.14 (Schwab and Davis, 2018). Furthermore, empirical evidence suggests that new ventures benefit more from innovation than mature SMEs (Rosenbusch et al., 2011). Hence, the significant impact and benefit offered by innovation, especially for SMEs, must be understood by economists and government policy makers to allocate the right support to ensure the continuous success into the future. This also provided additional motivation for our study.

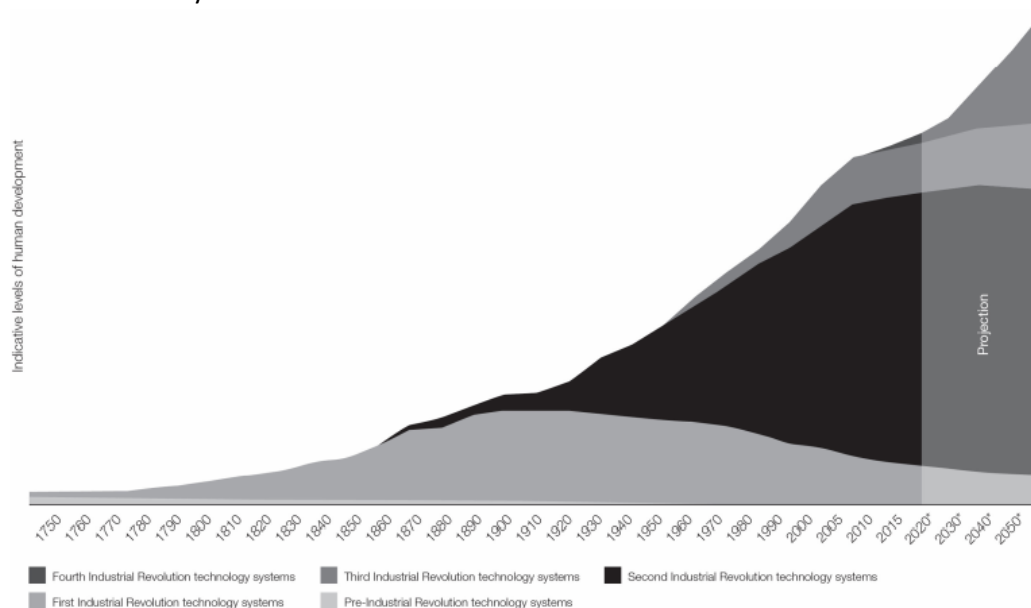


Figure 2.14: Illustrative Contribution of Industrial Revolutions to Human Development to 2050 (benefits realized) (Schwab & Davis, 2018)

2.1.2) Comparing Different Forms of Innovation and their Implication to Competitiveness of Firms

2.1.2.1) Definition of Open Innovation

Open innovation is one form of innovation which itself composed of inbound open innovation and outbound open innovation. Inbound open innovation happens when organizations adopt ideas or technologies from external parties for product development or enhancement. Conversely outbound open innovation takes place where organizations share their own expertise with others, normally at a price through licensing or some form of strategic alliance. Open innovation is important because competencies for innovation are distributed throughout a network of actors and their links or relationships, it is a system which consists of a network of institutions in the public and private sectors, consists of customers, subcontractors, infrastructure and suppliers. It also consists of competencies or functions and links or relationships, whose activities and interactions initiate, import, modify and diffuse new technologies (Mazzucato, 2011). Furthermore, open innovation is a powerful value creation engine because internal

efforts will be multiplied many times through embracing external ideas and inspiration. The benefit is long lasting even though organization still needs to conduct internal R&D activities to resolve complex interdependencies among promising technologies in order to create architectures to advance them later on (Chesbrough, 2003).

Although the concept of open innovation was formalized by Henry Chesbrough, Webster also proposed similar idea through his network organization and confederation of specialists approach in 1992. In fact, one of the key core competencies of a network organization is the ability to design, manage, and control strategic partnerships with customers, vendors, distributors, and other (Webster, 1992). This clearly echoes the key concept of open innovation where various partners work together to enhance each other's competitive advantages and profitability.



Figure 2.3 Network Organization – (Webster, 1992)

From the view of Chesbrough and other academics, open innovation is alive and continuously evolving from a strategic, leadership and cultural perspective as shown in figure below (Enkel, Bogers & Chesbrough, 2020). Hence, by including Webster's belief that execution is one of the key competencies, open innovation is providing a context where strategy, leadership and execution are all important elements for success and this resonates with the 3H approach.

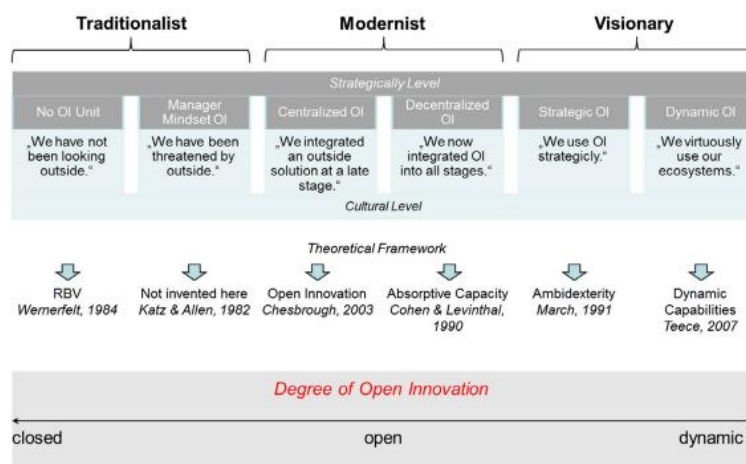


Figure 2.2 - Maturity framework of open innovation (Enkel, Bogers & Chesbrough, 2020)

2.1.2.2) Extending the Depth of Open Innovation by Leveraging Inbound Open Innovation

Inbound open innovation is a subset of the open innovation process and is an outside-in process where company can enhance its knowledge base and capability through the integration of external knowledge from suppliers, customers, and other sources to increase a company's innovativeness (Gassmann & Enkel, 2004). This occurs because difference between firms' product and knowledge expertise creates opportunities for knowledge trading to achieve fuller utilization of knowledge and an example of such knowledge trading between un-related companies is through strategic alliances (Grant, 1996). As inbound open innovation is not necessary bounded by or aligned to any internal pre-assumptions within the organization, it may become the new game breaker. This removal of boundary will not only broaden the minds but also increase the speed and the chance of success towards new technology adoption.

Through initiating the pursuit and evaluation of new ideas, top management may be able to make effective use of existing insight to explain and predict various scenarios for organizations. Furthermore, instead of only focusing internally, advice, capabilities and requirement of customer and suppliers can now serve as new insight for management to enhance the offerings of organization against other competitors under an inbound open innovation context. Since inbound open innovation is more relevant to the business nature of high technology SMEs in Hong Kong, our study will focus around inbound open innovation. The characteristics of inbound open innovation process includes corporate strategy planning activities such as external collaboration and intellectual property acquisition. It also includes internal execution activities such as staff training and knowledge transfer and is summarized in the figure below.

Characteristics:	Outside-in process:
- low tech industry for similar technology acquisition - act as knowledge brokers and/or knowledge creators - highly modular products - high knowledge intensity	- Earlier supplier integration - Customer co-development - External knowledge sourcing and integration - In-licensing and buying patents

Figure 2.4 Characteristics of Inbound Open Innovation Process (Gassmann & Enkel, 2004)

2.1.2.3) Disruptive Innovation as a Mean to Enter Established Markets

In matured industries, companies need to be managed to maintain leadership position in a few but crucial areas to support flexibility and rapid change, especially where the demand needs to be satisfied at substantially lower cost through advanced technology or advanced quality. With better financial strength, large firms tended to spend more on R&D than smaller firms, leading to bigger firms growing larger and to spend even more on R&D if the innovation was a success. Established industry leaders will try to extend the lifecycle of their innovation through the development and introduction of sustaining innovations (Christensen, 2016). The conventional process of learning, refining and specializing within organizations means delivering incremental innovation within a specific product category to existing customers is a key strength of an in-house R&D models.

Theoretically, there is a possibility competition will self-destruct and give way to long lasting monopolies. Successful organizations are generally fertile of incremental or cumulative innovations,

allowing them to stay ahead of competitors without making significant changes. This is particular the case when the market dominance of a successful product is protected by the organized research and development efforts of firms, which act as the source of innovation so competitors will remain laggards before an innovation can be imitated. However, matured industry also needs to have the ability to shift from one way of satisfying wants to another by incorporating alliances, partnerships and joint ventures, which are all part of inbound open innovation, to adapt rapidly to such shifts.

In comparison, Christensen and others suggests that the in house research models are far less effective at creating and adapting to disruptive products for entirely new markets. One can also relate disruptive innovation to Schumpeter's example of industrial mutation and the process of creative destruction. Creative destruction is an essential fact about capitalism and business which revolutionize the economic structure from within, destroying the old one and creating a new one (Schumpeter, 2010). Disruptive innovation can also be a competence or capability-destroying breakthrough, which bring major changes or improvements for the current process or technologies (O'Reilly & Tushman, 2021). Hence, a disruptive model fits nicely into the industry landscape foreshadowed by the technologies disruption due to the Fourth Industrial Revolution. This happens because technological focus of incumbent is too narrow and becoming reliant on cumulative innovation, leaving niches open to new entrants that can mount broader challenges by extending the technology application (Nelson & Winter 2002). This is particular the case when current leaders are dominating the mature stage of the overall product life cycle.

To tackle market gaps in established markets, new entrants can utilise disruptive innovation by addressing the less profitable segments that may be overlooked since incumbent companies normally overshoot market needs with high end solution. For instance, many mainstream customers only need lower specification product and want to avoid paying an extra premium for something higher than their requirement. Hence, an open window with a more streamlined specification at lower cost becomes available for new entrants (Christensen, 2015).

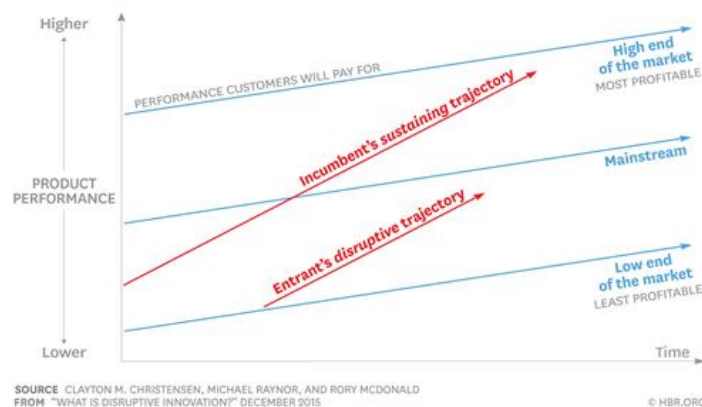


Figure 2.5 Disruptive Innovation (Christensen, 2015)

Furthermore, from time to time, organizations generate or adopt "radical" innovations without changing the overall dynamics of the sectors but able to achieve marked improvement in performance through different modes of working, which could alter the expectations of customers and users (Mulgan & Albury, 2003). These different modes of working also represent opportunities where both open and disruptive innovation can contribute when it comes to attacking established markets. Examples of

products fitting this approach will include the Electric Vehicles market since established non EV players such as GM and Ford have their existing infra-structure and sales network. Hencing entering such market for these incumbent will only incur lower entry investment cost, making the adoption of radical innovation an interesting business approach.

2.1.2.4) Composable Innovation – A Commercial Consultant Perspective

Besides suggestions from the academic world, commercial consultants, such as Gartner Research, have also been promoting the concept of business composability through the application of modularity and interchangeable building blocks to replace any business asset. These modules ranges from people, processes and technologies to physical assets coming from internal or external sources of the organization. Leaders can quickly, easily and safely recompose and re-orient these assets to create new value in response to disruption. This approach encourages continuous exploration and creation of disruptive business capabilities through the adoption of different modules as a mean to create new competitive advantage. As such, composable innovation is similar to the inbound open innovation as both focus on implementing a modular configuration approach to enable the adoption of various technology or process. Comparison between traditional business orientations against the composable approach is shown below.

Traditional Orientation		Composable Orientation
Efficiency	Goal	Flexibility/agility
Cost leadership at scale	Value	Highly attuned to business environment
Technology automation drives efficiency and scale	Approach	Composable technologies enable multiple outcomes simultaneously
Plan-driven, approval-based, safe	Governance	Distributed, emergent, empirical, continuous, calculated risk
Conventional enterprise services	Sourcing	Composable (low-code, no-code services)
Generalists and specialists	Talent	Flexible “versatilists”
Values low-risk, predictable execution	Culture	Values rapid responsiveness to environmental change
Long (months)	Cycle Times	Hybrid long and short*

Figure 2.6 - Traditional Versus Composable Approach (Costello & Rimol, M., 2021).

To demonstrate the benefit of composable innovation, organizations with high composability was able to act faster and be more effective during the pandemic. They were better at developing new partnerships, pursuing new opportunities, offering innovative products and being more responsive to customers, clients and citizens. Higher relative performance was found when greater level of business composability is presence as shown in the figure below. This gives clearly support of how inbound open innovation can improve organizational competitiveness from a commercial perspective.

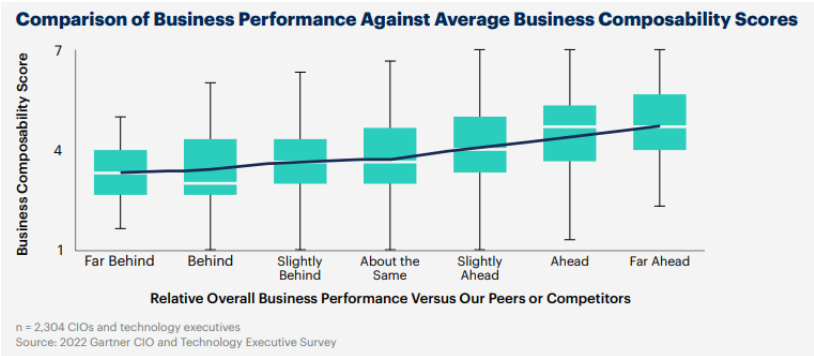


Figure 2.7 - Comparison of Business Performance (Costello & Rimol, 2021)

2.1.2.5) Summary

Incorporation of open innovation and inbound open innovation involves making strategic decisions to create favorable process to seize opportunities, create disruption and enhance diffusion of information. Sources of innovation can be derived purely from internal or external competences by enabling the firm to integrate external knowledge within its own operating boundaries (Di Stefano et al., 2012). Due to the emergence of functions that may not be typically considered as core to R&D a few years ago, many companies now rely on working with external partners, such as hardware and chipset suppliers. Hence, it is becoming essential to investigate and validate how innovation adoption commenced in high technology companies as a way to sustain and drive the development of new technologies and products.

Open innovation is more suitable for dynamic and highly competitive environments (Huizingh, 2011) such as those experienced by high-tech SMEs. An open innovation approach also provides a great opportunity for the application of Roger's Diffusion of Information Theory and Christensen's Disruptive Innovation theory so top management need to have the corresponding knowledge to execute. Since there is a higher chance of success using inbound innovation adoption, it would be important for management to understand how it operates from a business operation perspective. On the other hand, existing knowledge of firms rapidly becomes obsolete in dynamic environments (Teece, 2007) so it is also valuable for our study to understand it from an academic perspective. Hence, our subsequent analysis will focus on using inbound open innovation as our research context.

2.1.3) The Importance of Competitive Advantages in an Inbound Open Innovation Environment

Innovation, flexibility and responsiveness is widely regarded as a critical source of competitive advantage in an increasingly interconnected global environment (Dess & Picken, 2000). However, the nature of competitive advantage is continuously shaped by waves of technological and economic changes due to the ever evolving business landscape. The new organizations of the 21st century is bringing in dramatic changes and affecting the world of work, increasing global competition and shifting from vertically integrated hierarchies to networks of specialists due to events such as the arrival of Industry 4.0. Any given innovation depends on accompanying change in the firm's environment for its own success because the focal firm exists within an ecosystem of interdependent innovations (Adner & Kapoor, 2010). This concept is precisely the center piece of inbound open innovation which offers similar benefit of clustering as suggested by Porter (Porter, 2000). Furthermore, the changing environment is giving more opportunities to smaller companies that employ fewer people by revolutionizing the paradigm of doing business while breaking traditional practices from making a product to providing a service (Cascio, 1995).

Enterprises that choose to adopt innovation can create competitive advantages in the core elements of their business compared to their competitors. For instance, Covid-19 has created major disruption in business operations while enabled the rapid growth of internet based business with emphasis on remote interaction. In other scenarios, innovation is not just about saving a few dollars off the bottom line but is fundamental to how product offerings excel in the market. One example is in the car insurance industry, where the adoption of connected devices in drivers' vehicles, allowed insurer to have a better understanding of driver's behavior and can adjust their insurance premium accordingly. These are clear examples of how inbound open innovation can create new competitive advantages for companies and will be reviewed in more details below.

2.1.3.1) Establishing Competitive Advantages for Company through Innovation

A firm's competitive advantage depends on its ability to create more value than its rivals and value creation depends on the firms' ability to innovate successfully. All innovation begins with creative ideas and the implementation of new product, program or services are driven by good idea (Amabile et al., 1996). A well lead innovation is important for development of competitive advantage (Porter, 1990) because competition is dynamic and competitive advantage rests on innovation and the search for strategic differences (Porter, 2000). Schumpeter believed innovation is an essential driver of competitiveness (Śledzik, 2013) so organization must be innovative to survive in a volatile environment (Calantone et al., 2002) such as those in the fast changing high technology industry. For an organization to sustain its competitive advantages, it must continue to innovate to adopt to the changing environment and this applies also to leading companies like Apple, Facebook, Amazon, Microsoft and Google which adopt innovation from the broader ecosystem via a corporate venturing approach to maintain their competitive advantages (Sawers, 2020). For example, Apple CEO Tim Cook even told media that his company "buys a company every two to three weeks on average" back in 2019 (Feiner, 2019) which is a type of inbound open innovation.

In a recent survey of general managers conducted by Gartner, better use of advanced technology, through the new combinations of technology, value and sales experience, has been identified as their key enabler for them to grow beyond their core competencies and faster than competitors (Costello & Rimol, 2021). Creation of strategic advantages through external sourcing requires the integration of external activities and technologies. Its importance is recognized by the growing research on strategic alliances, virtual/online corporation, technology collaboration and closer buyer-supplier relations through outsourced manufacturing (Teece, et al., 1997). Hence, organizing the use of technology is definitely playing an important role for management to establish competitive advantages in the Industry 4.0 era.

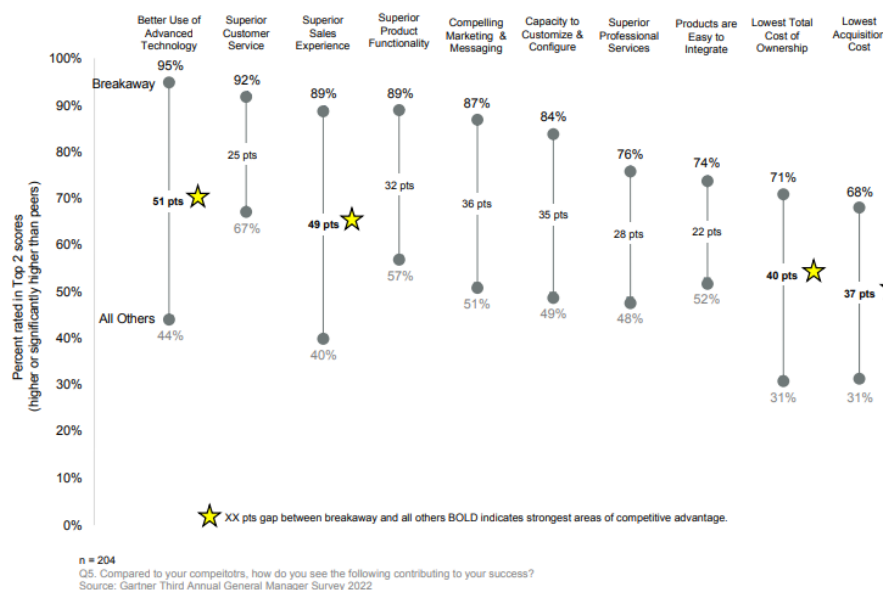


Figure 2.17 - Sources of Competitive Advantage (Costello & Rimol, 2021)

Moreover, competitive advantage manifests itself in being different from others because it can be noticed and valued by customers and this is supported by innovation which is a value-added novelty in economic and social spheres. This is achieved by the renewal and enlargement of products, services, and

markets, as well as the development of new methods of production and establishment of new management systems (Crossan & Apaydin, 2010). Established products are destined to be overtaken by invading products that is driven by continuous innovation based on the S-Curve model (Foster, 1986). Hence, for any company to remain competitive, it must stay ahead of others by introducing invading products before it has been overtaken during its product lifecycle (Foster, 1986; Christensen, 1992).



Figure 2.15 Technology/Marketing S-Curve Phenomena (Foster 1986)

Different technology organizations have conducted various studies to investigate the effectiveness of different innovation adoption strategies in order to sustaining their competitive advantages. Large corporations, such as GE and Boeing, have restructured their innovation strategies and practices to respond to new technologies brought by digitalization as the infusion of these new digital technologies has removed certain uncertainty in both processes and outcomes (Nambisan et al., 2019). Besides in-house innovation development, other form of innovation adoption have been proposed by research institution like IESE, commercial organizations like Telenor and Vodafone, as well as consultancy firm like McKinsey. Based on their survey of 1430 qualified respondents involved in shaping the suppliers and company technology requirements, Vodafone highlighted the benefits of innovation adoptions reported and result is shown in the figure below.



Figure 2.16 What Benefits are you seeing as a result of implementing IoT (Vodafone 2019)

In summary, many innovative companies, governments and civil organizations are now combining new technologies in new products, services and processes to reshape existing ways of delivering value. Being a technology leader nowadays means adopting innovation strategies in a collaborative manner. In particular, technology leadership in the Fourth Industrial Revolution will require working with a wide range of external partners. These partners could range from young, dynamic and entrepreneurial firms, academic institutions or organizations in entirely different sectors that offer radically different perspectives, approaches or market access (Schwab & Davis, 2018). This approach is in fact well aligned with the Open Innovation strategy proposed by Chesbrough under inbound open innovation in particular.

2.1.3.2) The Role of Inbound Open Innovation in Creating Competitive Advantages in Industry 4.0

According to multiple innovation studies, the ability to make use of external sources of scientific expertise and advice was one of the main determinants of success (Freeman, 1994). Leaders are also picking areas to innovate while also borrowing from other areas because they are not trying to invent everywhere (Bryan, 2020). This approach is important because within the Industry 4.0 context, no one group can tackle the challenges alone nor can these issues be resolved solely through the use of technologies. Moreover, empirical studies have shown externally generated scientific discoveries and advances are playing important roles in technical innovation at firm level. Making contacts with the world of science, which leads to the increasing interdependence of science and technology, are becoming area of great importance for knowledge accumulation and the creation of sustainable competitive advantages.

Large firms in OECD countries with intensive R&D appear to be less interested in increasing their R&D investments. Furthermore, larger firms today often prefer to license higher risks technologies or outsource the most risky parts of new product development to small high-tech companies, which operate at arm's length but can be taken over once proven to be successful. They may even try to reduce the risks involved in carrying out R&D by collaboration with others through publicly sponsored or enabled programmes, such as SEMATEC and IMEC in nano-electronics, or through so-called open innovation collaboration (Freeman & Soete, 2009). In a Cisco led study, which surveyed 1845 IT and business decision makers, 60% of the respondents believed forming partnership is critical for the success of IoT projects. Organizations with the most successful IoT initiatives leveraged ecosystem partnerships most widely, implying strong partnerships throughout the process can smooth out the learning curve (Cisco, 2017). Technology innovation can also be expedited through adoption either in the form of partnership, partial investment or tech ventures or by full acquisition of the company (IESE 2019). This is clearly confirming the advantages of inbound open innovation for organizations, echoing a growing trend toward opening the innovation strategy and avoid being at a competitive disadvantage by not responding.

By participating in open innovation as part of the value chain, firm needs to captures enough value to assure its viability during the joint value creation process (Christensen et al., 2005). Close linkages with buyers, suppliers, and other institutions are important for both efficiency and the rate of improvement and innovation (Porter, 2000). More importantly, the openness of R&D management in the inbound open innovation process was found to be crucial for achieving effective output in direct and indirect innovation. In particular, openness towards customers, suppliers and universities has a significantly positive impact on the different innovation performance measures (Inauen & Schenker-Wicki, 2011). Through partnering with other firms, alliances can result in knowledge accumulation, create new growth opportunities, and enable partnering firms to achieve their strategic objectives (Zollo et al., 2002). Other scholars have

subsequently conducted research based around Porter's value chain theory in highlighting the importance of open innovation. One particular study relating to Industry 4.0, Internet of Things and Porter's value chain theory was done in Hungary by Nagy and team (Nagy et al., 2018).

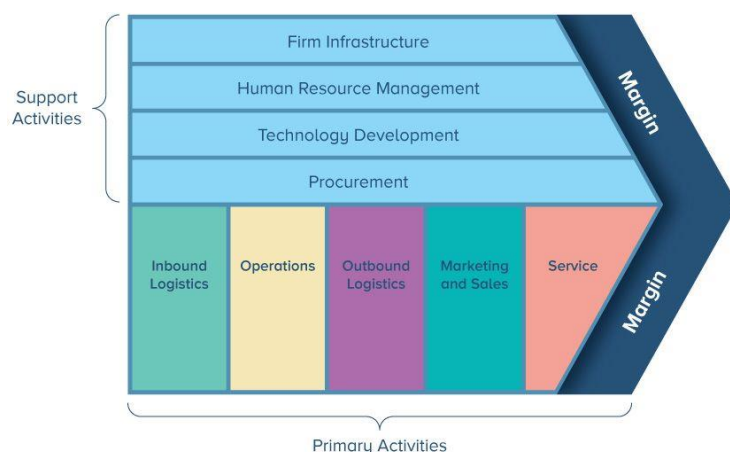


Figure 2.18 Porter's Value Chain (Porter, 2008)

As top management needs to take a broader view of the collective priorities and work on strengthening the areas where positive changes can be created by collaborating and co-operation (Schwab & Davis, 2018), an inbound open innovation strategy is becoming important in Industry 4.0. This is because the time gap between revolutionary events for high-tech industries is very short and revolutions are triggered by discontinuous environmental shifts which breaks incremental change and continuous improvement (Tushman, 1997). Looking inward, hierarchical structures of companies will be more networked and collaborative within the Industry 4.0 environment. Motivation for excellence and independence will be increasingly driven by the collaborative desire of employees and management. Businesses will become increasingly organized around distributed teams, remote workers and dynamic collectives, where continuous exchange of data and insights about the things or tasks being worked on will play a key role (Schwab, K., 2017). Significant value can be created for both parties if firms share resources through collaborative innovation. This is equally applicable for the economies in which such collaborations take place (Rossler, 2015).

By endorsing a more networked, distributed and collaborative organizational context, Industry 4.0 is offering firms, especially SMEs due to their limited resources, the opportunity to enjoy the benefit of inbound open innovation and establish competitive advantages by adopting the composable based approach for innovation adoption. In addition, if the core technologies of the company can be part of the foundation within the innovation platform, it can also enjoy the commercial benefits when other parties residing in the same value chain join the platform by investing development or financial resources to expand the ecosystem together. Participating firms may eventually reap the benefit of success by potentially unlocking a significantly greater set of resources available to all parties involved rather than doing it alone (Chesbrough, 2007). A prime example is the semiconductor industry where companies like ARM and TSMC are benefited by the ever expanding ecosystem driven by Industry 4.0.

2.1.3.3) Propagation of Organizational Competitive Advantage through Managing the Diffusion of Innovation

Organizations are inherently open systems from an adaptation and progression perspective. This openness is crucial to innovation activities because innovation cannot occur in isolation within a firm's boundary. As individual companies are unable to keep up with the pace of the development of technical and managerial knowledge, some level of information diffusion through inbound open innovation with suppliers, customers, research institutions, and even competitors are needed. In contemporary business, when innovation involves more complex technologies and operating under a more dynamic external environment, organization-environment boundary should be more porous. There is also a greater need for sourcing knowledge through different means of organization–environment relations (Dampour, 2017).

The solution may come from the diffusion of innovation where environmental input from external community and other organizations becomes a major determinant of an organization's innovation behavior (Baldrige & Burnham, 1975). For an inter-organizational innovation to succeed, business partners must also elect to adopt and use innovation (Prescott & Conger 1995) which is a form of innovation diffusion. Furthermore, porous environment clearly flavors the deployment of inbound open innovation as a mean to infuse new external innovation especially when firm's innovation capability depends on innovation diffusion (Calantone et al., 2002). In fact, some of the largest global growth and development achieved in the past two decades has been associated with the acceleration in the diffusion of technological change and worldwide access to codified knowledge, also known as “research without frontiers” (Freeman & Soete, 2009). The pursuit of innovation ability enables organization to remain competitive by staying at the “early” half of Roger's innovativeness spectrum as shown in figure below.

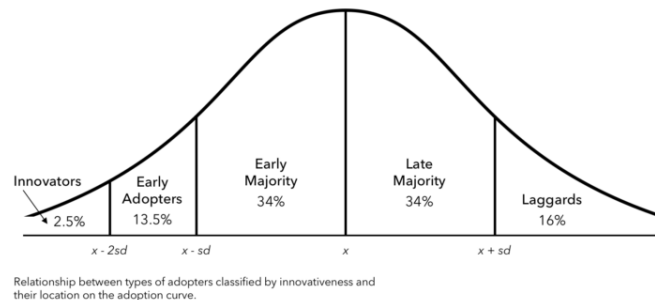


Figure 2.19 Adopters Categorization on the Basis of Innovativeness (Rogers & Williams, 1983)

Finally, organizational innovation is an indication of behavioral change (Rogers, 1995). New key factors for innovation does not appear as an isolated input but exist and diffuse within the core of a rapidly growing system of technical, social and managerial innovations. Once the new key factors are spurred by the limits to grow under the old paradigm, new paradigms and innovation will crystalized as a new type of “common sense” of management and design (Freeman & Perez, 1988). To expedite the diffusion of innovation, Rogers suggested five strategies ranging from changing the perceived attributes, activating peer networking, changing the norms of existing system, use of key opinion leaders and champions and provide education to staff to promote benefit of innovation diffusion (Rogers, 2002). The diffusion of innovation concept was further extended in the study of innovation by defining it as part of the production or adoption, assimilation, and exploitation process (Crossan & Apaydin, 2010). In private sector, diffusion rather than using an idea pushing approach in the form of dissemination was emphasized (Mulgan & Albury, 2003). Hence, good leadership and management approach is an important factor in driving innovation diffusion and this clearly calls for the adoption of a management framework.

2.1.3.4) Importance of Inbound Open Innovation for SME from Growth & Technological Perspectives

Although SMEs are specialist in their business activities, they must maintain efficient interaction with other firms and R&D institutions to support innovation through the exchange of knowledge and commercialization activities (Oslo Manual 2005). Organizations innovate through combinations of existing and new knowledge so they must often turn to external sources to gain new ideas, insights, and expertise (Rosenkopf & Almeida, 2003). Firms engaging in open innovation will depend on critical external knowledge assets for the successful realization of their innovative ideas. As organizations are constantly evolving globally and adopting a more open and collaborative approach to achieve their objectives and innovation, SMEs are also becoming more open. However, the ability to acquire knowledge from external entities is limited by the existing expertise and experience of the organization (Nelson, 1985). Hence, possessing the ability to adopt new ideas and innovation become not only the key for success but a matter of survival for SMEs due to their limited resources. Therefore, leveraging and engaging in innovation processes has been particularly important in small high-tech startups through their co-operation with high-end OEMs as both companies can obtained access to new external technology which made it possible to launch genuine innovations in the market-place (Christensen et al., 2005).

For high-tech SMEs, different inbound open innovation activities was proven to be beneficial for different innovation outcomes. For instance, technology sourcing is linked to better radical innovation performance while technology scouting supports incremental innovation performance (Parida et al., 2012). As such, the average level of inbound open innovation by SMEs is also increasing because they often lack resources to develop and commercialize new products in-house, hence becoming more inclined or forced to collaborate with other organizations as a result (Van de Vrande et al., 2009). Inbound open innovations enable SMEs to gain benefits through new ideas, new market opportunities and combination of knowledge. Due to the curvilinear relationship predicted between innovative performance and the depth of search through external sources of innovation, SMEs are probably better position to enjoy the enhancement of performance from inbound open innovation than larger organization as they are specialist in their own area. Consequently, using external sources to innovate can be important to improve or speed up innovation and achieve a higher level of innovation performance in SMEs as organizations are increasingly drawing in external knowledge in their innovative activities (Laursen & Salter, 2006).

SMEs must also find channels continuously to acquire the right knowledge exists externally to upgrade and expand their own capabilities effectively and continuously. Hence, smaller firms tend to use alliances to reach scale of economies with minimum cost while firms that are more dominant in market scale rely more on internal capabilities to expand (Acs & Preston, 1997). As such, SMEs are more likely to embrace open innovation in their strategy and one such channel is to become a participant in the clustering of companies. Clustering enable many potential competitive advantages in innovation compared to those companies that exist in an isolated location because it facilitates earlier perception of both the need and the opportunity for innovation from products or services perspectives while also providing a flexible channel to act on them quickly (Porter, 2000). In acting as an open and interacting ecosystem, Porter's clustering system is one example to demonstrate the benefit of open innovation and similar benefits was observed in Hong Kong Science Park where companies are located closely.

With the improvement of communication methodologies such as 5G and high speed internet, flow of knowledge can now be obtained regardless of geographical context. Furthermore, the effectiveness of alliances and people mobility should increase when technological or core competence

between companies are more different (Rosenkopf et al., 2003). This has important implications for open innovation adoption in high technology SMEs because they normally focus on their own niche so they are likely to benefit more from alliances with other entities that possess higher expertise but at a larger physical distance. As such, inbound open innovation will work for SMEs under both physical clustering based on close vicinity as well as “virtual” clustering based on common technological interest or complements but are physically more remote from each other. Nevertheless, developing and introducing innovations process through inbound open Innovation practices in SMEs and large enterprises is getting more specific and complex than before.

In a study of 293 small and medium manufacturing companies in USA, more than 50 percent of firms already engaged in open innovation to at least a slight degree during technology and product development and commercialization. Firms are more innovative when they use technology development collaboration with their suppliers to improve their products, and product development collaborations with their customers to improve their processes (Theyel, 2013). Strength of cooperative ties across a range of productive activities within the value chain are important facilitators for SME innovative capability. (Tomlinson & Fai, 2013). In comparison to conventional systems of meeting market demands, cooperation in co-creation as a form of inbound open innovation can often offer further advantages to firms because many service organizations are reliant on value chains that include suppliers, intermediaries, customers and financial partners that combine their capabilities to build and create value added processes (McManus & Ardley, 2020). All these studies also support the theory that SMEs can thrive under an inbound open innovation environment as they can access knowledge and skillsets that may be beyond its area of expertise through co-operations.

As the complexity of innovation, induced by technical and scientific progress, increases, the knowledge base of many firms has become inadequate to control all aspects of the innovation process. (Spithoven, 2013). Hence, how to manage the bridging of such knowledge gaps are becoming high priorities for management of technology organizations. As such, entrepreneurs must recognize open innovation is not just impacting a particular aspect of innovation performance but it will positively influence a wide range of innovation performance indicators (Cheng & Huizingh, 2014). Once again, this emphasize the need of a management framework to enable sustainable innovation for the SMEs.

2.2) Key Elements of Inbound Open Innovation and how they interact

Business models supporting open innovation must be committed by management and company is structured to allow a certain degree of organizational permeability to facilitate the inflow and outflow of knowledge across organizational boundaries (Chesbrough, 2006). Highly innovative companies establish companywide commitment to innovation and clearly communicate that innovation is everyone’s job. These companies also ensure disruptive innovation is an important part of the innovation portfolio. To deliver those new ideas to the market, these companies also create right structure, allocate right resources and combine different project teams to execute their plan (Dyer et al., 2011).

To Andy Grove, ex-CEO of Intel, performance and output of teams and organization can increase if information can be gathered both internally and externally, disseminate to the people who needs to know. This clearly supports using open innovation as an instrument to increase performance. At the same time, by being the role model and demonstrate the expected behavior to the team while also involved

subordinates or be involved in their decision making process will help. Finally, by providing appropriate training, motivation and feedback to the team, the overall performance will be increased (Grove, 2015).

In doing so, Grove clearly exemplified the importance of leadership, execution ability and vision as the basis of how innovative companies bring disruption to the market. Furthermore, innovative capability of an organization requires the simultaneous possession and collaboration of innovativeness in strategic, behavioral, product, marketing and process functions in the organization (Wang & Ahmed, 2004). Personal mastery, transformational leadership, shared vision, proactivity and environment also helps an organization to become more innovative and encourage learning more (García-Morales et al., 2006). All these observations identified leadership, learning, entrepreneurial drives as important elements for innovation. In the following sections, our review will examine the suggestions from Grove and Wang under an inbound open innovation context in more detail.

2.2.1) Identifying the Essential Elements for Operating an Effective Inbound Open Innovation Management Framework

Appropriate organizational context should be created and renewed through tangible and concrete management actions to influences the actions of all those within the company (Ghoshal & Bartlett, 1994). Change and reinvention needs to be supported by a strategy which is a plan that relates ends and means, goals and tactics, and such plans must vary according to context (Nye, 2008). Strategy has also been characterized as the manner in which a firm decides to compete, encompassing the pursuit, achievement, and maintenance of competitive advantage in an industry. (Morgan & Strong, 2003). Aligning the internal organizational aspects of companies with their business models to accommodate open innovation is important because different inbound open innovation strategies requires different business models (Saebi & Foss, 2015). So leaders define strategy by making decision on the breadth of product and service offerings, target customer group, technology strategy, execution timing and vision (Tushman, 1997).

On the other hand, superior organizational knowledge allows a firm to devise a more productive system of organization (Spender, 1994). Hence, organizations operating under inbound open innovation will need to have the capability or knowledge to constantly process new information while also being ready to transform its structure to align with the environment. Sustainable business performance is in large part derived from intangible assets such as organizational-level knowledge (Liebskind, 1996). As the stock of organizational level learning which aligned to system, structure and culture increases, so should business performance (Bontis et al., 2002). Furthermore, according to Van de Ven, innovation focuses on four basic factors (people, new ideas, transactions, and institutional context) which in turn create four major challenges for top management. First is to empower employees so they become more attentive to new ideas and able maximize their potential for the companies. This is followed by implementing processes that can manage new ideas and turn them into beneficial reality. The formation of a structure and relationship to support employees to operate as part of the whole innovation endeavour comes next while last but not least is to create an infrastructure that is conducive to innovation and organizational learning if necessary (Van de Ven, 1986).

In an inbound open innovation environment, new strategies often emerge from collaborative contacts between organizations and they learn and borrow, regardless of being intentional or not, when they trade and work together. This enables strategy being pushed along by the creativity of managers as they explore new ways of doing things more effectively (Mintzberg & Lampel, 1999). To develop strategic

flexibility and competitive advantages, leadership must develop and communicate a long term vision. They must also build out of the box thinking among all employees through encouragement while gaining commitment to continuous change (Hitt et al., 1998). Hence, management must be transformational to create a shared vision through the formulation of organizational strategies and structures that support the firm to grow and confront the challenges of the knowledge society (García-Morales et al., 2006).

To highlight the multifaceted nature of factors that can influence creativity and innovation, five main determinants (strategy, structure, support mechanisms, communication and behavior) have been identified and a model was proposed on how each of these determinants should contribute as shown in the figure below. In summary, these determinants address area including strategy, leadership driven items such as structure, behavior and communication as well as supporting mechanism in the form of resources such as learning and creative people (Martins & Terblanche, 2003).

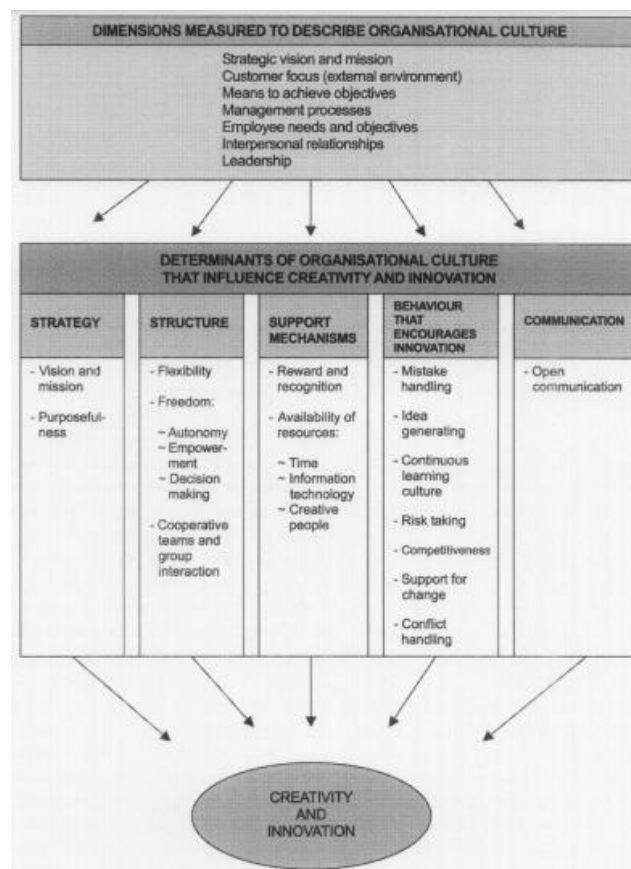


Figure 3.1 – Influence of Organizational Culture on Creativity and Innovation (Martins & Terblanche, 2003)

Hence, the use of entrepreneurial orientation to explore new ways of doing things shows up as an important strategy under inbound open innovation. In addition, management must be transformational leaders that encourage and gain commitment from staff through continuous change from out of the box thinking. Finally, execution must be aided by continuous learning and knowledge development via learning orientation. These elements combine to fulfill the desired outcome of innovation orientation toward the goal of innovations by guiding all organizational strategies and actions, driving the firm strategy, learning, and functional interaction (Siguaw et al., 2006). As such, entrepreneurial orientation, learning orientation and transformational leadership are chosen as the

essential elements for effective operation of inbound open innovation in our study. The inclusion of more factors are avoided because if more dimensions are included, greater misalignment could potentially exists between project and capability (Leonard-Barton, 1992). In the following sections, we will examine how each of these elements will relate to organizational performance and personal characteristics of entrepreneurs in more detail.

2.2.1.1) Role of Learning Organization

2.2.1.1.1) Importance of Learning as the Executing Hand in the Inbound Open Innovation Management Framework

In an entrepreneurial society, knowledge will have to be replaced or at least be refurbished by new learning, new skills and new knowledge (Drucker, 2014). It is also common where managers only focus on one or two domains, so they can only partially solve their problems without the capability to balance different aspects of innovation management. Knowledge is a reliable source of everlasting competitive advantage. Successful companies are those that can consistently create new knowledge, diffuse it effectively within the organization, and quickly adopt it into new technologies and products. These activities also help to produce the knowledge creating company that can deliver continuous innovation. Nonetheless, while it is important to ensure organization is populated with folks with strong discovery skills, the fastest way for an organization to fail is to stop executing. Leaders good at discovering opportunities and innovation need the skills of people who excel at execution (Dyer et al., 2011).



Figure 3.11 Desired skills composition in different types of teams (Dyer et al., 2011)

Organizational learning is a function of the form and strength of organizational interdependence with its learning partners (Slater & Narver, 1995). Moreover, value creation through innovation is different if knowledge is not fully realized internal. If external knowledge is only assimilated, such knowledge can merely sustain the organizational performance and provide flexibility to support strategic changes and reconfiguration of the firm. However, through absorptive capacity, knowledge is transformed and exploited to contribute towards the creation of new competitive advantages (Zahra & George, 2002). Firms that engage in higher-order generative learning also have close and extensive relationships with customers, suppliers, and other key constituencies (Wang, 2008), an essential element of inbound open innovation. Hence, Damanpour (2017) believed open innovation has followed the concept of absorptive capacity, which highlighted the importance of external sources of knowledge for the generation of technological innovations (Cohen & Levinthal, 1990).

Emphasis of organizational learning over immediate output alone is a critical element of competition because management can renew organizational skillsets by adopting the generative actions characteristic of learning organization as part of project implementations (Leonard-Barton, 1992). Staff of a learning organization continually focused on enhancing and expanding their collective awareness and capabilities to create what they truly desire in a team. Members of the learning organization immerse in a deep learning cycle where they develop new skills and capabilities, which in turn create new awareness and sensibilities. It requires hard, focused, purposeful work which is supported by diligence, persistence and commitment to create and maintain the renewal of talent, ingenuity and knowledge (Drucker, 2002).

For younger firms, learning orientation is critical since they need establish an efficient mechanism for rapidly internalizing knowledge (Calantone et al., 2002). Organizational learning provides the firm with the potential to expand its learning capability, promoting its development and growth (Senge, 1990). Continuous ability to generate knowledge is among the major determinants of a firm's ability to develop and sustain core competencies, including periods when its competitive landscape undergoes radical changes (Hamel & Prahalad, 1994; Zahra et al. 1999). For innovation, it is most important for organizations to understand the new situations so they can make use of what they already know (Hargadon, 2002). Hence, learning organization can sustaining its competitive advantages with its ability to learn faster than its competition (Senge, 2014).

2.2.1.1.2) Characteristics of Learning Organization

A) Learning Orientation is Positively Related to Innovativeness

Organizational learning plays a major part to support the capability of company to execute and deliver their vision in an innovation driven environment and learning orientation enhance the organizational competitive advantage which directly or indirectly enhance performance. Since firm's innovativeness is the output of learning orientation, learning is also central for innovation (Calantone et al., 2002) because technology standards are driven not only by external drivers but also a firm's learning orientation (Schilling, 2002). As companies that possess higher level of learning orientation are more likely to be more innovative, it is essential for any organization to equip its staff with the right skills to overcome challenges they face and provide the necessary platform for ongoing innovation.

Higher levels of innovativeness are associated with cultures that emphasize learning, development, and participative decision making (Hurley & Hult, 1998). Organizational learning also needs to incorporate creativity and radical innovation as part of the strategic orientation to sustain competitive advantage (Wang & Ahmed, 2003). Entrepreneur should focus on devising strategy that cultivate and promote learning since firms that have a greater capacity to innovate can develop competitive advantages and achieve higher levels of performance (Hurley & Hult, 1998). Moreover, if orientation toward learning exists in organizational cognition, it can become a driving force towards the development of knowledge and action in organizations. This creation and maintenance of a learning culture is one of the primary way to attain and maintain competitive advantage (Sinkula et al., 1997).

B) Learning Orientation is Negatively Related to Discomfort towards new technologies

Learning orientation comes with a set of organizational values including commitment to learning, open-mindedness, and shared vision which combined to influence the propensity of the firm to create and use knowledge (Sinkula et al., 1997). Open-mindedness is the willingness of an organization to review its operational routine and to accept new ideas (Calantone et al., 2002). This requires the SMEs and

younger organization with limited resources to accept inbound open innovation, especially in idea adoptions. The continuation of innovation clearly require the existence of learning orientation and a firm with a strong learning orientation is not just a collector of knowledge but a processor of it. Knowledge processing makes the firm more likely to promote generative learning as a long lasting core competency, enabling it to foresee environment and market changes and make adjustments (Calantone et al., 2002).

C) Learning Orientation is Positively Related to Organizational Performance

A climate that encourages proactive learning, also known as learning orientation, should be positively related to team performance (Edmondson, 1999; Bunderson & Sutcliffe, 2003). Objective evidence also supports the integral role of training plays in bringing positive impact for the individual and organizational performance. This happens because workers now possess the information, skills, incentives, and responsibility to make decisions essential for innovation, quality improvement, and rapid response to change (Cascio, 1995). Through learning and a learning oriented culture, adaptive capabilities can continuously evolve and strengthen within an organization because adaptive capabilities and learning are often described as coevolving and mutually reinforcing (Barkema & Vermeulen, 1998; Simonin, 1999; Autio et al., 2000; Lewin et al., 2011). In fact, the role and process of learning from both internal and external sources and how it drives the firm's absorptive capacity were part of a model developed (Lane et al., 2006), providing further evidence that learning will evolve with adaptive capabilities to drive organizational performance.

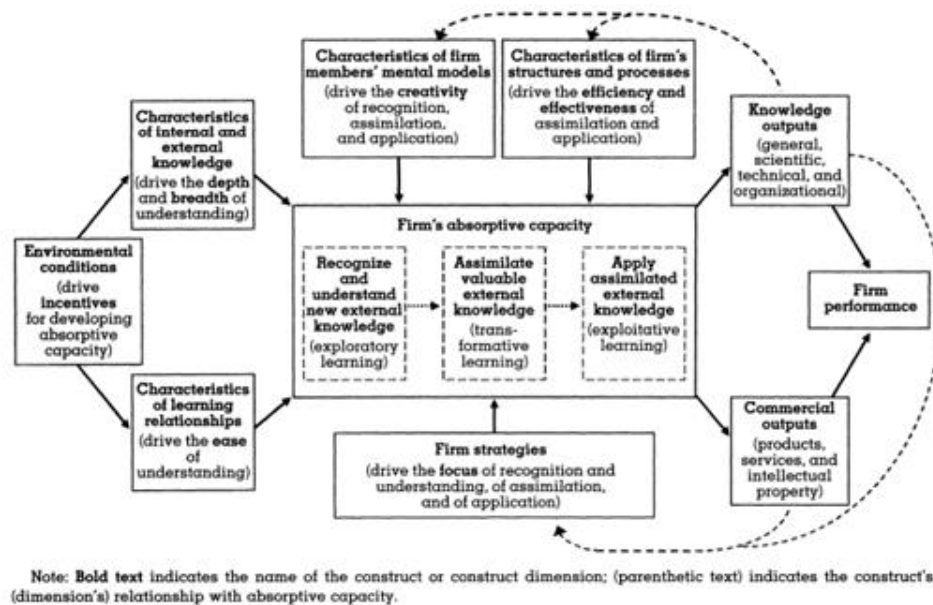


Figure 3.2 A Process Model of Absorptive Capacity, Its Antecedents, and Its Outcomes (Lane et al., 2006)

Organizational learning and innovation are positively related to organizational performance because organizational innovation and organizational learning work jointly to promote organizational entrepreneurship and to increase competitive advantages (García-Morales et al., 2006). With higher inclination towards absorbing inbound knowledge, positive association was found between the learning organization practices and firms' financial performance (Ellinger et al., 2002) because organizational learning is the capability to enable firms to create knowledge as the source of improved performance (Dess et al., 2003). Hence, a positive relationship exists between learning at all levels and business performance and more importantly, misalignment of communication flows, systems, structures, and

procedures support between departments in the organizational learning system is negatively associated with business performance (Bontis et al., 2002).

D) Learning Orientation and Organization Performance is Positively Related to the Level of Inbound Open Innovation

In turbulent knowledge environments, such as those for high technology industries, an organization that can positively deal with changing environment will not only process information efficiently but also able to create information and knowledge by establishing a link between the organization and the environment (Lopez et al., 2005). Such firms are likely to develop new organization forms and adequate combinative capabilities to increase their absorptive capacity. Enabling the organizational ability and readiness to detect external changes is important because it helps the firm to respond and learn quicker, creating competitive advantages through faster time to knowledge perspective. In comparison, an inward-looking organization will not be able to tackle changes in the environment proactively and would not survive even though they may possess sophisticated knowledge and technology. Hence, proactive perception of the surrounding environment by top managers will determine the organization's innovation and learning arrangement to maintain its edge in the competitive environment (García-Morales et al., 2006). Furthermore, knowledge driven approach was also found to be the strongest determinant that lead to a preference for informal inbound open innovation modes (Scuotto et al., 2017). When inbound open innovation exists within an organization, it will be constantly bombarded by new ideas and members will likely to be in regular search for error correcting solutions. Continuous interactive learning from internal sources as well as from a wide variety of external sources such as customers, suppliers, contractors and universities, government agencies and laboratories, consultants, licensors, plus licensees are shown to be the source of inbound open innovation in firms (Freeman, 1994).

Finally, a positive feedback loop exists between absorptive capacity and the level of prior related knowledge. Increase in absorptive capacity causes a change in related knowledge which in turn increases absorptive capacity and drives the final organizational performance outcome (Van den Bosch et al., 1999). Through inbound open innovation, more quality knowledge becomes available which will improve learning efficiency. Better knowledge and understanding through knowledge acquisition will facilitates behavior change to deliver performance improvement (Lopez et al., 2005). Effect of learning orientation on organizational learning is greater in SMEs than in large firms as organizational learning partially mediates the relationship between entrepreneurial orientation and performance while fully mediating the link between learning orientation and performance (Real et al., 2014). Relationship between firm's innovativeness, its performance and learning orientation is shown in figure below (Calantone et al., 2002).

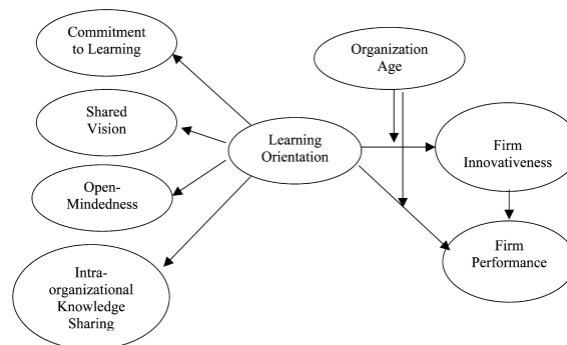


Figure 3.3 - A framework linking learning orientation to firm innovation and performance (Calantone et al., 2002)

E) Learning Orientation is Negatively Related to Insecurity

Risk taking and experimentation, dialogue, interaction with external environment and participative decision making are five elements which combine to form the foundations of organizational learning capabilities (Chiva & Alegre, 2009). A learning orientation, which encourage the engagement of experiential actions, repeated practice and codification of experience into technology and formal procedures, enable more rapid learning and the creation of new, situation specific knowledge (Eisenhardt & Martin, 2000). Development of learning in an organization must cover both absorptive and adaptive capacities. For absorptive capacity, it requires constant experimentation, double loop learning and a willingness to tolerate small failures so it is important to have an organizational context that encourages plausible judgment, active listening, periodic information exchange, and working consensus (Boal & Hooijberg, 2000). On the other hand, in the new competitive landscape such as those facing high technology SMEs in Hong Kong, which is characterized by increasing strategic discontinuities and disequilibrium conditions, highly competitive markets, and an increasing focus on innovation and continuous learning, organizational success depends upon strategic flexibility (Hitt et al., 1998). Hence, the ability to make changes through adaptive capacity is important and all changes will involve taking risk.

Defensive reasoning thrives in a contexts where members doubts error exist and this put the organization in an ultra-stable systems that are anti-corrective and inhibits learning which is dangerous to organizational performance and effectiveness (Argyris, 2004). The adoption of new ideas through inbound open innovation will break the negative cycle of defensive reasoning and encourage learning. Source of organizational innovation ranges from continuous interactive learning from their own experience of design, development, production and marketing. It can also come from a wide variety of external sources such as customers, suppliers, contractors as well as from other organizations such as universities, government laboratories and agencies, consultants, licensors, licensees and others (Freeman, 1994). Normally, organizational learning occurs when members of the organization respond to changes in the internal and external environments of the organization by detecting and correcting errors in organizational norm. These new knowledge created by the change agents is then embedded in new "maps" of the organization (Argyris & Schon 1978:23).

F) Learning Orientation is positively related to Optimism

Learning orientation influences the degree to which proactive learning occurs in an organization (Sinkula et al., 1997:309). Based on the positive future envisioned, proactive personal goal settings may also happens at the individual level. This may include the development of new skills, building new networks, and acquiring more information (Parker et al., 2010:832). Positive economic benefits and outcomes of proactive and innovative behaviors include rapid, deep and broad learning of new technologies and skills (Dess et al., 2003:372). As such, optimism may drive the efficiency of entrepreneurs from learning through their own experience in the context of new venture (Hmieleski & Baron, 2009:483). Moreover, the ability to create new knowledge also depends on committing to access the tacit insights and intuitions of individual employees and make it available for the entire organization (Nonaka et al., 1995:96). Such commitment will also depend on the level of management belief and optimism towards the need and likelihood of success in knowledge creation. Hence, a significant proportion of organizational information acquisition through searching becomes a consequence of proactive managerial initiatives at higher organizational management levels (Huber, 1991:99).

On the other hand, business disruption leads entrepreneurs to rethink about the objectives of failed or disrupted tasks. Using a double-loop learning approach, they will question and think through the assumptions about their current objectives, finding new ways to discover and invent new alternatives, objectives, perceptions, as well as ways of approaching problems. Alternatively, the use of transformative learning may be particularly relevant for entrepreneurs of SMEs due to the amount of personal investment, resources and exposure that entrepreneurs spent on starting and managing a small venture. It involves a sequence of learning activities that begins with a disorienting dilemma and concludes with a changed self-concept. This emotional and multifaceted attachment has significant implications for understanding the learning outcomes associated with discontinuous events and an optimistic character will provide positive support for transformative learning. In summary, both types of learning can be useful in organizational learning since it can drive creativity and innovation, going beyond adapting to change but also prepare for anticipating or being ahead of change, which is the essence of executing innovation.

2.2.1.1.3) Learning Management under an Inbound Open Innovation Context

General body of knowledge in modern times are accumulation of internal and external experience and apprehended in terms of causal sequence (Veblen, 1898). However, the creation and provision of resources will come from both internal and external sources. Expertise, which is critical to support such endeavors, will need to be acquired, integrated or developed through a learning oriented organization so the skillset and competitive advantages can be maintained. On the other hand, dynamic core competences must be built through a corporate culture and incentives that favors learning orientation. Under this view, organizations may also be viewed as information processing systems whose viability depends on their ability to master the challenges posed by their environments. Hence, to cope with additional processing requirements due to the increasing dynamic, hostile and complex environment, organizational structure must also be modified (Miller & Friesen, 1983). This can be achieved by constant learning and increase level of higher order thinking (Cascio, 1995).

As part of the strategic orientation to sustain competitive advantage, organizational learning needs to incorporate creativity and radical innovation (Wang & Ahmed, 2003). Successful leaders must have the ability to create both absorptive and adaptive capabilities (Boal & Hooijberg, 2000). This also highlighted the essential role of learning and its management in supporting constant transformation of organization under innovative environment. Outsourcing units that are not competitive and partner with suppliers that excel, reliable and ethical in those area is the core of inbound open innovation. Other important inbound open innovation approaches include continuous recruitment, development of human capital through skills and capabilities training, identification, acquisition and implementation of the latest and most effective technologies available that is relevant to the business (Hitt et al., 1998). Quite often, under an inbound open innovation environment, innovation is managed and conditioned by the individual firm's exposure to external information from various sources, including universities, companies operating in similar industries and other scientific institutes.

Moreover, the evolving intellectual capital of an organization over time is dependent on knowledge management (Bontis et al., 2002). Efficient knowledge and talent development also enable the generation, replication and scaling of skill and innovation. From a knowledge management perspective, firms need particular managerial capabilities to develop organizational capabilities for managing the collaborations with external partners because the challenges in managing internal innovation activities, which does not result in a complete outsourcing of innovation activities, and the

handling of interdependencies between internal and external processes is different (Lichtenthaler, 2011). According to the network organizational model suggested by Webster, a firm must define ever more narrowly those core competencies to which it will devote scarce resources in order to develop new knowledge and skills. For all other areas, it must depend on strategic partners who are focusing on their own area of expertise (Webster, 1992).

Finally, there is growing recognition that the management of a small enterprise under major disruption such as Industry 4.0 is a turbulent and nonlinear process. Such changes and disruptions present themselves as opportunities for entrepreneurs to build deeper understanding of higher ordered learning outcomes either through double-looping, which is the core of organizational learning theory, or via transformative learning (Cope, 2003). Learning can change values and beliefs so knowledge management practice driven by top management is crucial in supporting the effective sensing and seizing of occasions for innovation and stay relevant in dynamic markets (Singh et al., 2021). Moreover, higher order learning ultimately influence the quality of competitive advantage of the organization because learning enable it to be more capable to respond to both explicit and latent environmental forces through a combination of adaptive and generative learning that enables innovation (Baker et al., 1999). On the other hand, successful knowledge management, which is a critical component in creating competitive advantages, requires the coordination of multiple functional area of the organization (Cabrera & Cabrera, 2002). This is particular important because the motivation for sharing and creating knowledge in organizations might be limited, and people often try to protect what they know, which accentuates the need for leadership (Von Krogh et al., 2012). Learning organizations will enjoy competitive advantages because they are competent learners which are skilled at creating, acquiring, and transferring knowledge, with the ability to modifying its behavior to reflect new knowledge and insight (Sinkula et al., 1997). Hence, the creation and management of a learning orientation approach may be the right element for a sustainable inbound open innovation framework.

2.2.1.2) Role of Transformational Leadership in Delivering Impact under an Inbound Open Innovation Management Framework

The impact of transformational leadership is so enormous that it can even get a country like America moving again because it is rated as a final ingredient of renewal and more important than any other factors (McCormick, 2023). Transformational leadership is associated with the climate for organizational innovation through the mediating role of a competitive, performance-oriented organizational culture, it has a power effect on organizational culture (Antonakis, 2001) because top managers' attitudes positively affect all aspects of innovation adoption and creativity. Furthermore, creativity, as a part of innovation, is associated with strong and visionary leadership backed by supportive cultures. Since organizational culture is an important determinant of climate for innovation (Sarros et al., 2008), transformational leadership is bound to be a strong and impactful element for supporting inbound open innovation and positively related to innovativeness.

2.2.1.2.1) Transformational vs Transactional Leadership as Predictor of Organizational Performance

Transformational leaders are more likely to succeed in time of change while transactional leaders are more suitable for well-ordered environment (Bass, 1985). Transformational leadership was also found to be significantly more correlated to the business performance than is transactional leadership in Taiwan (Chung-Wen, 2008). In addition, when innovation performance was compared between transformational and transactional leadership over a one year period, transformational leadership was found to be directly

and positively related to the predicted performance of the business surveyed (Howell & Avolio, 1993). It can achieve higher effectiveness and satisfaction than transactional leadership alone and increase the ability to predict the levels of innovation, risk taking and creativity (Bass & Riggio, 2006). Management support for innovation was also positively moderating the relationship between transformational leadership and performance. Hence, transformational leaders perform better in more innovative environments than transactional leader (Howell & Avolio, 1993), leading to better organizational performance under a fast changing environment such as Industry 4.0.

2.2.1.2.2) Transformational Leadership drives learning orientation

In contrast to upper echelon and strategic leadership, transformational leadership theory emphasize the interpersonal processes between leader and followers (Boal & Hooijberg, 2000:525) and transformational leaders try to stimulate creativity and innovativeness by encouraging staff, who are also involved in the analysis process, to address problems with new approach. As transformational leaders are strong believers of coaching and mentoring, they are likely to adopt a learning orientation environment to foster members to achieve their full potential. This is particular relevant to the fast changing high technology industry because when transformational leaders pay close attention to individual development need, they will also develop individual development training program for their staff (Bass & Riggio, 2006). This learning orientation is also crucial for the operation of high technology SMEs that require innovation to drive its competitive advantages because new organizations of the 21st century is likely to be smaller in size, requiring transformational leaders to bring out creativity, imagination, and best efforts in culturally diverse organizations (Cascio, 1995). These organizational characteristics also echo those observed operating under an open innovation environment and is likely to produce better team and organizational performance.

2.2.1.2.3) Transformational Leadership creates positive organizational culture

Successful leadership implies influencing the attitudes, abilities, and behaviors of followers (Bass et al., 1987). Transformational leaders provide modeling behaviors that are emulated by followers even at multiple levels below so their behaviors will be ingrained in all organizational activities and its artifacts which forms the organizational culture (Bass, 1998). Hence, successful transformational leadership must be able to change or drive the organizational culture because when followers share perceptions about the importance of specific organizational goals with their leader, they may assess leadership behaviors positively, irrespective of actual leader behavior (Colbert et al., 2008). In addition, competence is the perception and expectation that the leader is capable of delivering on a promise and on upholding commitments (Dervitsiotis, 2006) so as the top leader of an organization, CEO of the company must ensure there is a goal converge between his direction with the rest of the organization because there is an indirectly relationship between CEO transformational leadership and organizational performance, with within-team goal importance congruence as an intervening variable.

A) Transformational Leadership is Negatively Related to Discomfort towards new technologies

Emphasis on innovation and creativity early in the organizational cycle with the presence of a powerful leader can lead to high levels of cohesion among workers, a dedication to the organization's ideology, and a sense of unity among the employees (Quinn & Cameron, 1983). Transformational leader is committed to continuously searching for moral excellence so a platform of common values can be formed within the organization to stimulate alignment and congruence of interests rather than producing

a blueprint for others to follow (Bass & Steidlmeier, 1999:211). Hence, the leaders' ability to communicate a compelling vision of the future supported by inbound open innovation may prove to be effective for increasing follower's commitment to organizational target as well as offering an opportunity to reduce all types of internal disagreement from a common goal perspective. This ability of communication and motivation to inspire staff towards a positive culture with common goal and vision is a key element of transformational leaders that can help to remove their discomfort.

B) Transformational Leadership is Positively Related to Optimism

Innovativeness focuses on the willingness of organization to change (Calantone et al., 2002). Change normally leads to some level of transformation either in term of operation process or structure of the organization. However, changes due to innovation would normally create conflict within the organization but transformational leaders find ways to align those seemingly conflicting interests and improve understanding of group dynamics because under transformational leadership, followers are more open to shifts in their world view (Boal & Bryson, 1985), which in turn is a precursor to actual change (Boal & Hooijberg, 2000). This willingness to accept change supports the organization to adopt new ideas and make adjustment to operate under an inbound open innovation environment.

Transformational leaders can identify the core values and unifying purposes of the organization and its members while also encourage liberation of human potential (Bass & Steidlmeier, 1999). They are also likely to be confident with high self-esteem, positive, optimistic, emotionally balanced, and able to cope with stressful and complex environments (Bass & Riggio, 2006:168). Since confidence is the best fit capacity element of positive organizational behavior and positively affect goal aspirations and attainment, strategy formulation, entrepreneurial start-ups and managing very difficult situations (Luthans, 2002), transformational leaders are likely to create an environment of positive organizational behavior which links to strong learning orientation.

C) Transformational Leadership is Negatively Related to Insecurity towards new technology

According to a meta-analysis study comprising of 43 studies with a combined sample size of 6341 organizations, managers of innovative organizations are most likely going to implement a developmental culture which emphasizes an external and a flexibility orientation. To implement radical innovation strategy, top management should also establish a developmental culture in their organization (Büschgens et al., 2013). Hence, disruptive innovation is most likely coming from a transformational leadership that enables flexibility, risk taking and operating under an inbound open innovation environment. Moreover, in organizational development during innovation, transformational leaders normally play important roles by emphasizing universal principles of justice and the interests of all stakeholders in the organization (Bass & Steidlmeier, 1999). Trust created by transformation leadership implies that coworkers will accept mistakes as learning experiences and likely to encourage individuals to try things beyond core tasks and enhance their self-efficacy (Parker et al., 2006). Hence, transformational leaders will bring moral feeling into the organization and be able to maintain trust within where members will feel secure and comfortable during the changing environment brought by innovation.

As organizations operating under an open innovation model is more likely to be transformational rather than transactional, our study can utilize TRI to measure the level of innovativeness, optimism and risk taking by the top management as an indicator of their inclination towards transformational leadership.

2.2.1.3) Role of Strategy through Entrepreneurial Orientation as Thinking Head in the 3H Based Inbound Open Innovation Management

Entrepreneurship involves the identification of market opportunity and the creation or combinations of resources to pursue it. Entrepreneurship also exhibits higher ratio of market scanning and ability to identify market opportunities (Zahra, 1993). It is transforming corporate bureaucracy because when competitive, technological, social, and political change in the environment of firms continues to accelerate, organizations are forced to change strategically to embrace innovation as strategic direction component of innovation orientation complements the entrepreneurial orientation construct (Naman & Slevin, 1993).

Strategic orientation, which provides a futuristic view of the organizational orientation, is also a prime factor of innovation capability that acts as one of the determinant of organizational survival and success (Wang & Ahmed, 2004). Entrepreneurial orientation is a type of strategic orientation since it dictates how a firm intends to compete through the methods, practices, and decision-making styles managers use to act entrepreneurially (Lumpkin & Dess, 1996). For SMEs, an entrepreneurial orientation strategy will enable organization to identify new and disruptive opportunities which may lead to future success of the organization. This is because entrepreneurial orientation could be regarded as an antecedent of innovation performance, which could be a useful parameter to explain why firms perform differently (Nelson, 1991). Entrepreneurial leadership is more prevalent among founder leaders than non-founder leaders (Renko et al., 2015) and since leadership of SMEs are dominated by founders, entrepreneurial orientation is likely to be the dominant feature of SMEs.

A) Entrepreneurial Orientation is positively related to Optimism

Entrepreneurial organization encourage individuals' imagination, flexibility and willingness to accept risks but innovation and the pursuit of opportunity impose a cost that many executives resist. They will find it is easier to stay at the administrative or routine end of the organizational spectrum than move towards the entrepreneurial end (Stevenson & Gumpert, 1985). It also consists of an attitude towards taking risks with individual ambitions, personal objectives and certain levels of self-confidence alongside having access to resources such as social and family support (GERA 2021). Entrepreneurial orientation is defined to have five dimensions which include innovativeness, risk taking, pro-activeness, competitive aggressiveness and autonomy (Lumpkin & Dess, 1996). These dimensions influence the relationship between competitive strategy and firm performance. Innovativeness is highly related to differentiation strategy. Risk-taking and competitive aggressiveness are negatively associated with both differentiation and cost leadership strategies. However, both differentiation and cost leadership strategies are positively related to performance (Lechner & Gudmundsson, 2014).

Corporate entrepreneurship includes risk taking, pro-activeness, and radical product innovations (Miller, 1983). Renewal of key ideas on which organizations are built also reflects the process of corporate entrepreneurship and the renewal of key ideas requires the ability to manage transformation and discontinuous change. If a company wishes to continue to be entrepreneurial, it must convince everyone that change is the company's overriding goal (Guth & Ginsberg, 1990). Hence, management must have the vision, optimism and commitment to overcome any barrier brought by existing social contracts, planning cycle and performance expectation assigned based on the de facto operation plan of the organization to embrace entrepreneurship.

B) Entrepreneurial Orientation is Positively Related to Organizational Performance

Entrepreneurial Orientation is the main predictor for performance because it leads to better performance over competitors and contribute to higher number of employment in the long run if the level of entrepreneurial orientation increases over time (Madsen, 2007). For business that are 10 years or below, only entrepreneurial orientation was a significant predictor of performance because the strength of the owner's entrepreneurial orientation continue to dominate the younger small businesses during its drive for positive performance (Runyan et al., 2008). This is particular the case for young technology SMEs and the pro-activeness and innovativeness elements of entrepreneurial orientation was found to have a positive influence on business performance (Hughes & Morgan, 2007) because innovation has a positive effect on the performance of SMEs especially through the fostering of an innovation orientation (Rosenbusch et al., 2011). Entrepreneurial orientation also represents how a firm is organized and it is a starting point for generating superior performance. It represents how the organization is structured to discover and exploit opportunities to enhance the positive relationship between resources and firm performance (Wiklund & Shepherd, 2003). Finally, entrepreneurship is positively related to firms' ability to perform under hostile and dynamic environment, having growth strategies and operate at early stage of product life cycle (Zahra 1993).

C) Entrepreneurial Orientation is Negatively Related to Insecurity towards new technologies

A successful firm is either capable of responding rapidly to changes that are beyond its control or so innovative that it contributes to change in the environment. Entrepreneurship is an approach that offers these benefits (Stevenson, 1983). The function of entrepreneurs is to reform or revolutionize the pattern of production by exploiting an invention or, more generally, an untried technological possibility for producing a new commodity or producing an old one in a new way (Schumpeter, 2010). Entrepreneur has the ability to spot opportunities, possess the attitude towards taking risks with individual ambitions, and driven by a high level of self-confidence while able to access social and family support (GERA, 2021). These are critical inputs because for start-up firms, they must exercise intentionality to carry forward the specific actions required to launch new ventures.

Corporate entrepreneurship includes risk taking, pro-activeness, and radical product innovations (Miller, 1983). Entrepreneurship is closely associated with innovation as well as risk taking and can be understood as the ability to gather the necessary resources to capitalize on new business opportunities. There is also strong empirical evidence entrepreneurship improves company performance by increasing the firm's pro-activeness and willingness to take risks, and achieve good performance by pioneering the development of new products, processes, and services over competitors (Zahra et al., 1999). Entrepreneurship has flourished because independently minded people elected to leave secure positions in order to promote novel ideas or venture into new markets, rather than allow organizational superiors and processes to inhibit them (Lumpkin & Dess, 1996).

D) Entrepreneurial Orientation is Negatively Related to Discomfort towards new technologies

Entrepreneurial activities can improve the rate of organizational growth and profitability which may further increase over time, depending on the company's competitive environment (Zahra et al., 1999; Zahra & Covin, 1995). As SMEs and startup organizations grow, they will need to keep up with the pace of change and act faster than their competitors to seize ongoing and new opportunities that appear in the

market. Hence, incorporating flexibility is also a key factor for entrepreneurship because a focus on control by standardizing outputs does not encourage innovation (Mintzberg, 1993). Encouraging entrepreneurial behavior by making those involved feeling comfortable towards change and new innovation adoption is critical for the long-term vitality of our economy. Larger corporations should remain comfortable towards entrepreneurial orientation to stay competitive against their often smaller but successful competitors that are innovative.

E) Entrepreneurial Orientation is Positively Related to Innovativeness

Entrepreneurship can be characterized as innovative, creative, dynamic, risk-tolerant, flexible and growth-oriented (Kayne, 1999). Entrepreneur is characterized principally by innovative behavior and will employ strategic management practices in the business (Carland et al., 1984). This is because entrepreneurs are not just opportunistic but also creative and innovative (Stevenson & Gumpert, 1985). Innovativeness was determined to be part of the conceptual competencies which are reflected in the behaviors of the entrepreneur and the influential role of the entrepreneur in turn is affecting the performance of the firm, particularly when the firm remains small (Man et al., 2002). This relationship was confirmed by a study done in Turkey, where management skill of 33 firms was confirmed to play a critical role in innovation process. By promoting entrepreneurial activity in the firm, providing the right level of resources, being open minded and by supporting collaboration, good organizational performance was achieved (Bayarçelik et al., 2014). As such, this also support the theory that the rate of new product innovation is a direct reflection of how entrepreneurial the firm is (Drucker, 2014).

In a Hong Kong based study, the positive relationship between entrepreneurial orientation and performance for entrepreneur in China was also confirmed. Interestingly, since Chinese innovation environment is at the transitional stage, it is reducing the impact of environmental variable on Chinese entrepreneurs towards their entrepreneurial orientation (Chow, 2006). Hence, it will be essential for a study to be conducted for Hong Kong based SMEs to determine the pattern exists in Hong Kong today.

2.2.2) Positing the possibility of a coherent relationship between Entrepreneurial Orientation, Learning Orientation and Transformational Leadership in innovation management

Throughout the journey of innovation management studies, scholars have developed various interactive models in the attempt to group different critical antecedents together with innovation and organizational performance. These antecedents ranging from organizational learning and knowledge management, entrepreneurship and strategy, transformational leadership and organizational culture/behavior, external environmental factors to resources and organizational structure. Their models all have their own individual merits in explaining the relationships between these antecedents with innovation and performance. However, most fall short in explaining how to provide a holistic management approach in ensuring the continual success of innovation. Nevertheless, they all suggested innovation approaches must align with the strategy of the organization to overcome different challenges that arise during execution. This is because different aspects of organizational competencies that can drive organization-wide innovations and subsequent firm performance must be addressed under a multi-dimensional structure and a sample approach is listed in figure below (Siguaw et al., 2006:562).

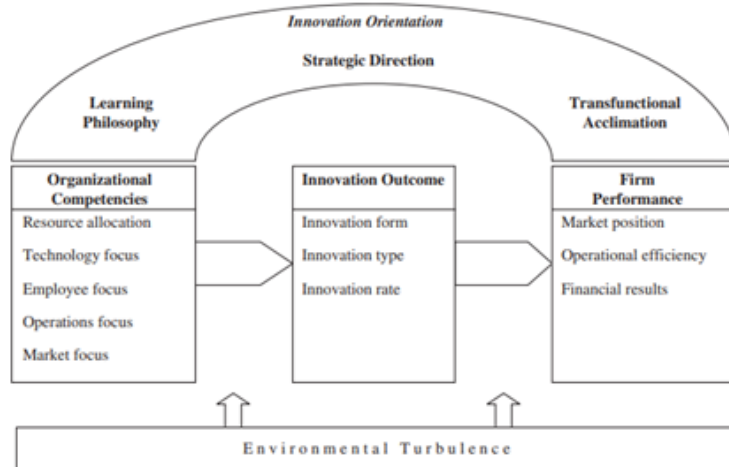


Figure 3.21 Model of Innovation Orientation: Drivers, Actions and Outcomes (Siguaw et al., 2006:562)

To prepare for paradigm shift due to technology changes, top management needs to have the vision and commitment of resources to develop and assemble the requisite human assets to develop the innovation capabilities necessary to succeed (Rothaermel & Hess, 2007). In addition, to embrace the new vision and opportunities seized by the top management, certain changes in the organization, such as new organizational structure, resources allocation and development strategy, new workflow processes, new knowledge acquisition, retention and transfer strategies, will all need to happen coherently. However, in a rapidly changing world of SMEs within the high technology industries, the boundaries are becoming increasingly blurred between what an organization is and what a team is. Furthermore, management can remain clueless about how to embed changes deeply into the organizational culture (Dyer et al., 2011).

Nevertheless, the long term success of companies depend on the ability to manage streams of innovation instead of just a single event (Tushman, 1997). Successful organization can absorb innovation into its culture and management process (Martins & Terblanche, 2003). In addition, to overcome the cycle of hurdles within and outside the organization as shown in the figure below, a transformative leadership approach supported by execution and forward looking strategy is required to motivate and train existing staff to adopt new innovation and ideas. Organization will also be oriented to gather or create the necessary resources to become successful under this strategy (Kim & Mauborgne, 2014). Based on the key success elements identified, different interactive relationships will also be examined in the following sections to assess the possibility of creating a coherent interaction cycle within the context of inbound open innovation.

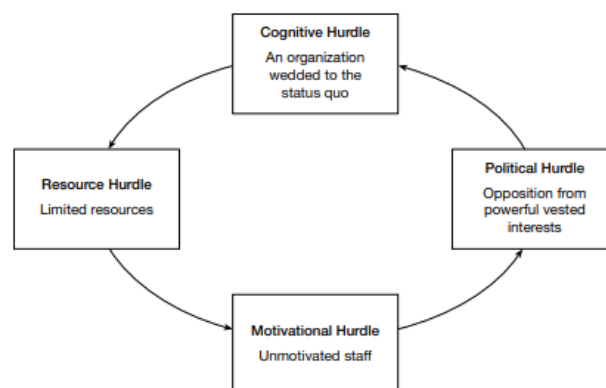


Figure 3.22 Blue Ocean - The Four Organizational Hurdles to Strategy Execution (Kim & Mauborgne, 2014:150)

2.2.2.1) Intertwining of Entrepreneurial Orientation & Learning Orientation

Entrepreneurial orientation is an amalgamated construct composed of both strategies and actions (Hult et al., 2004; Naman & Slevin, 1993). It is also perceived behaviorally as the processes, practices, and activities that result in innovation (Slater & Narver, 1993; 1995). Hence, entrepreneurial orientation inherently include execution as part of its characteristics. Organization that promotes entrepreneurship will learn and innovate, encouraged by the presence of key pre-existing internal/external attributes that enable it to change, renew and reinvent itself (García-Morales et al., 2006). Moreover, learning and its management plays a crucial role throughout opportunity sensing, seizing and transformation stages especially under an inbound open innovation context (Teece, 2007). In addition, entrepreneurial orientation enhances the positive relationship between knowledge-based resources and performance from a resource-based theory perspective because it drives how a firm is to be organized to enhance the performance output. This is achieved by focusing the structure to facilitate the utilization of the firm's knowledge-based resources to discover and exploit opportunities (Wiklund & Shepherd, 2003).

Entrepreneurial orientation is beneficial to firms with an organizational learning capability because their strategies already support deep integration of external sources, which can be highly diverse, into the company's innovation activities. Such organizations should also possess business structure which allow close collaboration with external partners and facilitate mutual exchange of knowledge between partners (Saebi & Foss, 2015). In technology organizations, even though entrepreneurial orientation affects technology innovation positively, organizational learning acts as a partial mediator between this strategic orientation and technology based innovation. Firms that want to engage continually in innovation should first build learning mechanisms in their organizations to enhance their ability to accumulate, assimilate, and apply both internal and external knowledge (Zhao et al., 2011).

The existence of entrepreneurial orientation within an organization can create significant opportunities for multi-dimensional organizational learning (Pinchot, 1985) because it is influenced by industry, markets, competitors, external environment, internal operations and processes (Zahra, 1991). Through either formal or informal entrepreneurial activities within an organization, company performance can be enhanced as the creation of new knowledge becomes a foundation for building new competencies or revitalizing existing ones (Zahra et al., 1999: 169). Since proactivity, a major characteristic of entrepreneurship, is also geared toward modifying the environment and not simply adapting to it, it favors generative learning (García-Morales et al., 2006). This is typically forward-looking and critical in reducing the frequency and magnitude of major shock (Slater & Narver, 1995). Adoption of a customer value centric and relationship approach, characterized by an entrepreneurial oriented business practices, may positively influence learning orientation by stimulating firms to "unlearn" old ways of doing things. This approach should also enable flexibility and facilitate firms to reconfigure their skills and talents (Wang, 2008:649).

Learning orientation must also be in place to maximize the effect of entrepreneurial orientation on performance especially in more entrepreneurial firms (Wang, 2008) because organizational learning is a principal mean of achieving the strategic renewal of an enterprise. Organizational learning itself need to encompass the entire enterprise instead of only at the individual or group level because organization operates in an open system (Crossan et al., 1999). Simply having entrepreneurial orientations as a corporate strategy does not automatically lead to better performance because deeply rooted values and beliefs that bring about certain behaviors can affect firm performance (Zhou et al., 2005:54). Hence,

organizational learning must also be encouraged to maximize the effect of entrepreneurial orientation on performance because organizational learning capabilities could reinforce the effect of entrepreneurial orientation on innovation performance. In fact, entrepreneurial orientation also having positive effects within the organization and drive organizational performance (Alegre & Chiva, 2013). Finally, even though corporate entrepreneurial activities can be multi-dimensional, they are very important for promoting organizational learning and developing new knowledge that generates advantages (Dess et al., 2003). Fortunately, entrepreneurial firms encourage non-authoritarian structures that facilitate creativity, collaboration, and dialogue (Alegre & Chiva, 2013), enabling the creation of positive relationship between entrepreneurial and learning orientations.

In summary, after gaining broader access to knowledge and expertise, organizations would need to modify their structures continuously to cope with the additional information processing requirements invoked by more dynamic, hostile or complex environments. They must also revise their strategy-making processes to cope with more challenging environment (Miller & Friesen, 1983). To visualize the relationship between entrepreneurial orientation and organizational learning, an entrepreneurially driven model is shown in the figure below on how ongoing organizational learning provides a mechanism for the integration and creation of different types of knowledge. The ultimate goal of this model is to produce distinctive competence and competitive advantage under various input considerations. The coverage of this model ranges from the integration of existing knowledge into new application to the transferring, and later exploiting, of new knowledge in the marketplace under an open innovation context. This competence-based approach, which is driven by corporate entrepreneurship, suggested how organizational performance and competitive advantage can be enhanced. This is achieved by placing organizational learning and the facilitation of learning orientation at the core of the managerial responsibilities in a company (Zahra et al., 1999). As the core of management is its strategic or entrepreneurial orientation, this model exemplifies the intimate relationship between learning and entrepreneurship.

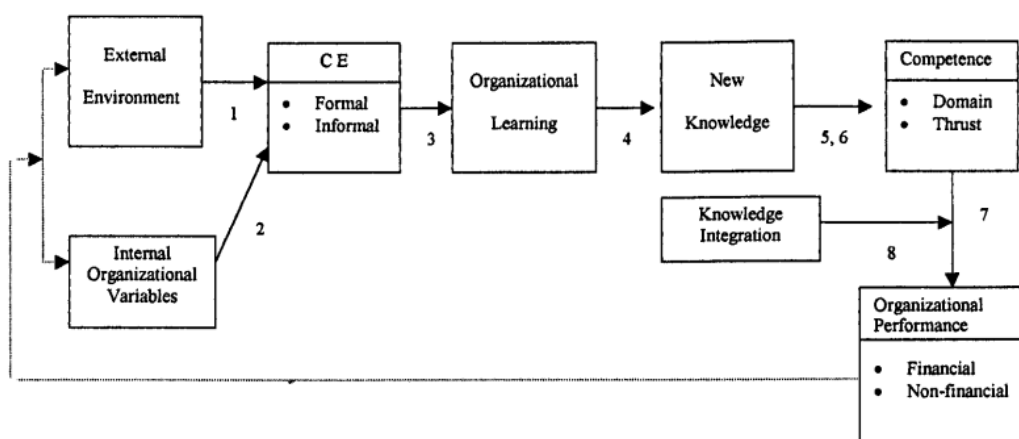


Figure 3.23 Corporate Entrepreneurship, Knowledge, & Organizational Competence Development (Zahra et al., 1999:172)

2.2.2.2) Enhancement of Entrepreneurial Orientation by Transformational Leadership

High technology SMEs are always facing turbulent environment and to succeed in such environment, organizations need to have flexibility to forecast changes and meet new demands as they occur and only transformational leadership can enable the firm to do so (Bass & Riggio, 2006). Entrepreneurial leaders' passion, creativity, and vision motivate others to experiment and learn for themselves. They set examples and encourage others to emulate their behavior and challenge status quo and such leadership characteristic is an integral part of organizations that seize and profit from new opportunities as they arise (Renko, et al., 2015). Entrepreneurial leadership establish conditions conducive to role performance and social exchange that include organization trust, consensus on dominant logic, and appropriate organizational controls (Dess et al., 2003). This clearly echoes the trust based core value of transformational leadership.

Top management can make sure that entrepreneurial activities correspond to their strategic vision and continue autonomously by controlling the level and the rate of change rather than the specific content of entrepreneurial activity to maintain a balance of diversity. Top leaders can also maintain entrepreneurial activities through the introduction of new managerial approaches and innovative administrative arrangements to facilitate the collaboration between entrepreneurial participants and the organizations in which they are active (Burgelman, 1983). This clearly suggests entrepreneurial orientation, which is strong in seizing new opportunities, must be supported by transformational leadership when organizations are operating under an inbound open innovation driven environment such as Industry 4.0.

The role of entrepreneurship, as posture in firm's behavior, is positively related to firms' ability to perform under hostile and dynamic environment, supporting growth strategies and operate at early stage of product life cycle. Moreover, entrepreneurship is the core element in linking different variables together. It is positively related to inherent elements of transformational leadership that embrace empowerment, teamwork, an innovative and change supportive culture, more de-centralization and less structural (Covin & Slevin, 1991).

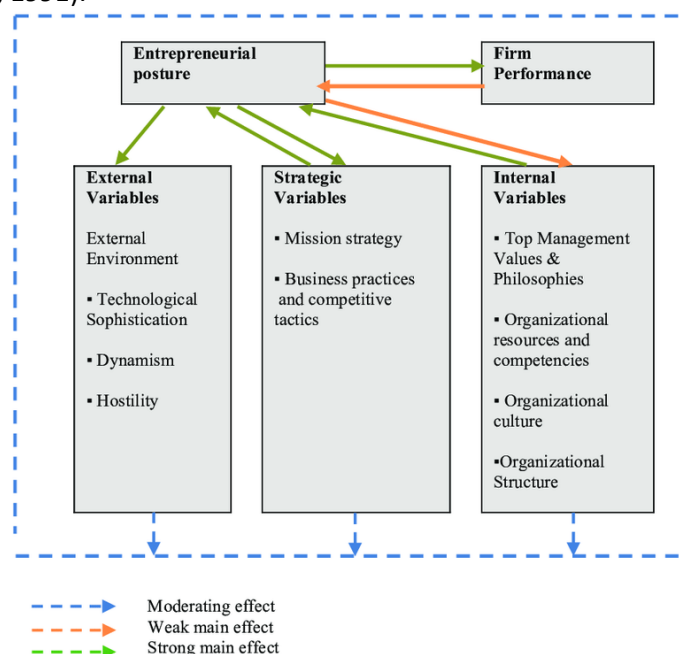


Figure 3.24 Relationship and Interaction between Organizational Factors (Covin, & Slevin, 1991)

Transformational leadership at top level was also found to moderate the entrepreneurial orientation-performance relationship and entrepreneurial orientation produces the best performance when transformational behaviour are at the highest (Engelen et al., 2015). As leadership is associated with entrepreneurship in a complex manner, transformational leadership was found to create the most favorable managerial circumstances for entrepreneurial activism in the organization (Eyal & Kark, 2004). Since entrepreneurial leadership is more transformational than transactional (Page 273 Chung-Wen, 2008:273), the innovative nature of entrepreneurial orientation will also enhance inbound open innovation under the transformational leadership.

From a company performance perspective, transformational leadership with higher entrepreneurial orientation can contribute to higher business performance (Chung-Wen, 2008). During disruptive and transformative period under Covid-19, successful leaders are those with vision to proactively identify new opportunities. They are able to strategically align the organization to exploit these opportunities through innovative thinking, reconfiguration of existing resources, recruiting new external resources or mixture of the above. These leaders are mostly transformational rather than transactional as transformational champions have higher level of risk-taking propensity and innovativeness, which are related to entrepreneurship. They also initiated more attempts to articulate their compelling vision of the innovation's potential to the rest of the organization (Howell & Higgins, 1990).

2.2.2.3) Bringing Learning Orientation and Transformational Leadership to Work together

Firms can gain competitive advantages by acquiring knowledge, implementing strategic changes, and increasing the rate of innovation through either the recruitment of external talent or alliance with external organizations as part of its inbound open innovation activities. Conversely, creation of collective knowledge is the exchange of information among individuals and groups within the organization and collective knowledge is also an important source of competitive advantage. Regardless of the method used for knowledge creation, there is a synergistic relationship among the elements of culture and climate that maximizes learning and its benefits (Slater & Narver, 1995). However, since culture and climate are reflection of leaders' attitude and behavior, effectiveness of organizational learning will depend on leadership style. This is because leader act as a coach in helping those in the organization to surface assumptions, understand patterns and relationships among people, organizations, and events. This view is echoed by Hurley and Hult's model as shown below, where culture is the driver of innovativeness while structure and culture work together to enable further capacity to innovate.

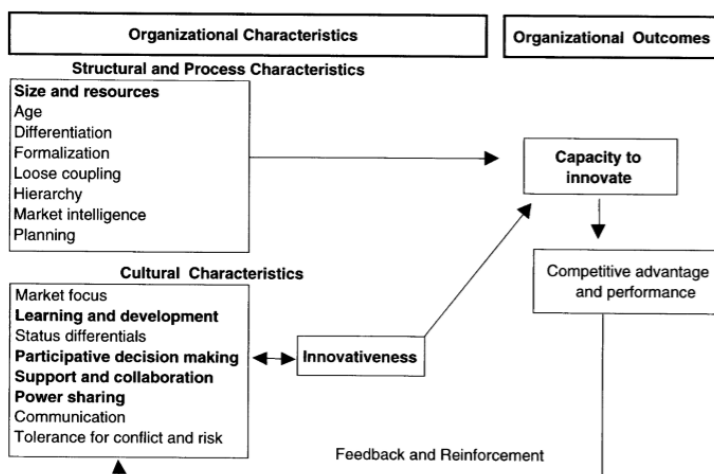


Figure 3.27 Organization and Market Driven Innovation (Hurley & Hult, 1998:45)

More importantly, positive relationship between transformational leadership and organizational innovation are more strongly reinforced in organizations with high organizational learning than in organizations with low levels of organizational learning. Similarly, both positive relationship between transformational leadership and organizational performance as well as positive relationship between organizational innovation and organizational performance are reinforced in higher learning organization (García-Morales et al., 2008). In fact, innovation is the mediator by which organization develop the competitive capabilities to succeed within its operating environment, and achieve better performance than its peer.

Besides using technologies, creating of a social environment that encourages knowledge sharing is important. Such social environment include climate of openness, commitment to education and development, demonstrating involved leadership, increasing organizational commitment, communicating the benefits of knowledge exchange and redesigning work processes and jobs (Cabrera & Cabrera, 2002). Under transformational leadership, employees are likely to be more creative and leaders can leverage learning orientation to positively moderate the level of creativity by promoting an open environment for learning that encourages innovation and creative problem-solving (Jyoti & Dev, 2015). Trust and support, which are major features of transformational leadership, were also identified as some of the primary dimensions of organizational context to influence the levels of individual initiative, mutual cooperation and collective learning within companies (Ghoshal & Bartlett, 1994). To enable organization to compete based on dynamic capabilities, the use of higher dimensional factors that correspond to transformational leadership, such as informal relationships, trust-based relationships, emotionally inclusive relationships and externally oriented relationships, have been suggested (Wang & Ahmed, 2003).

Through understanding the nature of these systematic relationships, subordinates can take responsibility for learning and make better decisions with less interference from top management (Slater & Narver, 1995). This freedom is an important element in a learning orientation organization. All these clearly indicate knowledge creation and sharing depends on the collaboration of learning orientation and transformational leadership. Furthermore, transformational leadership acts as the motor and transmitter of innovative culture and dissemination of knowledge while also enhancing organizational learning and innovation. This positively drives organizational performance because organizational learning positively influences organizational performance as shown in the figure below (García-Morales et al., 2012).

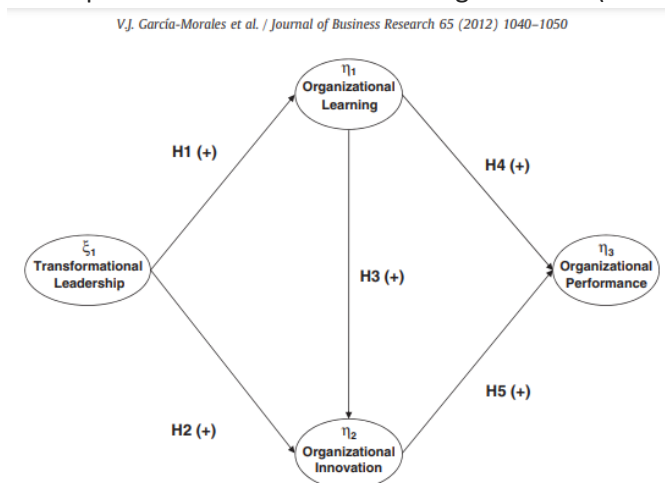


Figure 3.26 Relationship between Transformational Leadership, Organizational Innovation, Learning and Performance (García-Morales et al., 2012)

Furthermore, from a performance delivery perspective, learning orientation and transformational leadership were found to be positively related to employee creativity, which in turn positively related to employee performance (Gong et al., 2009). Business performance is also a combination of organization factors such as culture, behaviors, knowledge management as well as structural elements, including process and infrastructure. Failure in any of these elements, especially knowledge creation, transfer and use will lead to degradation in business performance and management solution in balancing various elements is needed. A model which suggests how strategy, knowledge and organization specific elements are responsible for delivering business performance in the figure below (De Long, 1997:3).

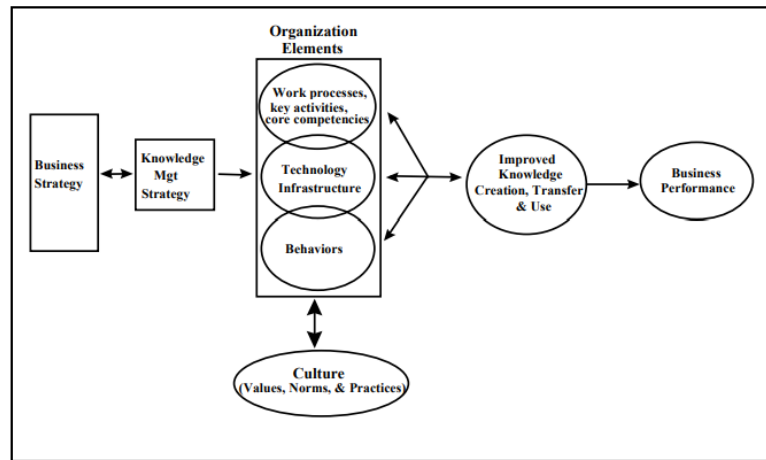


Figure 3.25 An Overview of Knowledge Management Elements (De Long, 1997:3)

Finally, economic models of evolutionary economists also focus on organizational learning, structure and co-ordination at an organizational level (Nelson & Winter, 2002:41). Positive learning orientation – transformational leadership relationship was found in an empirical study of professional accountants in the UK. This happens when the desirable leadership behavior for a learning organization is transformational and desirable follower behavior should include a learning orientation (Coad & Berry, 1998). In addition, in an experimental study, managers who received transformational leadership training were rated by their subordinates as being more transformational and the organizational commitment of subordinates were also significantly improved after the training. There were also evidence better financial outcomes was reported by branches in which managers followed the training session (Barling et al., 1996). To create organizations that is capable of continuous learning such as adopting the double loop learning approach, the chief executive officer and his immediate sub-ordinates hold the key to success, because the best way to generate such learning is for the top to do it (Argyris, 1977). This proves the reciprocal possibility of producing better transformational leaders through learning also. All these findings support the concept that learning orientation works constructively with transformational leadership.

2.2.2.4) How these three factors interact as seen by previous studies

Transformational leader is required to create a synergistic influence on learning and performance (Slater & Narver, 1995). This is particular the case under a complex environment, such as inbound open innovation under Industry 4.0, where entrepreneurship can be complemented by an appropriate leadership climate to produce a learning organization. This is because transformational leaders were found to have better quality vision and vision implementation techniques. They can give better task cues and clarity through their communication skills so followers were able to perform with quality, thereby

positively enhancing their task satisfaction and achieving better organization performance (Kirkpatrick & Locke, 1996). This ability in generating quality vision is complementary to entrepreneurial orientation because once the right opportunities are identified by entrepreneurs, they are converted into quality vision by transformational leaders. To complete the delivery cycle, transformational leaders also have the ability to enable followers to execute, which is crucial for sustaining the organizational performance cycle.

Teece (2014) offered another example on how these three elements interact in the form of dynamic capabilities theory which supports the concept of evolutionary fitness. Dynamic capabilities include the identification and assessment of opportunities, which is entrepreneurial in nature, and developing ability to enable firms to maintain competitive advantage that is hard to replicate. The ability to seize opportunities through resource allocation and guided learning as well as continuous renewal through transformation requires leadership support (Teece, 2014:18). This dynamic capabilities framework builds on the resource-based approach and is an entrepreneurial approach that recognizes the importance of critical resources. Resources in turn is developed through learning, and good strategy through business processes that leverage internal and external partners (Teece, 2014:15). By coupling with good strategy, dynamic capabilities can sustain superior enterprise performance for organizations so they are better equipped to benefit especially in fast-moving global environments (Teece, 2014:23). As such, the scenario suggested by Teece is where transformational leadership, entrepreneurial orientation and learning orientation can combine into one solution to tackle the challenges of performance delivery. The emphasis on using external partners highlighted that inbound open innovation adoption by SME will play a key role in organizational success under the fast moving environment driven by Industry 4.0.

These management elements convergence scenarios offer a favorable environment for the emergence of entrepreneurs and transformational leaders to succeed because they support a learning organization that can rapidly reconfigure its structure and focus its resources through reallocation with inherent flexibility. Supported by more proficiently knowledge as a resource and capability, leader of organization will become more willing to take risk, allowing it to seize new opportunities in a more entrepreneurial manner (Büschgens et al., 2013) which in turn increase the need for more knowledge acquisition. Through advocating an entrepreneurial spirit that favors change, firm can streamline business processes, promote autonomous decision-making, and tap into individuals' creative power to bring a higher order generative learning environment (Wang, 2008). This in turn support entrepreneurs to identify and respond to emerging opportunity or threat more promptly, leading to more transformation and knowledge acquisition need. The positive reinforcement cycle between learning and adaptive capability driven by external changes (Lane et al., 2006) is another good example to show the benefit of management factors working coherently under an inbound open innovation context. Hence, assisting organizations to enter this coherent management cycle may be one possible solution to address the need of continuous improvement in dynamic environment as predicted by the evolutionary process (Winter & Nelson, 1982).

After revealing some of the interactions between different combinations of management elements in previous sections, it is logical to proceed further by bringing all these interactions together and investigate as a single combination. Not surprisingly, there is strong evidence from previous academic research to support the existence of a coherent relationship and constructive cycle among our three management elements. It is also encouraging to see these relationships being supported in a reciprocal manner. Hence, this coherent integration introduces the possibility of a sustainable cycle. Economic innovation performance was found to be positively correlating with sustainable innovation performance.

This is also true when both factors are positively associated with higher open innovation collaboration intensity with external customers (Rauter et al., 2019). By putting different findings into a single perspective, the selection of entrepreneurial orientation, learning orientation and transformational leadership as our key management elements for research analysis is implicitly validated and the relationship is shown in the figure below.

Strong Academic Support for Interactive and Reinforcing Relationship

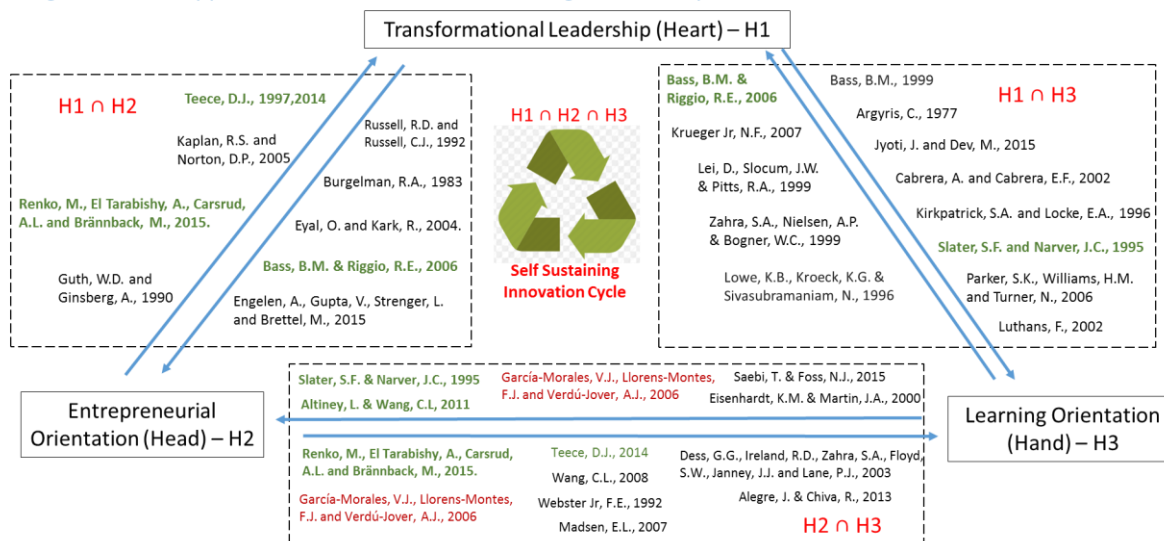


Figure 2.??28 The Coherent Cycle of Relationship between Entrepreneurial Orientation, Learning Orientation & Transformational Leadership

2.3) How can Inbound Open Innovation be Managed to deliver organizational performance

2.3.1) Why do We Need to Manage Innovation

In the twenty-first century, every company, to a certain extent, needs to become a technology company so the management of innovation have to respond accordingly to maintain the organizational competitiveness. Companies cannot confine their modes of innovation management into one particular set of routines as there are important cyclical aspects to innovation strategies (Christensen et al., 2005). In many organization, their existing business operating model are creating conflicting condition if they need to move with rapidly changing technological landscape. This is becoming a strategic issue which prevent the company from remaining competitive since slow development of capabilities are more likely to inhibit performance (Selassie, 2022). As highlighted in previous section, a certain amount of management activities will be required so a framework could be the answer to such challenge. The presence of a management framework can also help to identify and mitigate conflicting environment while capabilities can be forecasted and developed. For instance, if it is a company's culture that sustains high performance with high integrity, top management needs to create an institutional framework so the company's norms and values are widely shared. Its reputation for integrity is so strong that most leaders and employees want to win the right way (Wren, 2013). All these would make a significant contribution to the prevention and resolution of downstream challenges. Moreover, studies by numerous scholars (Naman & Slevin, 1993; Waterman et al., 1980; Dyer et al., 2011; Yu, 2021) all lead to the suggestion of leveraging a framework to co-ordinate various determinants to produce the best outcome for innovation management and this is perfectly applicable for the case of inbound open innovation adoption.

2.3.1.1) Challenges of Innovation Management

Innovation is about change and according to Van de Ven, there are four central problems in the management of innovation. This ranges from developing ideas into an implemented reality (execution focus), ensuring attention being paid to new ideas and innovation (organizational behavior or culture), part-whole relationships where individuals involved in specific transactions or parts of the innovation not losing sight of the whole innovative effort (vision), and strategic problem solving where leadership have to links these self-organizing innovative units into a larger and more encompassing organizational mission through the strategy context at the institutional level (strategy oriented) (Van de Ven, 1986). So even though SMEs already possess specialist nature in their expert area, they still require a managerial framework to balance their organizational capacity related factors include professionalism, technical knowledge and resources to deliver leadership dependent factors, such as administrative intensity, communication, formalization and centralization. Ultimately, this complex management journey will assist the organization to achieve a successful outcome as an innovation organization.

To achieve stable and significant relationships for organizational innovation, 13 determinants were identified and managing these determinants to enable an innovative organization is no easy task. These including specialization, functional differentiation, professionalism, centralization, managerial attitude toward change, technical knowledge resources, administrative intensity, slack resources, and external and internal communication (Damanpour, 1991). Interestingly, increase in functional differentiation were already found to facilitate the adoption of innovation (Moch & Morse, 1977). To resolve this challenge, Kirzner's Austrian theory propose the use of a framework to constrain the speculative element in human decision making (Kirzner, 2009). Hence, the use of framework is essential to maintain the equilibrium amongst many factors. Since at different stage of company growth, different attitudes, decision strategies, contextual and structural conditions are required, the figure below summarized the remedial emphasis that should be considered within the framework to obtain the best outcome for the organization (Smith & Sharif, 2007).

	Start-up	Expansion	Consolidation	Leadership
	Humanware Human resources are dominant. Values are beginning to form.	Technoware Acquisition of technology resources to expand the business and improve productivity.	Inforware Understanding of competitive environment and selection of identity based on values.	Orgaware Creation of organizational structure and processes.
Competencies	Competitive advantage stems from the unique skills of individuals and small groups.	Technology assets and equipment add to the competencies of the people and expand the market reach of the company.	Mastery of information about the industry, customers, suppliers, and government lead to specialization.	Competency focuses on the creation of effective organizational structures and the alignment of business processes.
	Organization has minimal established capabilities to support competencies.	Technology assets create an initial foundation for corporate capabilities beyond human capital.	Organization establishes processes to govern its resources and to allow them to become independent of uniquely talented individuals.	Organization applies its significant resources in accordance with the business processes and organizational structures that encode its operations.
Competencies & Capabilities Ratio				
	Leonard-Barton (1992) Skills & Knowledge	Technical Systems	Values and Norms	Managerial Systems
	Christensen & Overdorf (2000) Resources (Human)	Resources (Technology)	Values	Processes
	Subramaniam & Youndt (2005) Human Capital	Organizational Capital	Organizational Capital	Social Capital
Capabilities				

Figure 3.4 Different Technology Assets Make Different Types of Contributions to the Growth and Competitiveness of a Company as it moves through its Lifecycle (Smith & Sharif, 2007)

2.3.1.2) Innovation as a Process

Innovation is a tangible procedure or product process within an organization that is new to a social setting, intentional, not routine and aimed at producing benefits and public in its effects (Kezar, 2011). It covers the entire process when new idea is brought into productive use by engaging multiple parts of organization and eventually into society. In comparison, creation, invention or discovery only focus upon the conception of the idea and may remain in some individual's brain (Adair, 2007). Major motivation for innovation in private sectors and SMEs is to maintain or increase profitability, improve market share, create new products and differentiating services, as well as cutting costs through innovation without stretching workload (Mulgan & Albury, 2003). Innovation capability is the most important determinant of firm performance by enabling organizations to gain competitive edge to survive (Calantone et al., 2002). From this perspective, innovation is a process that needs to be managed effectively to achieve the best outcome for an organization and is realized by the theory of diffusion of innovations (Rogers et al., 2014).

The concept of innovation orientation has also been interpreted as a multidimensional knowledge framework. It includes learning philosophy, strategic direction, and trans-functional beliefs which ultimately fosters the development of organizational competencies so companies can recognize and respond to shifts in a dynamic market environment (Siguaw et al., 2006). Organizational innovation is complex—multilevel, multidimensional, and context-dependent because it overlaps with several other concepts such as creativity, invention, imitation, as well as organizational and technological change and often used as an umbrella concept covering all of the above (Damanpour, 2017). With this multi-dimensional nature, innovation and its management is a sophisticated process for any top management to foster and facilitate. It involves the resolution of complexities, such as identifying new key factors, evaluating the strength of existing obstacles and preparing for the availability of resources.

As such, the ability of SMEs to orient innovatively through capable leadership, appropriate strategy, receptive culture and good supporting structure would be the determining factors of success. Five major group of attributes were identified and shown in figure below as critical in ensuring the success of the innovation process by allowing innovation progress from being accepted, integrated into the organization and the individual users continue using the innovation (Hameed et al., 2012).

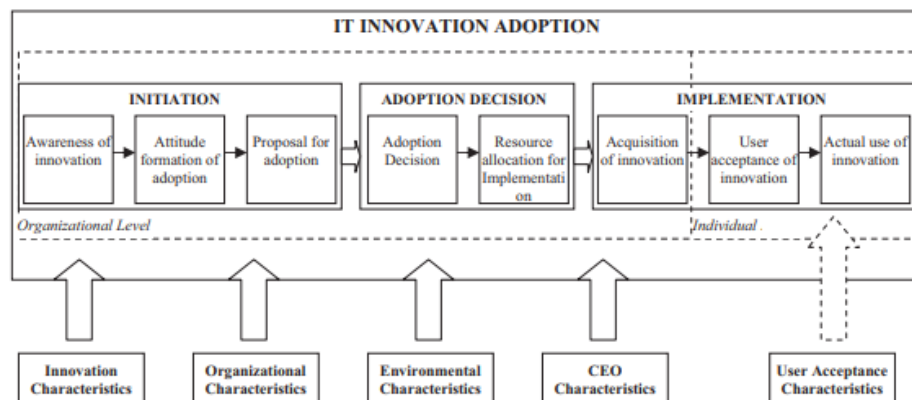


Figure 3.5 Conceptual Model for the Process of IT Innovation Adoption (Hameed et al., 2012)

Innovation characteristics identified include relative advantage, security, observability and trialability while organizational characteristics contain top management support, IT expertise, organization readiness, availability of product champion, infrastructure, technology level and organization

size. Besides, environmental elements are determined by competitive and external pressure, government policy and support, partner readiness, business and environmental uncertainty. Furthermore, CEO characteristics including innovativeness, attitude, technical knowledge, education level and tenure all act together to determine the success rate of innovation adoption in the organizational level. Finally, user acceptance factors such as perceived usefulness, ease of use, attitude towards use, compatibility, behavioral intention, organizational support and user experience will determine the success of innovation adoption from the user perspective (Hameed et al., 2012). Hence, the complexity involves in marching innovation forward within the organization is a challenging task that demands guidance from a well-structured framework.

2.3.1.3) Benefit of Deploying a Management Framework for Inbound Open Innovation

Innovation is by nature is a creative, non-routine and unpredictable task. Moreover, open innovation is a distributed innovation process based on knowledge flows being purposely managed across organizational boundaries. It needs to operate in line with organization's business model because these flows of knowledge may involve knowledge inflows to or outflows from the focal organization or a combination of both (Chesbrough & Bogers, 2014). Within the Misesian (Von Mises, 1949) concept of human action, all decisions made in relation to entrepreneurship are of speculative character and exist within an open ended framework. Hence, strategic management researchers have identified the importance of aligning systems, structure and strategy with the environment (Mintzberg et al., 1998). However, organizational boundaries were drawn to support existing operations and may impede new innovations that may lead to the creation of new structure (Christensen, 2016). Hence, effective organizations are management practices that facilitate the development of knowledge that can become the basis for competitive advantages (Slater & Narver, 1995).

A) Provide a Platform for Aligning Internal and External Parties

Under an inbound open innovation context, relationship management with external parties is also becoming part of the organizational core competence due to the increasing importance of long-term, strategic relationships with both customers and vendors as part of the overall value chain. Key activities such as strategy setting, coordination, and relationship management are essentially knowledge-based activities and involve the management of information. Furthermore, focusing on customer value and relationship management to achieve better outcome may result in much stronger coordination within the organization, eliminating internal boundaries between management functions, and a blurring of the boundaries between the firm and its market environment (Webster, 1992). This is also echoes with the suggestion to align strategy with structure and the competitive environment (Chandler, 1962).

Hypothesis 6c - Learning Orientation is positively related to the Level of Inbound Open Innovation

B) Organizational performance vs organizational lifecycle management

As organization develops through its unique life cycle, its area of emphasis and strategy will also adjust over time to fit into the environment of operation. To represent the variation in focus, a model as shown below was developed to represents four quadrant of "effectiveness values" and how organization alignment to these different criteria of effectiveness should change over time due to the variation of activities and characteristics of organizations (Quinn & Cameron, 1983). This need of alignment or organizational lifecycle control will undoubtedly involve some level of management intervention based on their understanding of the external environment.

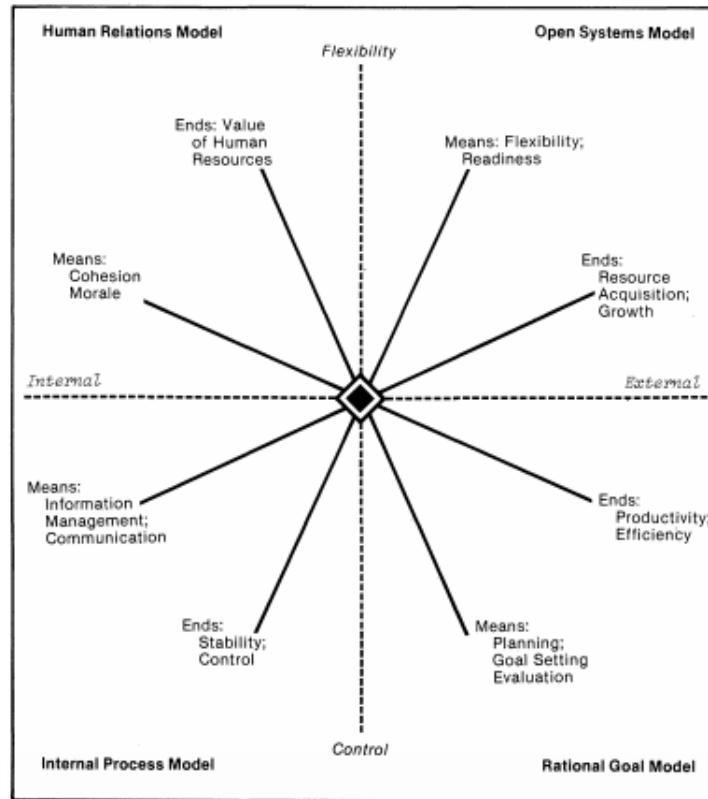


FIGURE 1. Four Models of Effectiveness Values.

Figure 3.6 Four Models of Effectiveness Values (Quinn & Cameron, 1983)

As individual organization evolves through different stages of organizational lifecycle, the emphasis requires will vary. Top management needs to have the ability and vision to adjust the organization structure and strategy accordingly to fit into various stages of organization journey. For instance, during the entrepreneurial stage, organizational success tends to be defined primarily by how well the organization meets criteria of growth, resource acquisition, external support, and readiness (Quinn & Cameron, 1983). This is typified by innovation, creativity, and the direction of resources with the strongest emphasis towards an open systems criteria of effectiveness. The success of an organization will be highly associated with its flexibility, growth, resource acquisition, and the development of external support. This association clearly echoes the strategies selected by the entrepreneurial and high-tech SMEs that operate under an inbound open innovation driven environment. Although open systems criteria are also hypothesized to be important in other life cycle stages (e.g. Collectivity and Elaboration), they appear to be particularly important for the entrepreneurial stage because entrepreneurship is defined as a management process (Stevenson, 1983). However, as business becomes more steady and routine, the company may move towards a rational or transactional approach.

Hypothesis 6a – Entrepreneurial Orientation is positively related to the Level of Inbound Open Innovation

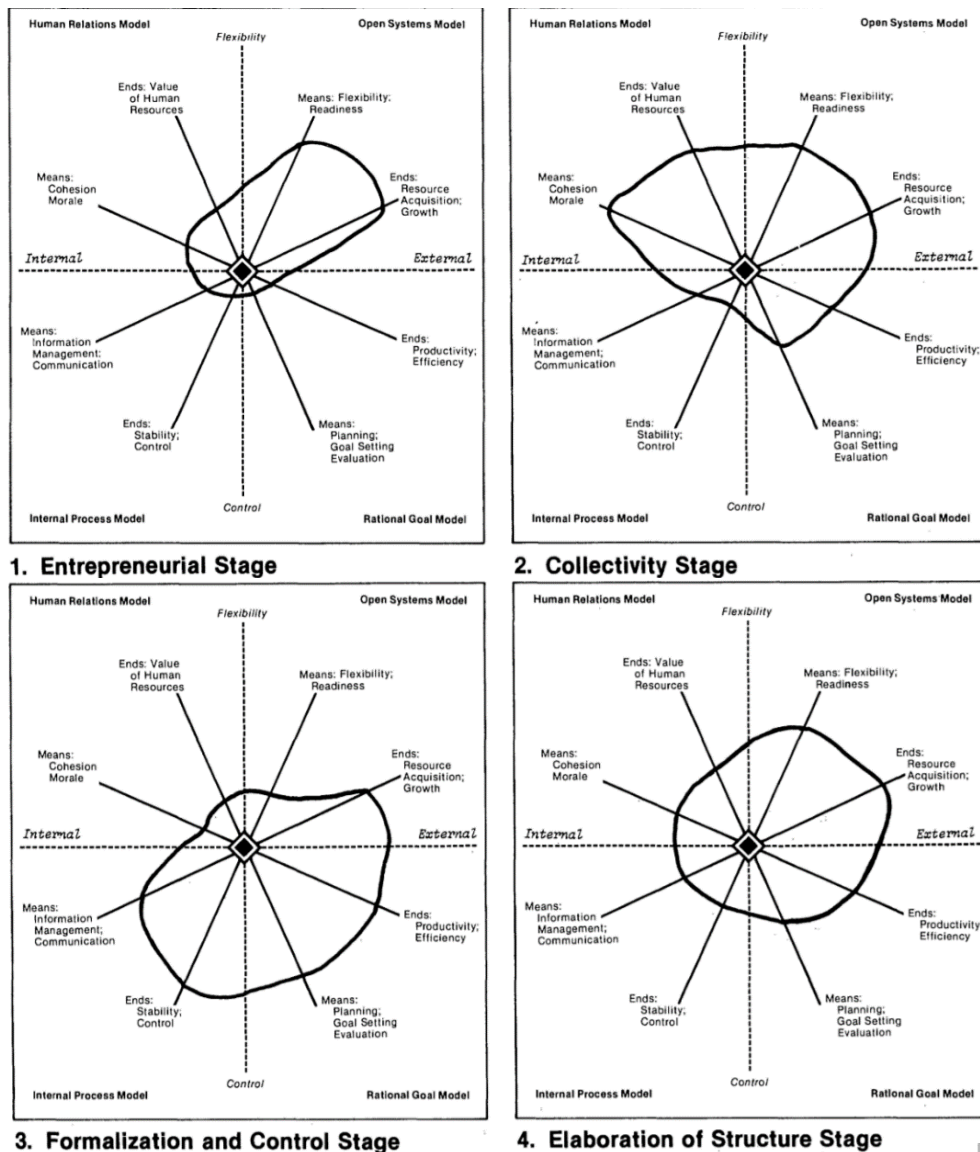


Figure 3.7 Four Stages of Organizational Growth Cycle (Quinn & Cameron, 1983)

C) Reduce Human Error with Better Risk Control

Finally, rationality of human action is bounded and according to formal economic evolutionary models. It will be difficult for modelers and users to deduce an optimization strategy based on all the elements involved especially these elements also evolve as time progress (Nelson & Winter, 2002). Hence, management needed a theoretical framework to guide them to create an organizational structure that is optimal for the circumstances at the time and managers need a tool to effectively adjust the way organizations are managed contingently (Christensen, 2016). Therefore, an elegant, direct and easy to understand framework, which can be extended in depth if necessary to meet with the particular needs of the organization, could provide top management an effective instrument to track if major elements are co-existing harmoniously on an ongoing basis. This will also enable the operation of inbound open innovation to stay within the risk tolerance level of the firm.

2.3.1.4) Characteristics of a Framework that is Relevant to Inbound Open Innovation Management

It is difficult for any single entity, either it is a country or a company, to enjoy the full benefit of Industry 4.0 without technology adoption or collaboration. The management inbound open innovation management is complex so the primary task of management for inbound open innovation focused SMEs is to establish the coordination necessary for the integration of specialist knowledge reside with the individual employees into goods and services (Grant, 1996). This begins by identifying all the distinct technologies that may offer an advantage but focus on those that are most significant for competitive advantage and industry structure. The actual benefit for the company is realized when strategies that encompass all the important technologies and reinforce the firm's competitiveness are selected (Porter, 2008). By using enhanced processes under a managed approach, companies can consistently and repeatedly turn technology into competitive advantages instead of a scientific curiosity.

A) Capable to Identify and Track Changes

The process of transforming innovation into tangible products will include the discovery or the recognition of a possible market for an innovation, the development and subsequent manufacturing the innovation into a product, and deployment through selling and distributing the product in distribution channels (Datta et al., 2015). Under such complicated transformation process, leadership needs to work on delivering the expected benefit of innovation. Fundamental changes in organizational, social and cultural arrangements will be required as company needs to adjust its workforce structure as well as external relationships with other organizations as part of transformative innovations (Mulgan & Albury, 2003). The successful management of such process is important because the ability of delivering products or services to customers is the ultimate goal of any commercial entities.

B) Consistent and Repeatable

Unfortunately, mainstream economic theory has in general ignored the role of managers but in the real situation, managers need to be multi-tasking in filling entrepreneurial and leadership roles, sensing opportunities, developing and implementing viable business models, building capabilities, and guiding the organization through transformations (Teece, 2016). Managerial wisdom with the ability to perceive variation in the surrounding environment, supported by an understanding of the social actors and their relationships, through such skills as social awareness and conflict management, can produce the capacity to take the right action at a critical movement (Boal & Hooijberg, 2000). Hence, a management framework that reduce the reliance on such individual wisdom is crucial in establishing consistency.

C) Flexible and Adjustable

Finally, successful innovation often relies on the existence of an innovative business model and rapid prototyping of business model is critically important for the future of technological innovation. Since innovation is a multi-dimension and multi-discipline process, organizations need to staff teams with complementary expertise in many different area and the composition may also change at different stages of company growth cycle. As competencies also cover resource allocation, technology, employees, operations, and markets, the final innovation outcomes and firm performance can be enhanced if competencies are managed and developed appropriately under a framework (Siguaw et al., 2006). Hence, a framework that can maintain the right balance between existing and new innovative elements through consistent mechanisms is critical. Such management framework can also enable top leaders to create

organizational processes to mirror their individual discovery behaviors and innovative leaders can build their unique personal DNA into their organizations (Dyer et al., 2011). Therefore, a framework that is broad but dynamic enough to be adjusted continuously is crucial for innovation management success. This framework can help companies of all sizes to convert technological potential into economic value through a business model if it can link technical decisions to economic outcomes (Chesbrough, 2003).

2.3.1.5) Relating 3H to Management Elements identified for Inbound Open Innovation Management

After identifying entrepreneurial orientation, learning orientation & transformational leadership as our key management elements of inbound open innovation management, it is important to find a framework that can fit all these three factors together constructively. For instance, leaders good at discovering opportunities and innovation need the skills of people who excel at execution because the fastest way for an organization to fail is to stop executing (Dyer et al., 2011). Determining how to balance various skills within the organization becomes an important area and one approach is shown below.

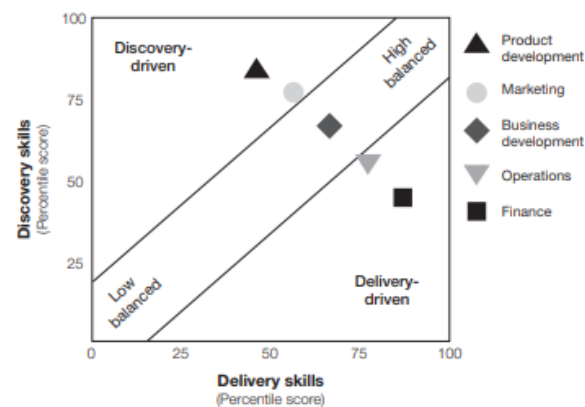


Figure 3.11 Desired skills composition in different types of teams (Dyer et al., 2011)

A) Enhancing Execution Ability (Hand) with Learning Orientation

It is quite common where managers only focus on one or two domains so they can only partially resolve their problems without developing the capability to balance different aspects of innovation management. The ability of closing competitive gaps relies on competencies development through knowledge creation and integration. This is based on important components of organizational-level knowledge stocks include systems, structure, strategy and all of the storehouses of learning need to be aligned to deliver desirable business performance (Bontis et al., 2002). As business and technology condition is continuously changing in a high technology environment, it is crucial to have the ability to upgrade execution skill relentlessly also. Hence, possessing the ability to enhance execution competency is an essential requirement for successful managers. This critical challenge for organizational success can be overcome by driving learning orientation within the entire firm to create dynamic capability.

Dynamic capabilities can also combine with different strategy to create and refine a defensible business model. For instance, through the development and coordination of resources from the firm and its partners, transformational leaders can address and even shape changes happening in the marketplace. It becomes possible for enterprise to sustain and enhance its capabilities and resources within its business environment (Teece, 2018). Hence, the availability of dynamic capabilities enable top managers to become more proactively in managing their strategic choices. With a higher level of entrepreneurial approach, it is likely to bring in more innovative results for the firm.

B) Organizational Change through Transformational leadership (Heart)

In any knowledge driven economy, such as Industry 4.0, constant change in organizational structure is essential to meet with new and adjustment in existing processes. For organization to compete based on dynamic capabilities, the use of higher dimensional factors, such as informal relationships, trust-based relationships, emotionally inclusive relationships and externally oriented relationships, was proposed (Wang & Ahmed, 2003). This organizational management approach is very similar to the characteristics of transformational leaders. It also corresponds to the heartfelt leadership approach recommended by 3H.

C) Strategy Selection (Head) driven by Entrepreneurial Orientation

The key role of strategic management is to match the requirements of a changing environment with organizational capabilities and its development (Teece et al., 1997:515). The level of scope expansion for resource based view in a dynamic environment will depend on management selection and execution of the appropriate strategies. The connection between core competencies and the degree of coherence between different parts of the firm is a reflection of how resource are strategically allocated from an organizational economics perspective (Dosi et al., 1992). To remain relevant, firms need to assign the appropriate level of organizational capabilities to support its strategies and ambitions. Hence, to deal with the constantly changing environment, such as Industry 4.0, entrepreneurial orientation is driving strategic thinking (Head) and resource distribution of the organization towards higher level of innovation support.

D) How Management Elements Coming Together

The central theme of the 3H framework is the strategic alignment of three key domains, namely leadership and people, strategy supported by structure and systems, as well as competence. This holistic management framework means leaders can effectively and efficiently combine all three domains together to deliver the best performance outcome in a sustainable manner for the organization. In providing a simple but holistic framework for management, Yu's 3H is offering high-tech SME management the opportunity to cover different aspects of innovation management under one instrument, starting from strategic consideration (Head), supported by leadership with mediation and intervention ability (Heart), to execution tracking and optimization (Hand). This simplicity echoes observation made by Leonard-Barton in her study where greater misalignment potentially exists between project and capability if more dimensions are included (Leonard-Barton, 1992).

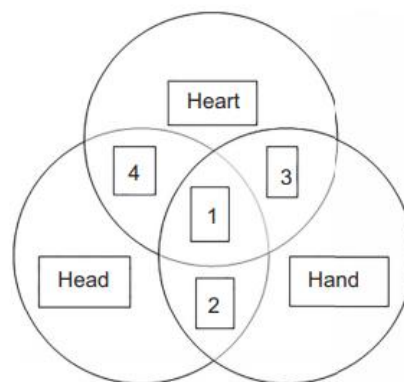


Figure 3.12 Structure of 3H Framework (Yu, 2021)

2.3.1.6) How the 3H Framework Fits into Inbound Open Innovation Management

Open innovation is about combining internal research with external ideas and deploy them within the business of an organization, or perhaps also through other companies' businesses. The key for inbound open innovation is to figure out which missing pieces should be internally supplied and how to integrate both internal and external pieces together into systems and architectures (Chesbrough, 2003). Organizations must also be equipped with ability to continuously detect changes in their markets so they can prepare corresponding actions. They must possess capabilities to create and manage close customer and market relationship so all functional activities and organizational processes will be better directed toward anticipating and responding to changing market requirements ahead of competitors (Day, 1994).

Knowledge creation within the organization should be at the center of company human resources strategy supported by organizational design, business practices and managerial responsibilities so personal knowledge becomes readily available to others (Nonaka et al., 1995). Nevertheless, leadership during organizational knowledge creation is complex and should consist of a core layer of local knowledge creation, a conditional layer that provides the resources and context for knowledge creation, and a structural layer that forms the overall framework and direction for knowledge creation in the organization (Von Krogh et al., 2012). Successful leadership must be able to align and balance different expectations and values within the organization through a common framework which can also act as a platform for all to follow. This robust platform must be agreed and supported by the members to guarantee commitment so it should be simple to understand and avoid ambiguity to comply with Bass suggestion of moral excellence (Bass, 1998). This clearly calls for a framework that is able to incorporate leadership and learning simultaneously.

Furthermore, the possession of an organic structure, the ability to respond quickly to changing market conditions, and pursuing planned, well-crafted strategies are critical intervening mechanisms in the entrepreneurial orientated strategic learning capability relationship (Anderson et al., 2009). Moreover, entrepreneurship is also positively related to those that embrace empowerment, teamwork, an innovative and change supportive culture, more de-centralization and less structural which corresponds to inherent elements of transformational leadership (Zahra, 1993). Hence, any framework that supports such operating requirement must incorporate learning, entrepreneurial orientation and transformational leadership. One possible model which includes considerations for external environment is shown below (Burke & Litwin, 1992) but it has not highlighted the importance of learning as an execution tool.

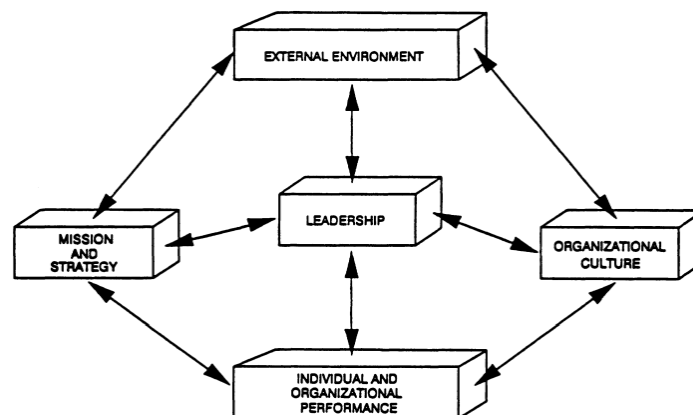


Figure 3.17 A Model of Organizational Performance & Change – The Transformational Factors (Burke & Litwin, 1992)

Another common theme that emerges is the need to regularly monitor and balance refining factors by top management because system approach for innovation requires feedback ranging from economic activity to institutional setup (Lundvall, 1999:72). Hence, an innovation management framework must be dynamic enough to define and direct organizational strategies, possess distinctive processes to coordinate and combine firm's specific capabilities, and act toward the creation of competencies and processes that foster innovation. This fits well under the central theme of the 3H framework as it supports the strategic alignment of three key domains, namely people, strategy as well as competence.

In addition to its flexibility to expand according to the particular need of the organization, 3H also enables the continuous adjustment through monitoring and is dynamic enough to offer management the ability to adjust easily to support the maintenance of firm's competitive advantages. In an ideal situation, the organizational performance (OP) may even reach a state of self-optimization continuously as represented by $OP = f(H^1 \cap H^2 \cap H^3)$ under the 3H framework. This holistic management solution means leaders can effectively and efficiently manage all three domains through influencing their followers and integrate different aspects to achieve a good and sustainable performance outcome for the organization.

On the other hand, the 3H framework has also strengthened the model development by Burke and Litwin through the introduction of execution into the framework within the context of inbound open innovation. Therefore, 3H appears to be a more viable framework for high-tech SME management as part of their effort to conduct innovation management under an inbound open innovation context. Our study is also providing an opportunity for the 3H model to demonstrate its ability to fill the behavioral gap in evolutionary economic models through the inclusion of leadership. Furthermore, the success and continuous survival of any organization is the combination of strategy, represented by entrepreneurial orientation, and execution, supported by learning orientation. More importantly, both of these elements must to be directed constructively to achieve a sustainable competitive advantage. This guiding light in the context of open innovation will be transformational leadership, which is likely to reflect social values and to emerge in times of distress and change (Bass, 1985:154). As part of our research investigation, these three elements will be combined through the 3H framework in the model below to expand our understanding on how to effectively support the continuous growth of high technology SMEs through inbound open innovation.

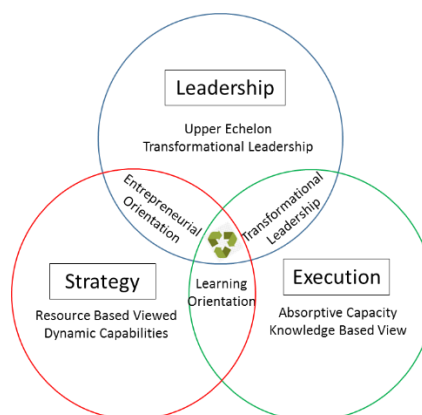


Figure 3.18 How Strategy, Leadership and Execution Combine in Open Innovation

Chapter Three Research Methodology

3.1) Establishing Assessment Instruments for Measuring the Current and Predicting the Future Organizational Performance

3.1.1) The Validity and Possibility of Using the Technology Readiness Index Lens to Predict Organizational Performance in an Inbound Open Innovation Environment

Organizations do the things they do, or perform the way they do because of the biases and dispositions of their most powerful actors in the form as their top executives. However, each person is unique, which means that no two leaders will be exactly the same because elements of their own personality to the way that they approach leadership will be included in their management approach. They are also likely to be influenced by the industry or business that they work in. This combination of personality and experience will give them a viewpoint and approach which is unlike that of anyone else. Hence, it is paramount to understand the personal attitude of top leaders in SMEs towards innovation to predict the likelihood of innovation adoption. It is also of particular interest to understand the leaders in an individual level because the attitudes, personal qualities and skills of leaders in organizations is vitally important ingredients in innovation (Adair, 2007:63). This raises the need to understand management as an individual especially under the inbound open innovation context because the norms that promote exploitation, such as incremental improvement and attention to detail, are substantively different from those needed for exploration such as risk taking and flexibility (O'Reilly & Tushman, 2021).

The importance of different experience in top management teams is a key source of innovation, especially in transforming resources, notably managerial resources, and fosters organizational growth (Penrose & Penrose, 2009), supporting the significance of understanding the top management teams in general. Moreover, the inclination of top management as an individual towards continuous rethinking or remaining over confidence could play a make or break role for an organization (Grant, 2021). Hence, performing a local study for Hong Kong is necessary to reflect how to correlate personal attitude towards inbound open innovation and its role in business management decision process within the local context.

3.1.1.1) Understanding the Strategic Decision Making Process

Before exploring the nature of individual, it is also important to understand the situation facing a strategic decision maker is complex and the phenomena could be far more than he/she can possibly comprehend. Hence, decision makers brings a cognitive base and values to a decision, which create a screen between the situation and his/her eventual perception of it. Executives act on the basis of their personalized interpretations of the strategic situations they face, and these personalized construals are a function of the executives' experiences, values, and personalities because executives vary and that the strategic alternatives available to them vary as well (Hambrick & Mason, 1984).

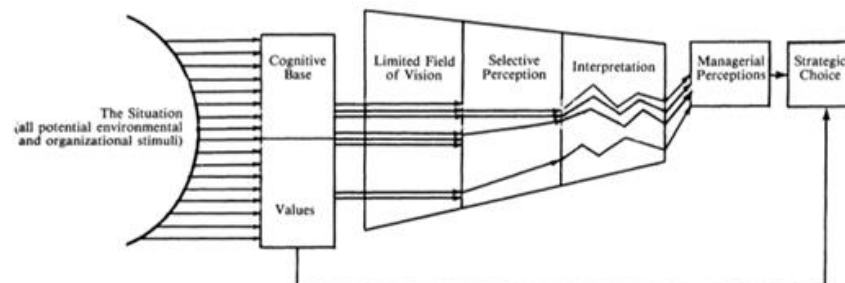


Figure 4.1 Strategic Choice Under Conditions of Bounded Rationality (Hambrick & Mason, 1984)

Recognizing the importance of top management perception in affecting interpretation and how filtering of various input can limit actual company performance, an enhanced model was built to include organizational performance also. This extension supports the proposition of selective perception within the “Bounded Rationality” model where further filtering occurs because an executive selectively perceives only a portion of the stimuli within his or her field of vision (Finkelstein et al., 2009) and is shown below.

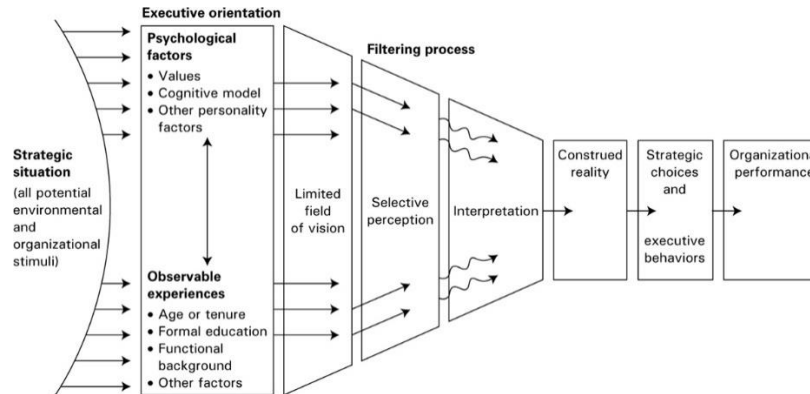


Figure 4.2 Strategic choice under conditions of bounded rationality the executive's construct reality vision (Finkelstein et al., 2009:45)

During the decision process, selection occurs subconsciously because top management usually take mental shortcuts and engage in limited search to arrive at their choices especially when they are under job pressure (Hambrick et al., 2005) and will economize in their strategic decision making by relying on their experiences to search for and interpret information as well as to select among options (Hambrick & Mason, 1984). The strategic choice is made based on his/her interpretation of the stimuli which was selectively perceived or grasped due to the limited field of focus attention or based on the executive's interest in the technological issues. (Finkelstein et al., 2009) Individuals will be drawn to what has worked for them before, what they find familiar or comfortable, and what fits their cognitive schema (Axelrod, 1976; Starbuck & Hedberg, 1977).

Strategy making styles, decision making biases especially on the escalation of commitment and work on individual and organizational minds are all important elements that help to establishing clear links to absorptive capacity, capacity to change, and managerial wisdom (Boal & Hooijberg, 2000). Decisions made by executives who are under significant job demands will closely reflect their backgrounds (Mischel, 1977) including their functional backgrounds (Kimberly & Evanisko, 1981), educational experiences (Wiersema & Bantel, 1992), and age and tenure (Finkelstein & Hambrick, 1990) as well as their psychological dispositions (Miller & Droge, 1986; Hambrick et al., 2005).

While how top management value innovation and creative behavior plays a critical role in the effectiveness of utilizing innovative capacity for that organization (Pierce & Delbecq, 1977), different choice made by strategic decision maker due to attitudinal orientations will result in variation of organizational structure and levels of innovativeness impacting the likelihood of innovation success for the organization. Therefore, we must also investigate how individual attitude affect strategic decision in our study. Finally, it was also observed in a Hong Kong study that knowledge and education level of company top management remains an important driver for entrepreneurial orientation for those in China

(Chow, 2006) and this is why general background data about the executive will also be collected for our study and analysis to determine if it plays any role in influencing innovation decisions.

3.1.1.2) The Role of the Individual

Innovative companies are most likely led by innovative leaders and the DNA of innovative organizations are reflections of the DNA of innovative individuals because the most innovative companies in the world have leaders who understand innovation at a deeply personal level (Dyer et al., 2011:191). For instance, the profile of CEO explains a significant proportion of the sample variance in firm R&D spending even when corporate strategy, ownership structure, and other firm-level attributes are controlled (Barker & Mueller, 2002). Entrepreneurship is not rational or necessarily purposeful because opportunities and ideas emerge from individual experience (Floyd&Wooldridge, 1999:138). Opportunities are perceived within organizations because individual entrepreneurs have access to unique information and willing to accept ideas based on subjective criteria. Entrepreneurial orientation will focus at the firm/business-unit level and this firm-level approach is consistent with classical economics in which the individual entrepreneur is regarded as a firm. Hence, since small business firm is simply an extension of the individual who is in charge (Lumpkin & Dess, 1996), its characteristics will follow the individual. Subsequently, the strategic direction chosen for the firm by top management normally focuses on their strategic understandings and beliefs toward innovation (Slater & Narver, 1993; 1995).

Furthermore, management attitude towards change is indeed identified as one of the major antecedents of organizational innovation and a favorable attitude toward change in managers is essential for creating a climate conducive to innovation through motivating members to stay engaged and remain in the journey of making innovation happens (Mumford, 2011). This is because individual characteristics such as personality tend not to be easy to change (Tornatzky et al., 1990) and attitude of managers and personnel towards change are defined as part of the Organizational Rigidity measurement which hampers in all area of innovation activities (Oslo Manual, 2005:113). In fact, since innovation is an attribute of an organization and the chief variable related to innovative change at an individual level are the attitudes of an individual toward change, any ideology from the management would influence the type of innovation chosen (Mohr, 1963).

Finally, diffusion of innovation is an important change strategy which focus on individuals rather than the whole organizations (Kezar, 2011) and human factors derived from personality, experiences, values, social connections, fatigue, envy, and so on play a substantial role in affecting organizational outcomes (Finkelstein et al., 2009). This is because organizational policy and adoption of innovation programs are more inclined towards the preference of the elite within the organization (Hage & Dewar, 1973). Hence, it is important to measure the individual attitude of the elite towards innovation as a predictor of innovation adoption. An understanding of entrepreneurs may include knowing their personal perspective, their ways of identifying opportunities, their methods of acting and managing, and their mechanisms for adapting and reassessing because their behavior models will be determined by past events, perceptions, traits, or personal principles and characteristics (Cunningham & Lischeron, 1991). Therefore, it is important for our study to include an instrument that can collect individual attitude towards innovation so further prediction can be established based on their strategic thinking within the inbound open innovation context.

3.1.1.3) Technology Readiness Index and Entrepreneurship

Entrepreneurship and leadership converge in area such as vision, influence on both followers and on a larger constituency, motivating others, risk-taking, creativity or innovativeness (of the leader as well as followers), high tolerance for ambiguity and proactiveness (Renko et al., 2015:56). Entrepreneurial orientation also encourage strategies that drive the creation of new ideas and facilitate proactive and competitively aggressive positioning (Cooper et al., 1989). In fact, entrepreneurship is a dimension of strategic posture represented by a firm's risk-taking propensity, proactive manners, tendency to act in competitively aggressive and reliance on frequent and extensive product innovation (Covin & Slevin, 1991). As discussed in previous sections, the strategic decision process taken by individual managers are likely to be highly influenced by their personal characteristics. Hence, the ability to measure such major characteristics related to entrepreneurial orientation and leadership will offer researchers a good insight into how organizations should perform going forward. Based on its dimensional focus, the Technology Readiness Index (TRI) may indeed be an appropriate instrument for conducting such research.

Technology Readiness Index (TRI) was first developed in 2000 as a 36-item scale, individual-level construct, based on literature that focused on adoption of new technologies and people-technology interactions. TRI 1.0 was aimed at measuring “technology readiness” which was people’s tendency to embrace and use new technologies in order to accomplishing their goals in home life and at work (Parasuraman, 2000). This instrument composed of four relatively distinct dimensions where optimism and innovativeness are “motivators” while discomfort and insecurity are “inhibitors” towards technology. Individual can possess different combinations of technology-related traits and profiled as a combination of these four alternate elements after assessed by TRI.

A more concise version, TRI 2.0, has been released after 14 years of review and optimization to match with new technology developments in the same period. It was also updated to facilitate the understanding of the dynamics behind adoption of various technologies and offer a robust predictor of technology-related behavioral intentions as well as actual behaviors. It is particularly useful for assessing psychographic variable in applied, decision-oriented research in contexts where technology based innovation plays an important role at an individual-level and this is well aligned with the context of our research (Parasuraman & Colby, 2015:14). Respondents with high technology readiness will be interested in advanced functionality and capable of mastering new high-tech offerings with minimal help, implying the existence of their ability to appreciate and adopt new innovations which come from external sources.

The positive relationship between factors measurement by TRI and entrepreneur characteristics was shown by a study of small business owner and entrepreneur. The characteristics of the entrepreneur identified by different scholars has been summarized and listed in the figure below (Carland et al., 1984). The entrepreneur is characterized by a preference for creating activity, manifested by some innovative combination of resources for profit and innovation is the main difference between an entrepreneur and a small business owner. These findings support our belief in using TRI is a relevant instrument to correlate SMEs’ strategy because TRI looks for key elements that can drive the adoption of various technologies and offer insights into technology-related behavioral intentions and possible behaviors. The outcome of our study will also help the development of a conceptual framework that can differentiate entrepreneurs from small business owners because entrepreneur is essential to economic development.

<i>Date</i>	<i>Author(s)</i>	<i>Characteristic(s)</i>	<i>Normative</i>	<i>Empirical</i>
1848	Mill	Riskbearing	x	
1917	Weber	Source of formal authority	x	
1934	Schumpeter	Innovation, initiative	x	
1954	Sutton	Desire for responsibility	x	
1959	Hartman	Source of formal authority	x	
1961	McClelland	Risk taking, need for achievement		x
1963	Davids	Ambition; desire for independence; responsibility; self-confidence		x
1964	Pickle	Drive/mental; human relations; communication ability; technical knowledge		x
1971	Palmer	Risk measurement		x
1971	Hornaday & Aboud	Need for achievement; autonomy; aggression; power; recognition; innovative/independent		x
1973	Winter	Need for power	x	
1974	Borland	Internal locus of control		x
1974	Liles	Need for achievement		x
1977	Gasse	Personal value orientation		x
1978	Timmons	Drive/self-confidence; goal oriented moderated risk taker; internal locus of control; creativity/innovation	x	x
1980	Sexton	Energetic/ambitious; positive reaction to setbacks		x
1981	Welsh & White	Need to control; responsibility seeker; self-confidence/drive; challenge taker; moderate risk taker		x
1982	Dunkelberg & Cooper	Growth oriented; independence oriented; craftsman oriented		x

Figure 4.3 Characteristics of Entrepreneurs (Carland et al., 1984)

3.1.1.4) Relevance of Using TRI as a Measurement Tool for SME

A company is not a machine but like an individual with own sense of identity and fundamental purpose (Nonaka et al., 1995:97). Strong desire for achievement, high internal locus of control, and medium risk taking preference is the personality characteristics of successful new business owner-managers (Korunka, 2003). The actions and attitudes of the SME's founder have a profound impact, especially in the formative stages of a company's processes and values because the founder often has strong opinions about the way employees ought to work together to reach decisions and get things done and impose their views of what the organization's priorities need to be (Christensen, 2013:134). In smaller firms, size could be a less significant predictor of structure than CEO personality (Miller & Droge, 1986).

Adoptions of innovations can be stimulated by key psychological aspects of the human capital existing within the organizations, such as innovativeness and SME entrepreneurs' basic personality traits (Marcati et al., 2008). Rogers believed adoption or rejection of the innovation are based on the individual's perceptions of the innovation and an adoption/rejection decision is always right in the eyes of the individual who is making the innovation-decision at the time of decision (Rogers, 1963:100). In addition, when top managers are faced with such common decision challenges as information overload, ambiguous cues, and competing goals and objectives, executives' perceptions of stimuli are filtered and interpreted through cognitive bases and values. As these psychological constructs are unobservable, observable managerial characteristics are efficient proxies that provide reliable indicators of the unobservable psychological constructs (Carpenter et al., 2004). This is because entrepreneurial intentions and cognitive maps to entrepreneurial behaviors and intrinsic motivation refers to a personal interest in the entrepreneurial task (Carsrud & Brännback, 2011) and the corresponding organizational flexibility depends on the leaders at the top and its ability to change requires that the leaders have cognitive and behavioral complexity and flexibility (Boal & Hooijberg, 2000:517).

Entrepreneurship is an outcome of top managers' cognitive mapping and also a form of planned and intentional behavior. Certain key attitudes or beliefs robustly predict intentions and these key attitudes and intentions are perception-based (Krueger & Brazeal, 1994). For instance, if the SME CEO is an internal person believes that the consequences of his behavior stem from his own efforts, then he will

favor innovation strategies and more focus on planning for the future, leading their competitors and taking risks (Miller & Toulouse, 1986). According to the Theory of Planned Behavior, personal attitude toward entrepreneurial behavior and action is determined by the total set of accessible behavioral beliefs linking entrepreneurial behavior to various outcomes where the strength of each belief is weighted by evaluating the outcomes. It works with subjective norm based on individual's perception of the social pressures to engage or not in entrepreneurial behavior (Ajzen, 1991).

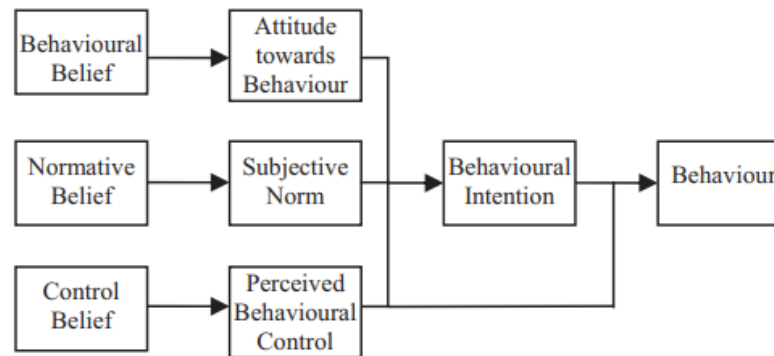


Figure 4.4 TPB Theory of Planned Behavior as Proposed by Ajzen (1991)

This combination of personal attitude and subjective norm exhibited by top management will determine their willingness to execute corporate strategy according to a study of Singaporean SMEs where CEO characteristics are important factors affecting IT adoption in small businesses. Small businesses are more likely to adopt IT when the CEOs are more innovative, have a positive attitude towards adoption of IT, and possess greater IT knowledge (Thong & Yap, 1995). There is also strong linkage between CEO characteristics and technological innovativeness in the Canadian context based on a study of 219 companies (Kitchell, 1997), confirming this linkage is universal across different culture. Moreover, for simple firms, that are normally small and power is centralized at the top, entrepreneurship would be determined by the characteristics of the leader (Miller, 1983; Mohr 1969). Entrepreneurial competencies are considered a higher-level characteristic encompassing personality traits, skills and knowledge, and therefore can be seen as the total ability of the entrepreneur to perform a job role successfully (Man et al., 2002).

In this regard, since most of our SMEs will be classified as simple firms in Miller's definition, our measurement of the firms' entrepreneurship can be based on collecting information to analyze entrepreneur characteristics of top managers through TRI. Attitude towards inbound open innovation adoption will also be collected in our study to predict likelihood of inbound open innovation for the Hong Kong high technology SMEs. This is because perspective from an entrepreneur is often regarded as crucial to sound strategic management (Lyon, 2000:1081). In addition, as an established and consistent instrument, TRI offers management the option to identify longitudinal changes to enable organization to make the crucial adjustment in strategic direction, leadership approach as well as learning and execution requirement when new beliefs and assumption emerges due to new experience from new awareness which further enhance the development of skills and capabilities in this cycle of learning (Senge, 2014). All these imply TRI is a potentially powerful instrument to predict the likely outcome of organizational performance on an ongoing basis.

3.1.1.5) Relationship between Individual TRI Elements & Inbound Open Innovation Management

Entrepreneurial style, which measured management willingness to take business related risks, their preference to be proactive when competing with other firms, and how much they favor change and innovation in order to obtain competitive advantages, is just one of the three major component identified by Naman and Slevin in their model of fit which relates positively to company success. (Naman & Slevin, 1993). Hence, it is difficult to use a single element to measure entrepreneurship because it is not an all or none trait but should be viewed as a range of behavior which is cohesive (Stevenson & Gumpert, 1985:86). The search for a single psychological profile of the entrepreneur is bound to fail as for each traditional definitions of the entrepreneurial type, there are numerous counter-examples that disprove the theory (Stevenson, 1983:3).

In fact, organizational innovation can be viewed as a five-dimensional construct including creativity, openness, future orientation, risk-taking, and proactiveness (Ruvio et al., 2014). Compatibility between optimism and proactiveness were reinforced when they were combined positively as a single factor to define personality for engaging in opportunity business ownership (Van der Zwan et al. 2016:287). Since proactiveness, risk taking and innovativeness are also focus areas of entrepreneurial orientation (Lumpkin & Dess, 1996), they correspond well to the element of optimism, insecurity, innovativeness measured by TRI because insecurity is negatively correlated to risk taking while optimism is associated with taking proactive steps (Carver et al., 2010:879). The relationship between individual TRI elements and Inbound open innovation management framework will be examined in detail below.

3.1.1.5.1) Innovativeness and Inbound Open Innovation

Innovativeness is an awareness of the need to innovate, or a positive attitude toward change (Hurt et al., 1977:59). Innovativeness indicates how early an individual can adopt innovations with respect to others in the social system (Rogers & Shoemaker 1971) so it is a person specific variable within an open context. Innovativeness also drive the capacity to innovate within an organization which in turn determine its performance and competitive advantage (Hurley & Hult, 1998). The innovativeness of SMEs is also enhanced by having a strong innovation climate, which stimulate lateral thinking and risk taking, because it encourages firms to take advantage of outside knowledge through inbound open innovation (Popa et al., 2017). Hence, measurement of innovativeness should reflect the level of entrepreneurial orientation as well as openness to transformation.

Hypothesis: Innovativeness relates positively to level of entrepreneurial orientation

Hypothesis: Innovativeness relates positively to openness to change and transformation leadership.

Hypothesis: Innovativeness correlates positively to organizational performance

Hypothesis: Innovativeness correlates positively to the level of inbound open innovation adoption

A learning oriented organization will ultimately produce a sustainable competitive advantage through self-reinforcement because the desire of learning is driven by the inherent awareness of the need to innovate, or a positive attitude toward change under an innovative management (Hurt et al., 1977). The presence of attitudes and beliefs as core elements in this learning-innovation cycle shown below also provide a direct measurement for TRI through assessment of individual attitude.

Hypothesis: Innovativeness relates positively to level of learning orientation

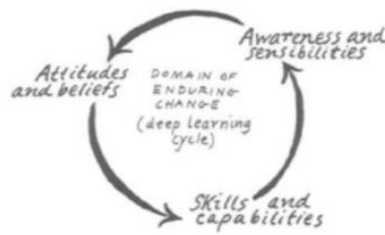


Figure 4.5 The Essence of the Learning Organization (Senge, 2014)

3.1.1.5.2) Optimisim and Inbound Open Innovation

In today's turbulent and disruptive environment characterized by economic uncertainty, globalization, 24/7 competition, and never-ending advanced technology, adopting a proactive and positive organizational behavior approach is important for firms, especially high technology SMEs. For company to continue to be successful, management needs to lead and maintain positive organizational behavior which is characterized by such features as optimism into the future, perseverance, forgiveness and a strong work ethic which are key elements of transformational leadership. Optimism is a form of future-oriented thinking and predicted people's engagement in anticipatory action. Employees who are high in consideration of future consequences reported greater proactivity (Parker et al., 2010:843) so it is aligned with transformational leaders who have vision.

CEOs with bright side personality characteristics including optimistic, self-confident, positive, stable, and feeling satisfied were positively related to transformational leadership (Resick et al., 2009:1365). As part of his/her tenacious goal pursuit, it is essential for an entrepreneur to have an optimistic belief that he is capable of initiating and maintaining difficult courses of action which is clearly a kind of proactiveness (Schwarzer & Taubert, 2002:10). Transformational leaders are confident, have high self-esteem, positive, optimistic, and emotionally balanced, and able to cope with stressful and complex environments (Bass & Riggio, 2006:168). Since optimism is closely related to proactiveness, (Carver et al., 2010:879) and optimism and proactiveness exhibited similar characteristics in terms of personality for entrepreneurial motivation (Van der Zwan et al. 2016:287), we will assume our survey results collected for optimism assessment through TRI being interchangeable with for proactiveness.

Hypothesis: Optimism is positively related to the level of transformational leadership

Proactive and positive organizational behavior is open to learning, development, change, and management in the workplace which can be developed through training programs, managed/led on-the-job, or self-developed (Luthans, 2002). Training can produce significant result in changing subordinates' own organizational commitment and their perceptions of leadership performance and their behaviors. (Barling et al., 1996). Moreover, learning goal orientation influence multiple proactive goals of individuals and those with higher learning goal orientation are more likely to be proactive in seeking feedback (Parker et al., 2010:842), possibly attaining an even higher level of development. If management can achieve a good balance between personal ability and job requirements, it will lead to better motivation & performance (Burke & Litwin, 1992). Hence, leaders' proactiveness towards learning will be reflected by the level of learning orientation exists within the organization. This is important for innovation because learning orientation affects the degree of proactive learning in an organization as a whole (Sinkula et al., 1997). As such, measuring the level of optimism will be indicative of organizational learning orientation.

Hypothesis: Optimism is positively related to the level of learning orientation

3.1.1.5.3) Risk Taking-Insecurity and Inbound Open Innovation

Innovation management is all about risk because innovativeness may also be deciphered as the proportional amount of risk taking involved in the deployment of resources in an uncertain situation (Hurt et al., 1977:58) and disruptive organizations and teams knowingly take risks in their pursuit of innovation. (Dyer et al., 2011:234). By balancing between adaptive and generative learning in line with the chosen strategy, management is also accepting a certain level of risk by allowing exploration and experimentation to exist alongside the development existing ideas (Wang, 2008:650). Management familiarity with the technology, the degree of confidence that the team can succeed in a new technical area and attitude to risk are all important factors composing the comfort level of management (Tidd & Bessant, 2020:328). From this perspective, measurement of insecurity and discomfort against new technology should be reflective of risk tolerance of leaders during the inbound open innovation process.

Hypothesis: Risk taking (insecurity) and discomfort negatively related to level of entrepreneurial orientation.

Hypothesis: Risk taking (insecurity) and discomfort negatively related to level of learning orientation

In summary, different elements of TRI are shown to be highly related to the three components of inbound open innovation management framework under 3H and this relationship is summarized in the table below. Hence, by leveraging TRI, our study will try to capture a snapshot of the attitudinal mind map from the respondent in order to determine the level of readiness for inbound open innovation instead of searching for a specific personal persona since innovation is multi-dimensional.

TRI Assessment Factors	Innovativeness	Optimism/Proactive	Insecurity	Discomfort
Entrepreneurial Orientation			Risk Taking 	Competitive Aggressive
Transformational Leadership	Visionary/Creative 	Caring 	Trust 	Communicative
Learning Orientation	Learn New Knowledge 	Commit to Learn 	Open-Mindedness	Sharing

Figure 4.6 TRI Elements Mapping Against Entrepreneurial Orientation, Transformational Leadership & Learning Orientation

3.1.2) Respondent Profiling and General Background Consideration

Besides capturing the entrepreneurial, leadership and learning orientation profile of our participants, understanding their individual background also plays an important role. Numerous studies covering social media acceptance, attitude and acceptance towards e-commerce have been conducted to correlate various independent factors or antecedents that are specific to individual respondent and his or her readiness of adoption technology innovation. Hence, our study will consider their findings to be part of our background analysis. Major independent factors that will be included in our study are listed below.

3.1.2.1) Age Group Segmentation in Profiling Participants

In a study funded by the US National Institute of Health (Czaja et al., 2006), it was concluded that older adults were less likely than younger adults to use technology in general. On the other hand, for the 1 in 1,000 fastest growing new ventures in the United States between the years 2007-2014, the mean age of founder at company commencement is 45.0, and the findings are similar when considering high-

technology sectors and entrepreneurial hubs, thereby rejecting common belief that youth as a key element of successful entrepreneurs (Azoulay et al., 2020). Hence, there is potentially an optimal age that can balance experience and youthfulness. As most SMEs surveyed by our study are managed by their founders and top management, the age of the founder is likely to be the CEO. Hence, our questionnaire will reference against Azoulay's study and use the age segmentation as shown in figure below, giving a final range of <30, 30-40, 40-50, 50-60, 60+.

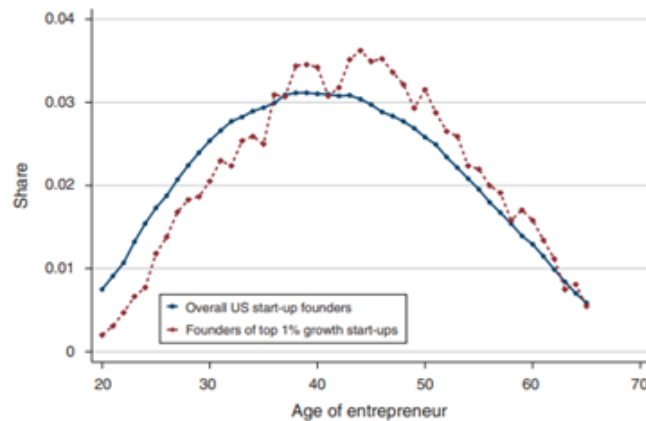


Figure 4.7 Founder Age Distribution: All Start-Ups and High Growth Start-Ups (Azoulay et al., 2020:74)

3.1.2.2) Education Level of the Respondent in the Company

Education level of an individual has a definitive influence of technology adoption for individual because education is the most consistent predictor when explaining people's willingness to adopt new technology (Rojas-Méndez et al., 2017). Other academic studies, such as Porter and Donthu (Porter & Donthu, 2006), have also found a positive relationship between educational level and the perceived ease-of-use of the internet. In addition, the average age and the average education level of top management team in small businesses are significant predictors of the extent of IT adoption, supporting the idea that the age and education composition of managers as current/future top management is critical in facilitating the extent of IT adoption in SMEs (Chuang et al., 2009). Therefore, the academic qualification of the respondent will be collected and assessed in our study to assess the likelihood of technology adoption by SMEs in Hong Kong.

3.1.2.3) Experience in the Current and Similar Industry to Company

Experience of the top management in the same industry enables them to enjoy compatibility, which was defined by Rogers as "the degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of the adopters" (Rogers, 2003:15). On the contrary, Rogers also highlighted complexity as "the degree to which an innovation is perceived as relatively difficult to understand and use" (Rogers, 2003:15), giving an important but also contradictory role to relevant experience in similar industries. The presence of both complexity and compatibility demand management to be well versed in the similar industry that they worked for so they can become a capable technology innovation adopter. This is because prior experience in the specific industry also indicates a much greater chance of entrepreneurial success (Azoulay et al., 2020). When identifying and selecting critical elements for inbound open innovation, lack of existing expertise and experience within the organization especially its top management will limit the ability to optimize the identification process (Nelson, 1985).

Experience occurs in the organization as tasks are performed and experience is temporal (Argote, & Miron-Spektor, 2011). Knowledge base of managers is derived from their past experience, and exposure to become part of the competitive advantage through a resource based approach. So when managers are moving between different organizations, they bring in experience and other knowledge that may create new competitive advantages and have a potential to determine the level of success in this new organization (McKelvey, 1982). Hence, previous experience gained by the entrepreneurs in the same or similar industries will influence final performance because experience interacts with context to create knowledge (Argote & Miron-Spektor, 2011) and knowledge eventually drives organizational performance. Hence, industrial experience should play an important role when inbound open innovation and learning orientation is being modelling together.

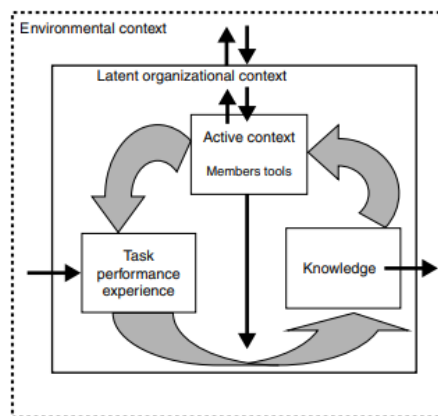


Figure 4.8 A Theoretical Framework for Analyzing Organizational Learning (Argote, & Miron-Spektor, 2011)

However, there are some exceptional cases when outsiders may bring in new business idea and able to run companies under different industrial segment from his own experience successfully. One of the best example was ex-CEO of Ericsson, Carl-Henric Svanberg, who was brought in from Assa Abloy, with no prior management in telecommunication industry but was able to turn-around the loss making business of Ericsson successfully. This is a successful example where inbound open innovation can bring in new entrepreneurial ideas for an organizational renewal but have to be evaluated carefully alongside other organizational factors. It is also the intention of our study to look at the correlations between different organizational factors.

3.1.2.4) Role of the Respondent in the Management Hierarchy within the Company

Management innovation is now a key factor for enhancing organizational sustainability especially in the area of information technology adoption in SMEs (Berkhout & Green, 2002) and top management needs to create and maintain a sustainable competitive advantage as part of an ongoing requirement to connect internal strategies and processes with external environmental changes and pressures. In the case of Hong Kong high technology SMEs, this process is a virtuous cycle created by combining innovation and competitive advantage (Loon & Chik, 2019). Hence, the current role and position of the respondent within the management hierarchy should have a positive correlation to the adoption of technology and will be investigated as part of our background information analysis.

3.1.2.5) Tenure of Management in Company

Competent managers are seen as a source of competitive advantages (McKelvey, 1982) so having a stable management team is important for any organization to develop. Moreover, the longer tenure

with a company also indicate a stronger attachment to the organization, so when decline in performance is detected, top management team with longer tenures and high diversity in top management is likely to result in greater determination and level of strategic changes (Boeker, 1997-B) to resurrect the company. The effects of executive migration are influenced by attributes of the executive and characteristics of the top management team of the organization. The impact of such migration on product-market entry are stronger when the new managers are more technical oriented, as part of top management and possess greater industry experience (Boeker, 1997-A). Combination of short organizational history and managers with relatively long tenure at the top usually leads to strategic changes as the result of external elements such as an outsider joining the company or the adoption of external ideas as in the case of inbound open innovation (Wiersema & Bantel, 1992). This combination echoes well with the fast changing high technology SMEs environment.

3.1.2.6) Size of the Company

The first factor influencing information technology adoption is organizational or the internal environment, including the size of the firm and its goals, the people within the firm, their behavior, culture, identity, structure and knowledge (Watson, 2006; Ngyuen, 2009). "Organisational circumstances like size, main technology or environment with which organisational structures and cultures need to fit or match if the organisation is going to function successfully" (Watson T. 2006:456). Moreover, management should consider the appropriate application for their firms when deciding whether or not to adopt new technology, including considering the size of the business, their employees' knowledge of technology and the amount of information that the organization possess (Premkumar & Roberts, 1999; Lee & Xia 2006). As such, the size of the company needs to be considered since it will influence the technology innovation adoption process itself because organizational structure is a crucial element in the diffusion of technological innovations (DeCanio et al., 2000). In our survey, which is specific to Hong Kong high technology business and not involving in manufacturing, the local government definition for a small and medium-sized enterprise (SME), which include those employing fewer than 50 persons in Hong Kong, will be used (HKSAR Government, 2012). Business that employs fewer than 10 employees is defined as micro enterprises and will be filtered out from the quantitative analysis.

3.1.3) Organizational Performance Measurement under the Context of Innovation Management

Organizational performance is important to academic across all domain of management research but scholars from different discipline adopt their own specific measures. Continuous monitoring and measurement of innovation and general organizational performance remains the key for the survival of every business because assessing progress and measuring the impact of innovation activities enables management to adjust strategy before mistakes become expensive or disruptive ideas are rejected. Performance represents the time test of any strategy and managerial importance of business performance is clearly exhibited by the many prescriptions offered for performance improvement as it is at the heart of strategic management (Venkatraman & Ramanujam, 1986). Performance provides important feedback about the efficiency of learning within an organization and affects how it will perform learning going forward (Mintzberg et al., 2003).

In a hostile environments, performance among small firms was positively related to an organic structure, a strategically entrepreneurial orientation, and a competitive profile that has long-term orientation with the predicted industry trends (Covin & Slevin, 1989). Fortunately, organizational

innovation influences organizational performance positively and was confirmed empirically (García-Morales et al., 2012) and innovation capability is the most important determinant of firm performance (Mone et al., 1998). However, performance is multidimensional and too complex to be measured effectively with single items, and/or a single measurement approach (Conant et al., 1990). To provide a better understanding of metrics related to inbound open innovation, we will also highlight in the following sections how performance metrics evolve towards a more innovation focus context and the role of performance management under TRI and 3H framework in assisting further optimization.

3.1.3.1) Evolution of Performance Definition and Measurement

Under a fast changing environment like Industry 4.0, the existing systems that was set out to measure innovation may not match the challenges facing high technology SMEs today due to the emergence of new business and technology pattern. Bititci and team (2012) proposed a possible trend of performance measurement by mapping the evolution of the previous performance measurement literature in figure 4.9. Their study clearly recognized the importance of R&D, innovation, management of knowledge and intellectual property in contributing to future competitiveness of an organization. Factors such as trust, relationship and innovativeness are important dimensions of performance evaluation in response to changes in the organizations' inner and outer operating environment (Bititci et al., 2012:24). Change will be disruptive and transformational so it is clearly corresponding to indicators such as transformational leadership (trust/relationship) and entrepreneurial and learning orientation (innovativeness) under an inbound open innovation framework.

This dependency on technology and knowledge collaboration between organizations, under both inner and outer operating environment, is clearly points to a future where organizational performance will be assessed under an open innovation environment. Furthermore, the disruptive and transformational changes in business environment due to Industry 4.0 is already forcing companies to move further towards inter-organizational collaboration as predicted, resulting in a complex networks of highly specialized organizations that work together to create competitive advantage and value. One major example of such collaboration is The 3rd Generation Partnership Project (3GPP) that unites seven telecommunications standard development organizations (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC), known as "Organizational Partners" to provide a stable environment to produce specifications that define the 5G mobile communication technologies and other similar organizations in other industries (e.g. 5G Automotive Association (5GAA)) are fast emerging as new technologies appear.

Therefore, the importance of inbound open innovation will only continue to expand due to the increasing pace of knowledge sharing and information proliferation. The performance of an organization or individual will be assessed by the network or community they belong to rather than as a closed system as the nature of work and the economics of production will depend more on the globalization of science and technology as well as the knowledge workers with greater complexity of skill (Bititci, et al., 2012:28), making performance measurement based on an open innovation approach a key element in the future.

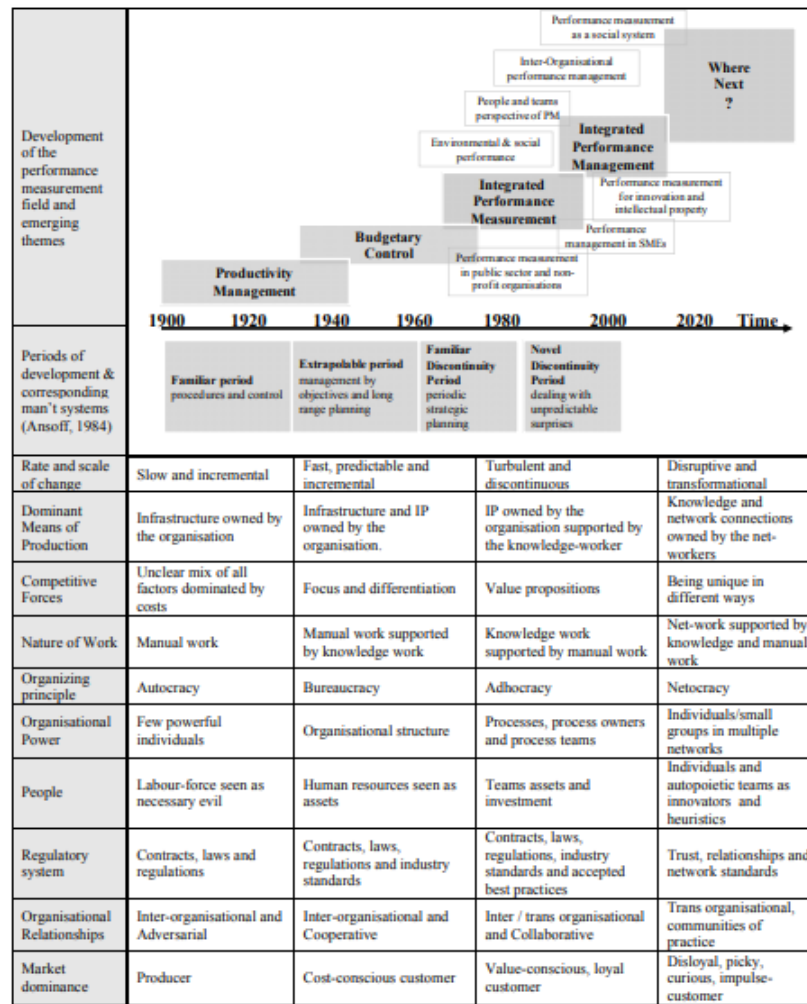


Figure 4.9 Development of the performance measurement literature and global trends (Bititci et al., 2012:26)

3.1.3.2) Selecting Organizational Performance Measurement Metrics Relevant to Inbound Open Innovation

Understanding firm performance in an innovation ecosystems which is highly dynamic, such as Industry 4.0, requires a change in the way strategy, value creation and firm performance are linked traditionally because the relationship is no longer limited to the innovation challenges that are faced by the focal firm but also includes the innovation challenges confronted by external partners (Adner & Kapoor, 2010:307). Unfortunately, most traditional studies focus on characterizing the magnitude and nature of the internal innovation challenges confronted by focal innovators (Adner & Kapoor, 2010:310). Hence, management may often overlook important areas from the external partners and not able to adjust strategies and execution approaches accordingly.

In comparison, the openness of inbound open innovation process in R&D management was found to be crucial for achieving a high level of direct and indirect innovation output. In particular, openness towards customers, suppliers and universities has a significant and positive impact on the different innovation performance measures (Inauen & Schenker-Wicki, 2011:496). Measurement of performance outcome due to innovation also need to shift from stand-alone to synchronous innovations since it has to

facilitate both internal and external fit. It is necessary to consider how organizations relate to their competitive and institutional environments instead of only focusing internally (Damanpour, 2017:25).

Actual performance also relies on the organizational ability to generate new and competitive advantages to win customers and how it can defend its competitive position in a distinctive, difficult to imitate capabilities perspective. High performance includes extra-ordinary financial results, a commanding market share, a culture of innovation, and a portfolio of compelling products and services (Benko & Anderson, 2010:172). Although the use of simple quantitative metrics, such as increase number of customers and increase number of products output, can provide more consistent view of performance, SMEs are less open to disclose exact monetary and sales related figures. As such, questions should be selected to avoid accessing sensitive financial topics so high-tech SMEs management can address them openly and honestly to reduce the chance of common method bias since there is no right or wrong answers and their responses would remain anonymous (Podsakoff et al., 2003). Questions related to direct comparison against competitors were also avoided to remove any subjective from respondents.

3.1.3.3) Sustainable Organizational Performance Improvement with Progress Tracking through 3H & TRI – An Longitudinal Approach

Organizational performance is often a source of persistent uncertainty. Forecasting is to limit uncertainty about the future, thinking about the future with intelligence and skill is the best way to enter it. Interpreting the future direction of innovation requires understanding of both the markets and the forces within them. Decision makers with experience are absolutely vital to generate credible visions that will be adopted because their judgment can be strengthened by examining the past to improve present performance while anticipating the future. The assumptions, needs, vision and goals of decision makers will be incorporated as part of the changes within the organization in accordance to the conceptual framework of organizational beliefs and goals and ultimately reflected in the final organizational performance (Porter et al., 1991).

Performance is also positively related to the innovativeness component of an entrepreneurial orientation, a market orientation, and a learning orientation (Kropp et al., 2006). On the other hand, although technology diversity through alliance has a positive impact on internal innovation efforts by increasing organizational product innovation performance, such collaborative strategies will also deliver a cost-increasing effects. Hence, organizations may need to balance their level of inbound open innovation against the establishment cost of alliance on a continuous basis (Faems et al., 2010:785). It is important for top management to accept that the relationship between compatibility, relative advantage, complexity and leadership style helps to predict organization performance because high managerial discretion occurs in industries with high R&D, resulting in high differentiation in high market growth, level of long term planning and product differentiation (Hambrick & Abrahamson, 1995: 1435).

These observations clearly indicate performance of high technology companies have high dependence on management ability and attitude at the time of measure. Hence, it is implicitly supporting the proposition that TRI, based around the 3H framework, can be a performance prediction tool for high technology SMEs and be used on a regular basis to provide a longitudinal view for management so organizational performance can be sustained. By combining the organizational performance metrics in conjunction with 3H indicators on a regularly basis, top managers will be empowered to obtain a multi-dimensional and longitudinal view on how to balance various components in an elegant and smooth

fashion during the inbound open innovation process. Since most studies only make use of cross-sectional snapshot data which could become inconsistent overtime, the use of TRI with 3H can make management tracking multi-dimensional and longitudinal.

3.1.4) Achieving Inbound Open Innovation Success through Operationalization and Optimization of Key 3H Elements

Evolutionary economist such as Veblen, Schumpeter, Nelson, Winter and Freeman have all played a major role in helping academic communities to understand the importance of innovation from the economic lens. These economists have also highlighted the significance of entrepreneurship, learning and their orientations within an organization to create and maintain competitive advantages. Despite claiming itself as a bridge between rational (Head based) and irrational (Heart based) approach and labelling “entrepreneurship” as an important element, evolutionary economics did not give a clear definition for the role of leadership and it seems leadership is just embedded in lesser function such as coordinating and structure (Nelson & Winter, 2002). In fact, although many evolutionary economics models has shown appreciation towards open innovation through learning in the form of knowledge accumulation and entrepreneurship, the role of leadership has not been obvious and implying an opportunity to strength our understanding in this area.

3.1.4.1) Accomplishing Innovative Strategies through Flexible Organizational Structure

In a highly competitive business world, such as those facing high technology SMEs in Hong Kong today, the environment is characterized by increasing strategic discontinuities and disequilibrium conditions, highly competitive markets, and an increasing focus on innovation and continuous learning where organizational success depends upon strategic flexibility (Hitt et al., 1998). Firm and economic growth are a process of creating more complex organization, or new connections, as well as the grouping of those connections. The attitudes, beliefs and other knowledge structures are products of local, discrete interactions and connections. By incorporating the latest and greatest information acquired from inbound open innovation, companies can indeed be able to create new competitive advantages through a constructive reconnection/re-structuring process where entities are combined to increase efficiency and output.

As such, organizational structure are just representation of connections that serves the purpose of the corporate need at any particular moment. Hence, for any organization that wants to grow through the inbound open innovation, it must constantly be establishing new connections within itself which is likely to appear in the form of organizational structure changes. There is a need to change the system or process and structure within the organization to embrace a more innovative culture because “people’s beliefs about innovation are related to beliefs about other aspects of system” (Hurley & Hult, 1998:52). Such strategic flexibility enhances current performance, supports organization to take advantage of future opportunities (Boal & Hooijberg, 2000) and allow firms to pro-act or respond quickly to changing competitive conditions and to develop strategic flexibility and competitive advantage so possession of an adjustment tool is necessary for organization to maintain its competitive advantages. This is because economic system is constantly being structure and re-structure and connections are constantly being formed and reform to create economic change and growth of knowledge (Potts, 2000).

Although innovation may be modified to fit the organization, the structure of the organization may have to be changed to accommodate the innovation. New organizational units may be created with responsibility for the innovation and in some cases, the innovation may affect the structure of the entire organization (Rogers & Williams, 1983). "Organizations are structured to capture and direct systems of flows and to define interrelationships among different parts. These flows and interrelationships are hardly linear in form, with one element following neatly after another" (Mintzberg, 1983:9). When it comes to embracing innovation, Mintzberg acknowledged major innovation will depend on cooperation and new programs usually cut across existing specialties so they require interdisciplinary efforts and rearrangement of the existing categorization (Mintzberg, 1983:209). As such, organization structure is simply a tool to assist the flow of cooperation between different parts within the organization and should be adjusted continuously to cater for the strategy chosen by top management in response to their aligned to the inbound open innovation environment at that specific moment.

Since open innovation in the 21st century is based on the support of an appropriate knowledge and information flow structure, its success will require new types of organization, framework and leadership approach for survival and global market leadership. Increasingly companies are forming interdependent and flexible relationships with other firms, including suppliers and competing firms, to fully capitalize on their core competencies (Acs & Preston, 1997). Companies can accomplish more by engaging in an inbound open innovation approach and position themselves at gaining strategic flexibility through differentiating management framework that create critical momentum in innovation diffusion to achieve broader customer acceptance and drive industry standards.

3.1.4.2) Resources and Capability Alignment to Support Execution under Inbound Open Innovation

Successful inbound open innovation depends on a company's willingness to commit the resources and leadership to research and development and high innovation organizations are more willing to follow up and follow through on behalf of new ideas (Delbecq & Mills, 1985). Success can be achieved by companies through innovative commitment and deployment of resources rather than just the size itself because with more simple and flexible structure, organizations are able to coordinate their activities and resources more efficiently through informal information networks both internally and externally. This is particularly useful for inbound open innovation situation where outside partners such as suppliers, professional consultants are available when they are needed promptly (Stevenson & Gumpert, 1985). This commitment towards inbound open innovation will only exist if the management has a positive attitude towards innovation itself. More importantly, in reflecting how resources are allocated and prioritized, organizational structure become part of the variables which moderate the project outcome based on the innovativeness and other personal traits of the leaders (Creasy & Anantatmula, 2013).

Resources commitment and control support are important needs under entrepreneurial orientation and entrepreneurs must look at these from a resourced based perspective because successful companies sometimes get preoccupied with the strength of their resource base and become unwilling and unable to perceive major environmental changes. Fortunately, entrepreneurship is a key manifestation of accumulating, converting, and leveraging resources for competitive purposes from a resource-based perspective (Dess et al., 2003) so entrepreneurs are more likely to be successful in resources commitment and control. In situation where trade-off between flexibility and specialization of

resources as companies mature is an option, how management control and assign these resources to innovation will influence the level and likelihood of success under an inbound open innovation approach. As such, eight elements were identified as responsible for governing the formation of resources and capability of a firm when work in tandem as shown below (Amit & Schoemaker, 1993:38) and management should consider these factors when create valuable resources accordingly.

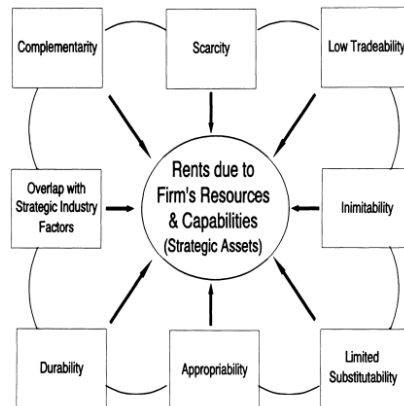


Figure 3.19 Desired characteristics of the firm's resources and capabilities (Amit & Schoemaker, 1993)

In addition, entrepreneurial orientation can strengthen the positive performance effects of open innovation significantly more than resource orientation alone (Cheng & Huizingh, 2014). Accomplished entrepreneurs are able to maximize the gain from their existing resources before trying to acquire control over additional resources to further pursue the opportunity. They have the ability to balance the return and resources commitment through in course corrections rather than investing an inappropriate level of resources. Entrepreneurs are also more likely to use other people's resources while keeping the option open to bring these resources in-house (Stevenson & Gumpert, 1985). Higher level of entrepreneurial orientation also increase the use networking as a knowledge resource to the company as and the utilization of unique competence resources because entrepreneurial activities contribute to the exploitation of the resources in a better way (Madsen, E.L., 2007). On the other hand, entrepreneurs could use external pressures, such as technology advancement, social style or value changes, to stimulate opportunity recognition by adjusting their resources allocation (Stevenson & Gumpert, 1985). Hence, SMEs, usually managed entrepreneurs, should benefit significantly through a strategic orientation favoring innovation as it can lead to allocation of resources which can create more value, develop more ambitious goals and proactivity with more effective risk analysis and risk-taking (Rosenbusch et al., 2011).

Hypothesis 6a – Relationship between Entrepreneurial Orientation and Organization Performance is Positively Related to the Level of Inbound Open Innovation

Although innovation can bring significant benefit and competitive advantages to an organization, it should also be supported by sustained improvements in performance through the utilization of existing skill set, resources and development of new capability. Knowledge is an intangible asset which is unique and hard to imitate or substitute and organizational knowledge constitute a key strategic resource (Cabrera & Cabrera, 2002). Furthermore, the ability to sustain significant improvements over a long period of time rests on the capability, resources and desire to learn from experience and possessing the ability to understanding of the root causes of those problems (Wheelwright & Clark, 1992). Organizational learning allows the combination of the firm's existing resources and capabilities, transforming them into distinctive competences and become a source of sustainable competitive advantage. In the process,

organizational learning becomes a fundamental strategic factor from a resource-based view approach perspective (Real et al., 2014; Lado et al., 1992).

Furthermore, resource based view can also be used as a tool to identify firm's resource strength, relationship and capability gap which is fundamental in strategy planning based on the entrepreneur's orientation to create competitive advantage (Grant, 1991). This is possible because the presence of different organizational capabilities positively affects the outcome of the product development process and resource-based theory can be used to identify capabilities that are specifically affecting firm performance (Verona, 1999). As summarized by the figure below, resource based approach can be a common lens to allow management to assess related and unrelated diversification as it is the only theory of corporate scope capable of explaining the range of diversification from related constrained to the conglomerate form. Under the resource based context, successful firms are those adopting strategies which their resources can support and the critical task for management is to strategically use its available resources to the greatest end that they can support (Peteraf, 1993). So by adopting a strategy which focus on utilizing resources to support the development of learning orientation, sustainable advantages for a high-tech company can be produced based on Grant's model.

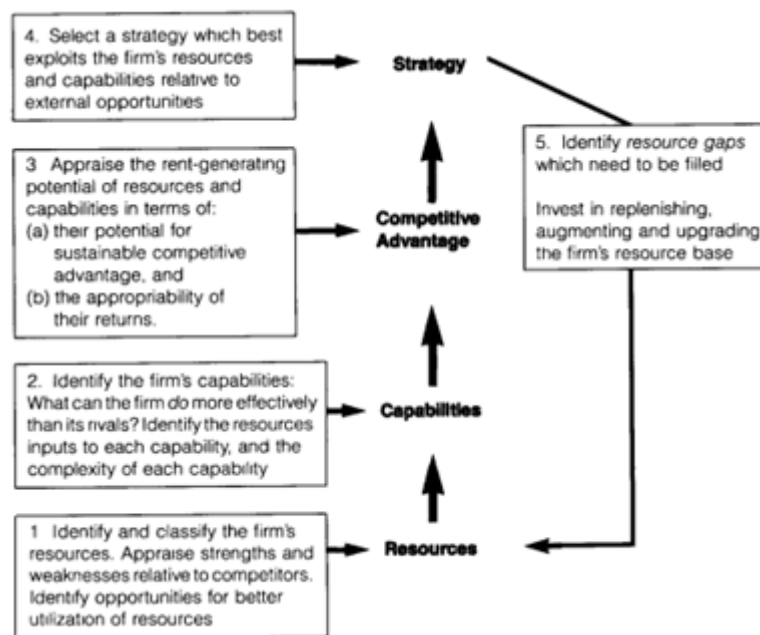


Figure 3.20 A Resource-Based Approach to Strategy Analysis (Grant, 1991:115)

In addition, user-product relationships, alongside managerial and technical skills as well as accumulated tacit knowledge are all important sources of diversity and of comparative advantage (Freeman, 1995) that can also become part of the organizational resources. Absence of access to publicly available knowledge and learning will position the firm at a competitive disadvantage relative to rivals (Zahra et al., 1999), reducing its ability to use entrepreneurial orientation as a path to create a new organization, engage in strategic renewal or successful innovation (Dess et al., 2003). Hence, if organizational learning include external knowledge and technologies through inbound open innovation, these additional resources will further enhance the competitive advantages of the organization.

Hypothesis 6c – Relationship between Learning Orientation and Organization Performance is Positively Related to the Level of Inbound Open Innovation (duplicated)

Finally, innovative capability of an organization requires the simultaneous possession and collaboration of innovativeness in strategic, behavioral, product, marketing and process functions in the organization (Wang & Ahmed, 2004). These are all necessary resources to support inbound open innovation because according to the resource-based view, a firm's competitive advantage derives from scarce, valuable, and durable resources, competencies, and capabilities (Barney, 1991). Hence, the inclusion of a framework that can support continuous optimization is essential for sustaining innovation capabilities and 3H could be the solution for this application.

3.1.4.3) Building an Internal Environment for Inbound Open Innovation with Transformational Leadership

Organization is a collection of people and a vibrant network of interacting human and in the case of technological organization, there are normally abundance of inventive ideas but boundaries are normally set by rather powerful social and economic interests of leaders because innovation is an expensive and risky activity with positive outcome on firm performances and negative outcome such as cost (Jiménez & Sanz-Valle, 2011). Besides coordinating growth, managing internal political dynamics is important area that needs leadership especially during the scaling stage of new innovative ideas (O'Reilly & Tushman, 2021). Furthermore, there are three innovation characteristics, namely compatibility, relative advantage, and complexity (Tornatzky & Klein, 1982), which is highly relevant to inbound open innovation adoption but need top management attention and resolution. Hence top managers of organization must be capable to lead the corporation to reduce the perceived complexity in innovation adoption journey to make it compatible with existing environment in order to create relative advantage for the company.

3.1.4.3.1) The Role of Leadership in High Technology SMEs under an Inbound Open Innovation Context

The role of every general manager is to lay a foundation for future growth by understanding the nature of innovation, the threat it poses, and how to lead the organizations to create growth through new ways of doing business that can keep pace with ever-evolving technologies, industries, and customers (Christensen, 2016). Total competitiveness of a business is positively influenced by a founder who can pay attention to the detailed operations of the business especially when the business is small (Slevin & Covin, 1995). Leader plays an important role in linking the organization and the environment, from which the organization must achieve acceptance and support for its inbound open innovation and learning orientation (García-Morales et al., 2006). Hence, competent leadership is important, especially for SMEs that are growing, because when organization grows, it will eventually need to emphasize structure and standard procedures in order to control the expanding responsibilities (Cameron & Quinn, 2011). All corporations must remember the role played by the owner/manager is one of the major determinants of SME competitiveness because of the concentration of decision-making power in the management within the SME structure and consequently influencing the firm's overall strategy (OECD, 1993).

Since sensing a change of circumstance and crafting a response is a role that CEO should fill, only CEO or someone with comparable power can assume responsibility for managing disruptive growth and sustaining innovation (Christensen & Raynor, 2003). Little to no organizational benefit will be achieved if resources are managed by incompetent individuals who cannot appreciate the usefulness and leverage these resources to the full potential (Katkalo et al., 2010). Therefore, the ability of managers to develop and combine resources in productive ways will determine the size of the productive opportunity of a firm rather than depending on external demand conditions (Penrose & Penrose, 2009).

An example that typified these observation is a study of 166 small businesses in Singapore conducted by Thong. It was confirmed that decision maker's characteristics, specifically CEO's innovativeness and CEO's IS knowledge, are positively associated with the decision to adopt IS in small businesses. With a CEO who understands the benefits of IS adoption and is willing to invest scarce resources in the IS project, the small business will be able to take advantage of the promised benefits of IS adoption, including improved organizational efficiency and effectiveness (Thong, 1999). This also corresponds to findings suggested by upper echelon theory which highlighted with greater discretion, the leader's choices will have more impact on organizational outcomes (Boal & Hooijberg, 2000). Hence, the upper echelon, especially in the case of SMEs, are highly critical in determining the subsequent organization outcome and performance as leaders are responsible for delivering results for the organization. Their personality and attitude towards inbound open innovation will determine the ultimate success of the inbound open innovation for the organization.

Hypothesis 6d –Organization Performance is Positively Related to the Level of Acceptance by Leaders towards Inbound Open Innovation

3.1.4.3.2) Creating the Right Attitude and Culture for Inbound Open Innovation Adoption

Organizational cultures represent the way people perceive what goes on in their organizational environment, residing practices within the organization (Hofstede, 2011). In its simplest and most frequently used definition, organizational culture is the way things are done around here to succeed (Lundy & Cowling, 1996). It is an integral part of the general function of an organization and a strong culture ensure everyone is on the same track (Martins & Terblanche, 2003). Culture is an abstraction but with concrete behavioral and attitudinal consequences and it is dynamically created by interactions between those within the group under the expected behaviors within the organization as shaped by leadership, the organizational structure, norms and rules (Schein, 2010)[171]. Among a group of people, such as an organization, culture refers to norms of behavior and shared values where norms of behavior are common or pervasive ways of acting within the group while shared values are important concerns and goals shared by most of the people in a group.

From an inbound open innovation perspective, organizational culture acts as an integration function by socializing new members, absorbing new knowledge through creation of new boundaries while also support coordinating function to create competitive edge and making sense of environment. If an organizational culture cannot fulfill its functions as both an integrator and coordinator, the efficiency of an organization will be greatly reduced (Martins & Terblanche 2003). More importantly, innovation related norms, which is part of organizational culture, organizational structure and environmental uncertainty, provide significant explanation for the variation in entrepreneurial strategy and is positively correlated to successful entrepreneurial strategy while it also plays a mediating role on influencing decentralization and environmental uncertainty on entrepreneurial strategy (Russell & Russell, 1992).

Organizational culture that support creativity encourages innovative ways of finding solutions so it can significantly affect the extent on how creative solutions are supported and implemented (Lock & Kirkpatrick, 1995). This is important because organizational creativity is a subset of the broader domain of innovation which itself is a subset of organizational change (Woodman et al., 1993). A culture that is more receptive to new ideas and innovation is associated with a higher level of innovation because a firm that encourages learning and development as well as include participative decision making is likely to be more innovative (Hurley & Hult, 1998). Furthermore, information assimilation and how a firm creates,

transfers, and applies knowledge are rarely possible without simultaneously altering the culture to support new behaviors (De Long, 1997), meaning innovation will also bring cultural transformation.

CEOs are more willing to experimentation and open innovation if they are more closely associated with cultures that emphasize adaptability and this is positively linked to revenue growth (O'Reilly et al., 2014). Furthermore, the leaders of an enterprise can do a great deal to encourage creativity. (Page 63 Adair, J.E., 2007)[224] because the dynamic processes of culture creation and management are the essence of leadership because culture is shaped by leadership behavior, and a set of structures, routines, rules, and norms that guide and constrain behavior (Schein, 2010). As a cultural behavior, risk taking and tolerance for taking risk are important characteristics for supporting innovation (Hurley & Hult, 1998). Hence, the combination of these cultural characteristics echo those seen in transformational leadership.

Hypothesis 3b - Transformational Leadership is Negatively Related to Insecurity (measured by TRI)

Behavioral elements such as organizational encouragement, supervisory encouragement, work group encouragement, freedom/autonomy are all positively related to innovation, while control was identified as decreasing organizational creativity and innovation (McLean, 2005). However, even though culture is also a powerful way to influence human behavior, it can be difficult to change and its near invisibility makes it hard to address directly. Moreover, shared values, which are more deeply ingrained in the culture but less obvious can be more difficult to change than norms of behavior (Kotter, 2012). Since cultural factors such as organizational norms and values also affects how an organization functions (Armstrong, M., 2006), leaders need to complete the inbound open innovation process to create competitive edge by adjusting personal attributes of participants at all level.

To overcome such challenges, organizational factors, such as commitment of human resources practices, which focus on providing incentive and development practices to support motivation and long-term growth can be used to produce a positive influence on innovation climate and that innovation climate contributes to both inbound and outbound open innovation (Popa et al., 2017). Making organizational culture more adaptive is critical because firms with adaptive cultures can become awesome competitive machines which produces superior products and services faster and better (Kotter, 2012). As most high technology SMEs are likely to be younger companies, their operating context and culture is probably close to that of new ventures. Leaders of new ventures need to adapt to the environmental conditions surrounding their firms and transformational leadership appears to be more effective in dynamic environments than transactional leaders so the choice of leader behaviors is critical to the performance and survival of new ventures (Ensley et al., 2006).

An organizational culture that is supportive of innovation is best described by one which is based on an open systems approach due to the complexity involved between different subsystems and elements of the organizational culture within the organization. The way of how these determinants operate will either support or inhibit innovation (Martins & Terblanche, 2003). If management failed to remove a segmental thinking from the corporate culture and attitude, it will create an unattractive and difficult environment for people in the organization to take initiatives to solve problems and develop innovative solutions and such organization may not even be able to take advantage of innovations when they occur (Kanter, 1984). This open systems approach is the essence of open innovation and inbound open innovation in particular.

Hypothesis 6b – Relationship between Transformational Leadership and Organization Performance is Positively Related to the Level of Inbound Open Innovation

Finally, the real challenges for top management to adopt inbound open innovation is once deliberate strategy processes have become embedded within organizations, they find it difficult to employ fledgling processes again when launching new businesses. A company's efforts to catch new waves of disruptive growth need to be guided through emergent processes (Christensen & Raynor, 2003). The ability to monitor and adjust the organization culture, structure as well as the implementation progress of transformational leadership through a management instrument like 3H is vital in ensuring disruptive innovations that create the next waves of growth is not filtered out by initiatives that sustain the existing business even though it has been successful. As such, our study will include the adoption of transformational leadership as part of the management framework under 3H.

3.1.5) Uncovering the Evidence of Coherence Existence

3.1.5.1) Proposed Relationship between Different 3H Elements by Previous Studies

	Transformational Leadership	Entrepreneurial Orientation	Learning Orientation
Cabrera, A. and Cabrera, E.F., 2002	Leadership breaks wall to increase knowledge sharing to improve learning (Leadership -> LO)		
Teece, D.J., 2014		EO via Dynamic Capability to seize opportunity and guide learning & org structure (ldr) renewal for future (EO -> Leadership) (EO -> LO)	
Luthans, F., 2002	Proactive and positive organizational behavior is also open to learning, development (Leadership -> LO)		
Slater, S.F. and Narver, J.C., 1995	culture and climate that maximizes learning and its benefits (Leadership -> LO)		
Ghoshal, S. and Bartlett, C.A., 1994	Trust and support (leadership) help to influence the levels of individual initiative, and collective learning within companies (Leadership -> LO)		
Eisenhardt, K.M. and Martin, J.A., 2000			learning mechanisms guide the evolution of dynamic capabilities (LO -> EO)
Krueger Jr, N.F., 2007			changes in knowledge to develop entrepreneurial expertise & mindset (LO -> EO)

	Transformational Leadership	Entrepreneurial Orientation	Learning Orientation
Engelen, A., Gupta, V., Strenger, L. and Brettel, M., 2015	transformational leadership at top level was found to moderate the EO performance relationship and EO produces the best performance when transformational behaviors are at their highest. (Leadership -> EO)		
Renko, M., El Tarabishy, A., Carsrud, A.L. and Brännback, M., 2015.		Entrepreneurial leaders' passion, creativity, and vision motivate others to experiment and learn for themselves. (EO -> LO) They set examples and encourage others to emulate their behavior and challenge status quo. (EO -> Leadership)	
García-Morales, V.J., Llorens-Montes, F.J. and Verdú-Jover, A.J., 2006			Organizational Innovation & Organizational Learning work jointly to promote organizational entrepreneurship and to increase competitive advantages. (LO ->EO)
Parker, S.K., Williams, H.M. and Turner, N., 2006	Trust created by transformation leadership implies that coworkers will accept mistakes as learning experiences and likely to encourage individuals to try things beyond core tasks and enhance their self-efficacy (Leadership -> LO)		
Zhou, Kevin Zheng, Chi Kin Yim, and David K. Tse, 2005		organizational learning acts as a partial mediator between strategic orientations and technology based innovation (EO-> LO -> performance)	

	Transformational Leadership	Entrepreneurial Orientation	Learning Orientation
Webster Jr, F.E., 1992		focus core competencies to devote scarce & strategic resources to develop new knowledge and skills (EO -> LO)	
Wang, C.L., 2008		Entrepreneurial Orientation & learning orientation-performance linkage and dependence (EO -> LO)	
Altinay, L. and Wang, C.L., 2011			educational attainment of an entrepreneur makes a positive impact on a firm's entrepreneurial orientation. (LO -> EO)
Slater, S.F. and Narver, J.C., 1995			learning organization reconfiguring quickly to focus on the emerging opportunity or threat (LO -> EO)
Argyris, C., 1977	CEO create organizations capable of continuous learning e.g adopting the double loop learning approach (Ldr -> LO)		
Alegre, J. and Chiva, R., 2013			Organizational learning capabilities & innovation performance should be enhanced to boost EO-performance link (LO -> EO)
Kirkpatrick, S.A. and Locke, E.A., 1996	Transformational leaders give better task cues and clarity through their communication skills for better learning requirement (Leadership -> LO)		
Pinchot III, G., 1985		Entrepreneurial orientation create significant opportunities for multi-dimensional organizational learning (EO -> LO)	
	Transformational Leadership	Entrepreneurial Orientation	Learning Orientation
Madsen, E.L., 2007		Higher level of EO also increase the use networking as a knowledge resource (EO -> LO)	
Bontis, N., Crossan, M.M. and Hulland, J., 2002			organizational learning is a dynamic process of strategy renewal and impact all three levels of the organization, namely individual, group and organizational wide (LO -> EO)
Brown, L.M. and Posner, B.Z., 2001			leadership development & learning process will also create a culture of leadership and learning within the organization (LO -> Ldr)
Eyal, O. and Kark, R., 2004.	transformational leadership sets the most favorable managerial circumstances for entrepreneurial activism in the organization and more closely associated with proactivity than organizational innovativeness (Leadership -> EO)		
Bass, B.M. and Riggio, R.E., 2006			learning orientation can enhance the effectiveness of transformational leadership (LO -> Leadership)
Bass, B.M., 1998 & (Bass, B.M. and Avolio, B.J., 1990			transactional & transformational leadership behaviors can be learned through training programs so individuals leaders can develop transformational and transactional behaviors (LO -> Leadership)
	Transformational Leadership	Entrepreneurial Orientation	Learning Orientation
Zahra, S.A., Nielsen, A.P. and Bogner, W.C., 1999			New knowledge generation enables the self-renewal of established companies (LO -> EO)
Guth, W.D. and Ginsberg, A., 1990		Entrepreneurship is transforming the corporate bureaucracy as environment of firms continues to accelerate. change is the company's overriding goal (EO -> Leadership)	
Kaplan, R.S. and Norton, D.P., 2005		strategy establishes goals and pull people toward the overall vision by adopting behaviors and actions to arrive at those goals (EO -> Leadership)	
Lowe, K.B., Kroeck, K.G. and Sivasubramaniam, N., 1996			development of leaders across all organizational level for transformational leadership & organizational effectiveness (LO -> Leadership)
Burgelman, R.A., 1983	top management controlling the level and the rate of change to make sure that entrepreneurial activities will correspond to their strategic vision and continue autonomously (Leadership -> EO)		
Howell, J.M. and Higgins, C.A., 1990	Transformational champions attempts to articulate their compelling vision (Leadership -> EO)		

Table 5.1 Proposed Relationship between Different 3H Elements by Previous Studies

3.1.5.2) Observed Relationship between Inbound Open Innovation and Different 3H Elements

	Inbound Open Innovation & Transformational Leadership	Inbound Open Innovation & Entrepreneurial Orientation	Inbound Open Innovation & Learning Orientation
Saebi, T. and Foss, N.J., 2015			Deep integration of external sources drive business models & resources structure to support knowledge transfer
Lei, D., Slocum, J.W. and Pitts, R.A., 1999			Management develop an organization that promotes rapid knowledge-creation and information sharing through open innovation
Russell, R.D. and Russell, C.J., 1992	Innovation related norms which is part of organizational culture, organizational structure & environmental uncertainty provided significant explanation for the variation in entrepreneurial strategy.		
García-Morales, V.J., Llorens-Montes, F.J. and Verdú-Jover, A.J., 2006		An organization that promotes entrepreneurship will learn and innovate, encouraged by the presence of key preexisting internal/external attributes that enable it to change, renew and reinvent itself.	

Table 5.2 Observed Relationship between Inbound Open Innovation and Different 3H Elements

Based on these previous studies, some of the corresponding questions was extracted and used as part of our research instrument to collect information about respondents' entrepreneurial orientation, learning orientation and transformational leadership. The full listing is available in **Appendix One**.

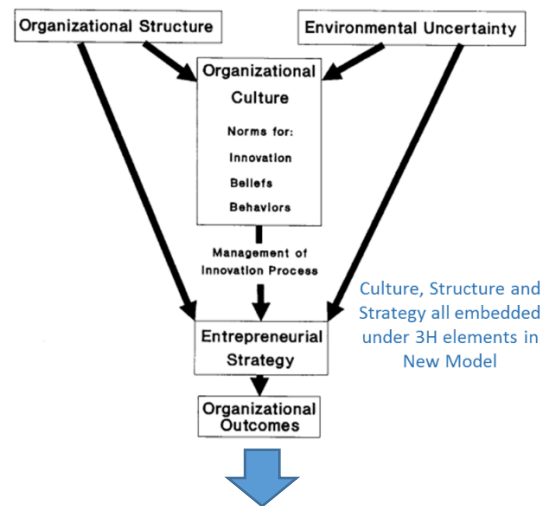
3.2) Research Design and Instrument Development

After identifying entrepreneurial orientation, transformational leadership and learning orientation as our three main elements for implementing inbound open innovation based on previous review, our study will proceed to investigate how to combine these three components together under the 3H framework approach. We will commence this investigation by referring to the model developed by Russell and Russell for management of innovation strategy and try to assess how these different elements will interact with inbound open innovation and organization performance (Russell & Russell, 1992).

3.2.1) Reference Model for our Study

Our reference model is an extension of Russells' model (Russell & Russell, 1992:645) where organizational outcome is now specifically replaced by organizational performance. Since organizational culture (innovation norm) is closely related to leadership, it will be represented by transformational leadership in our model. Strategy will be directly replaced by entrepreneurial orientation as explained in Chapter two while management of innovation process which is responsible for supporting execution will be replaced by learning orientation in our study. Finally, these elements are combined as part of our proposed operation model under the 3H framework as leadership, strategy and execution respectively. In addition, since these elements within the 3H framework are influenced by the personal characteristics of the SME entrepreneurs, our new model will also include those individual characteristics that are related to new technology readiness, as measured by TRI, to be part of the independent elements. At the same time, environmental uncertainty in the original model is replaced by level of inbound open innovation adoption because both are externally oriented by nature to complete our suggested model.

Initial Model of Corporate Entrepreneurial Strategy



New Model for Inbound Open Innovation

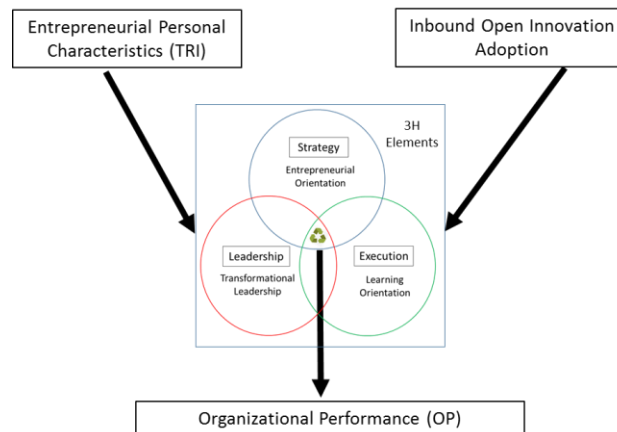


Figure 5.1 Suggested Model for Framework Research

3.2.1.1) Understanding Inbound Open innovation Adoption

To measure the level of inbound open innovation acceptance by respondents, questions covering interaction between new product development considerations and external factors (Sisodiya et al., 2013; Singh et al., 2021; Cheng & Shiu, 2015) will be used as part of the survey instrument. In addition, innovation performance measurement metrics covering sales growth, customer footprint, new product count and return on investment based on subjective evaluation were also used to establish the basis of organization performance over the last 3 to 5 years (Calantone et al., 2002; García-Morales et al., 2006; Hughes & Morgan, 2007; Venkatraman & Ramanujam, 1986; Bontis et al., 2002)

3.2.1.2) Establishing General Background Context

To improve the quality of collected data, multiple dimensions other than performance should be included where possible through the addition of several critical control variables such as industry, age, and size of the firm (Murphy et al., 1996:15). Age of firm is particularly important in the examination of learning orientation in smaller entrepreneurial firms during the start-up, breakout, and mature stages (Wang, 2008:649). As such, the following will be collected as our general information.

- (1) Age of respondent,
- (2) Age of Firm,
- (3) Education Level
- (4) Position of respondent in Company
- (5) Year of Experience in the industry
- (6) Size of Company

3.2.1.3) Independent Variables

3.2.1.3.1) External Environment Management

Based on our suggested model, adoption preference of Inbound Open Innovation will be the main independent variable to reflect how external environment is handled within an inbound open innovation context. For actual measurement, a more recent instrument from Sisodiya and team was deployed (Sisodiya et al., 2013) to assess participants under their organizational context.

3.2.1.3.2) Entrepreneurial Characteristics

To attain the final organizational performance, our initial model suggested there will be up to four independent variables will be coming from Technology Readiness Index, namely optimism, innovativeness, discomfort and insecurity. Technology Readiness Index is used because personal attitude is specific to the individual so measurements made by this index would be reflective of the respondent attitude. Our instrument leverages the questionnaire within Technology Readiness Index as an established instrument to measure the individual respondent characteristics which will be treated as the main antecedents of 3H framework under an inbound open innovation environment. Detection of deviation could ideally act as an alert mechanism to ensure the continuous operation of as a well balanced, constructive and self sustaining 3H framework.

3.2.1.3.3) Mediating Role of Entrepreneurial Orientation, Learning Orientation and Transformational Leadership

As proposed in our model, entrepreneurial orientation, learning orientation as well as transformational leadership is hypothesized as the mediators of our framework. Moreover, the performance of the organization would also be the outcome of these mediators so results from Technology Readiness Index and adoption level of inbound open innovation would likely to be mediated by these three elements as defined within the 3H framework. Our measurement instrument used for measuring entrepreneurial orientation and learning orientation is from Wang (2008) which is a modification from Miller (1983) while Leadership measurement were based on proven instruments developed by Avolio and Bass (2006), Carless (2000) and Podsakoff (2003).

3.2.1.3.4) Entrepreneurial Experience and Attachment to the Organization

As previous studies (Wang, 2008; Murphy, 1996) indicated tenure and industry experience are relevant to the performance of organization, these factors will also be included as part of the consideration during the development of our model.

3.2.1.4) Dependent Variables

3.2.1.4.1) Organizational Performance

To assess the effectiveness of the SMEs, the past 3 – 5 years performance were requested from the respondents in order to provide a relative picture against the independent variable as well as the mediators in our model. The performance metrics cover both sales and product range to broaden our understanding of the SMEs performance from different perspective.

3.2.2) Instrument Development Methodology

3.2.2.1) Survey Introduction and Confidentiality Declaration

An introduction statement is provided to ensure respondents have full understanding of the purpose of this survey and the detail is included in Appendix One. There will also be a clear statement to ensure respondents know their feedback will remain anonymous and confidential according to the guidelines provided by the ethics review committee of the University of Wales TSD. Respondents are also reminded about their right to exit the survey if they choose to do so (World Health Organization, 2020). These statements are located on top of their consentment to the data sharing agreement which is on top of the submit button.

3.2.2.2) Increasing Survey Response Rate

To increase the likely response rate of our survey, the following recommendations were adopted during our survey design (Nulty, 2008:305).

- 1) Persuade respondents how their responses will be used: This is stated in our introduction statement where respondents were informed their responses will be part of the input for the creation of a Hong Kong specific entrepreneurial profile.
- 2) Push the survey: By embedding the survey link as part of the email and whatsapp message, the questions are being pushed to the respondent and making it easy for them to access and respond.
- 3) Include channels that seek constructive criticism: A comment entry box is inserted at the end of the survey before submission so respondents provide their opinion as part of survey feedback.
- 4) Assure participants the anonymity of their responses to enhance response quality

3.2.2.3) Survey Scale Development

In order to create a consistent experience to the survey participants, a drop-down list selection approach was adopted where 5 answers, corresponding to a 5 point Likert scale, were made available for selection under each question. Although the original scale of most survey questions are either 5 or 7 point Likert, 5 point scale was chosen because the 5- and 7-point scales were found to produce the same mean score as each other once they were rescaled (Dawes, J., 2008; Joshi et al., 2015). In addition, since Technology Readiness Index is running on a 5 point Likert, good consistency will be created when our instrument is also aligned to the 5 point scale utilized by Technology Readiness Index 2.0.

From a performance measurement perspective, 5 point Likert were used by a number of studies such as role based performance (Welbourne et al., 1998) and balance scorecard vs organizational performance (Hoque & James, 2000). Furthermore, 5 point Likert has also been used for organizational

climate measurement especially in the area of support for innovation (Anderson & West, 1998). Hence, 5 point Likert is chosen to be the scale of our survey instrument.

3.2.2.4) Instrument Validity

All measurement items were selected after careful literature review as summarized in the previous sections and all the variables collected in the study cover multi-items and the source of these instruments are listed under Appendix One.

3.2.2.5) Optimization Procedures Taken for Survey Instrument

Before mass dissemination of the questionnaire, translation into Chinese were introduced and it is located alongside the English questions throughout the entire instrument. This ensures respondents can have better understanding of both the ethical standard followed by the survey and the actual questions themselves in case they are not clear in either English or Chinese. The research instrument was then pretested with eleven different researchers, entrepreneurs and experience managers from technology companies. The primary purpose of the pretest was to detect inadequate wording and increase the ease of administering the instrument. A total of two verification stagess were conducted so general structure of the questionnaire and understanding of the questions can be improved during phase one while additional refinement can be imported based on the entrepreneurial point of view in phase two.

3.2.2.5.1) Phase One – Initial Verification

Five individuals, who are experienced in either high technology or entrepreneurship, were invited to review the draft stage of the questionnaire after initial comment from the director of study and supervisor for this research were incorporated. Since these participants are not entrepreneurs themselves, they simply provided the researcher with an overview from a general understanding perspective. The background of the five individuals are listed below.

- 1) Director of a venture capital fund
- 2) Product management head of the Asia Pacific branch of a high technology MNC based in Hong Kong.
- 3) Retired business development head of a technology certification organization
- 4) Director of a research department within the School of Communication in Chinese University of Hong Kong
- 5) Co-Director of BBA Joint Degree programme in Chinese University of Hong Kong
- 6) Former marketing manager of an Information technology services provider.

Result:

- i) One question about technology support was expanded to improve understanding.
- ii) Revision of topic to improve clarity and understanding.
- iii) Addition of ethical standard such as privacy and data integrity protection.
- iv) Provided translation into Chinese to ensure full understanding of respondents to original questions.
- v) Survey questions that are personal and company specific are move to the end of the survey to increase completion rate of survey per one academic suggested.
- vi) Rephrased some of the TRI questions to make sure it is addressing directly at the respondents
- vii) Introduction of consistent timeframe by focusing on the last 3 – 5 years for all performance related questions.

3.2.2.5.2) Phase Two – Refinement Interview

After incorporating the feedback from Phase one, owner or CEO of five high technology Small and Medium enterprises in Hong Kong were invited to review the survey questions in detail. Besides ensuring they have clear understanding of the purposes of the survey, the relevance and effectiveness of the survey questions were discussed in a physical interview so the researcher can record both their reaction and feedback to the instrument.

i) Comment from Founder of a local medical implant company (~30 staff Heart, started company in late 40s, previous sales and product head in local machinery companies, reputable High school graduate) – Questions are easy to understand and length is acceptable. Additionally, he prefers to develop own IP but willing to turn university ideas to commercial products also through in-house research.

ii) Founder and CEO of an Internet of Things and platform company (~10 staff with IoT, around 30 staff in Platform – started company in early to mid 40s after former employer, Freescale, closed HK office) – minor wording adjustment, other looks good

iii) Founder of Medical monitoring devices company (~25 staff) – highlight the importance of clarifying to respondent that questions for technology perception assessment is for daily life rather than work related. Expect questionnaires can filter out those experienced entrepreneurs from those new to entrepreneurship.

iv) Founder of fabless IC company (PhD and Adjourned professor) – suggested three questions about inbound open innovation has a certain level of overlapping and it has since been combined into two questions only. Also highlighted the use of the word “sometimes” in TRI (for question 9 & 11 – insecurity and discomfort) may in biased respondent to reply with “agree”.

v) Founder of an AI based customer behaviour Analytics Company – good questions for entrepreneurs and staff to rethink about management. Suggest to add questions or measurement for other personal aspects such as how to see raising kids and travel plan as an additional psychological measurement area. Also how they invest stocks and what other investment habit they would take. Inclusion of items like what YouTube channel they watch and frequency of watching technology – these will be part of future research to expand the understanding of entrepreneurial profile to make it more comprehensive. However, the suggestion of adding item like Crypto to make questions more contemporary is implemented.

vi) Founder of video and audio streaming product company – questions are easy to understand, good measurement for area such as execution (as he likes to keep the team together), leadership (as the team has grown together like a family) and entrepreneurship (adjustment of product and business market strategy to adapt to market need)

vii) Founder of AI-IOT Device Company – questions reminded me a lot of things in managing a company

3.2.2.6) Questionnaires Summary

The details of the questions and the relevant references can be found in Appendix One. A summary based on the nature of the questions is listed in the Table below.

Area Being Surveyed	Reference	Number of Questions
General Background	Dawes, J., 2008	6
Technology Readiness Assessment	Parasuraman, A. and Colby, C.L., 2015	16
Transformational Leadership	Carless, S.A., Wearing, A.J. and Mann, L., 2000, Kouzes & Posner, 1990, Avolio, Bruce J., Bernard M. Bass, and Dong I. Jung, Podsakoff, MacKenzie, Moorman, & Fetter, 1990	5
Learning Orientation	Wang, C.L., 2008	9
Entrepreneurial Orientation	Wang, C.L., 2008	8
Level of Inbound Open Innovation	Sisodiya, S.R., Johnson, J.L. and Grégoire, Y., 2013, Singh, S.K., Gupta, S., Busso, D. and Kamboj, S., 2021, Cheng, C.C. and Shiu, E.C., 2015	3
Performance of Organization	Calantone, R.J., Cavusgil, S.T. and Zhao, Y., 2002, Venkatraman, N. and Ramanujam, V., 1986 & Bontis, N., Crossan, M.M. and Hlland, J., 2002, García-Morales, V.J., Llorens-Montes, F.J. and Verdú-Jover, A.J., 2006, Hughes, M. and Morgan, R.E., 2007	4

Table 5.3 High Level Summary of Survey Instrument Composition

Chapter Four – Data Collection and Results Analysis

The survey data collection period began in mid August 2022 and ends at mid December 2022 to ensure the external environment is relatively consistent before the re-opening of the Chinese border. With the close relationship between many Hong Kong high technology SMEs and the mainland, this change could play a major role in redefining the trading and organization performance in Hong Kong that may affect the response due to new uncertainty.

4.1) Approach Used for Data Sampling

The firms selected for this study are Hong Kong SMEs from the high technology sector. These companies were selected in order to ensure inbound open innovation is relevant due to the fast moving nature of technology business. As the symbolic home of many Hong Kong high technology companies, the Hong Kong Science and Technology Park is chosen to be the core of our sampling reference due to its high concentration of high technology SMEs. The final questionnaire was directly distributed to at least 150 of Hong Kong based SME entrepreneurs or top management via Google Forms through electronic media such as email and Whatsapp with the survey link embedded to make accessing the survey more easily. Moreover, since our target respondents are from the high-tech industries, it is most likely their prefer method of communication is online instead of paper based survey. All respondents will remain anonymous unless they purposely put their contact as part of the survey feedback. To improve the response rate, the questionnaire will be sent by contact persons who know these entrepreneurs personally.

As mentioned in the optimization section, data was collected in three stages. After an initial review, a pilot study was subsequently performed and following that Google forms were used to conduct a questionnaire. Five SMEs were selected from the HKSTP tenant list to perform the pilot study. Based on their responses and subsequent interviews with participants in the pretest, minor modifications were made to the questionnaire and summarized in the optimization section. Responses from the firms that participated in the pilot study were not included in the final sample. The survey was administrated between mid August and mid December 2022 by using Google Forms. In total, a final dataset of 110 valid cases was obtained, yielding a response rate of 73%. Data was examined for non-response-bias by comparing the characteristics of early and late participants in the study. The results of this comparison revealed that non-response bias does not represent a threat for the results obtained and their interpretation.

According to Kline, there should be a minimum of 10 cases for every parameter that's estimated and in initial our model, 9 parameters exist: 4 from TRI, 1 from Acceptance level of Inbound Open Innovation, 3 from management framework and 1 related to organizational performance. Hence, the total number of responses is sufficient to produce meaningful model (Kline, 2015). As such, we will proceed with our model and parameters validation based on the collected responses.

4.2) Demographic Background of Respondents

4.2.1) Participant Role in the Company

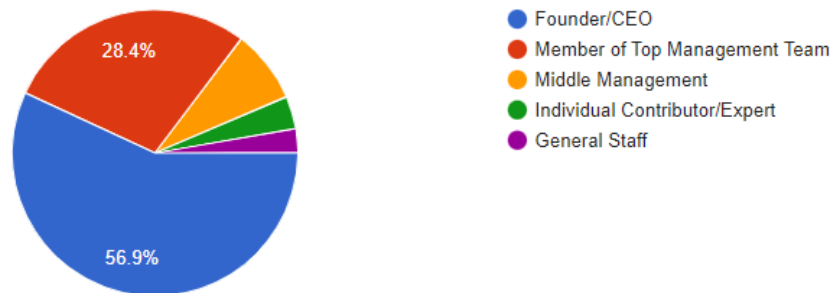


Figure 4.1 Role of Respondents in the Company

More than 85% of respondents are from the top management of the organization. If middle management (~9.3%) is included, then 95% of our respondents are mid to high level decision makers.

4.2.2) Tenure in the Company

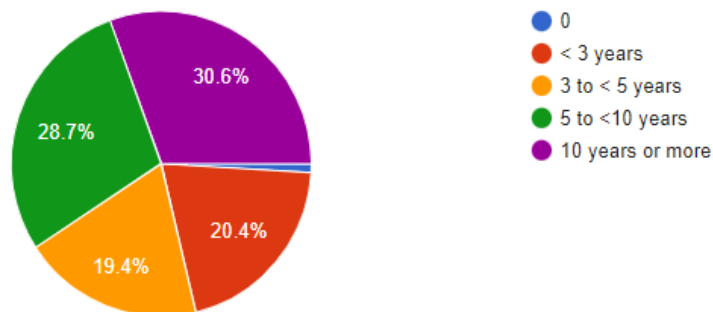


Figure 4.2 Tenure of Respondents in the Company

The tenure of respondents in the company is fairly evenly distributed, enabling a broader spectrum of opinion to be included in our analysis from an on the job duration perspective.

4.2.3) Age Distribution of Respondents

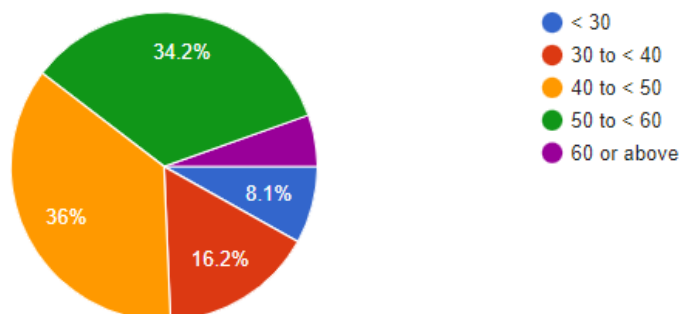


Figure 4.3 Age of Respondents

The largest respondent group is from the 40 – 50 age group and the total from 50 – 60 group is not far behind. This age group distribution is slightly higher than the distribution results shown by a similar survey done in the US for high-tech startup which could be the result of higher conservatism in Asia in general. Nonetheless, the dominance of the 40 – 50 age group in our survey still corresponds to the CEO age pattern exhibited by the fast growing startups in the US (Azoulay et al., 2020).

4.2.4) Industry Experience of Respondents

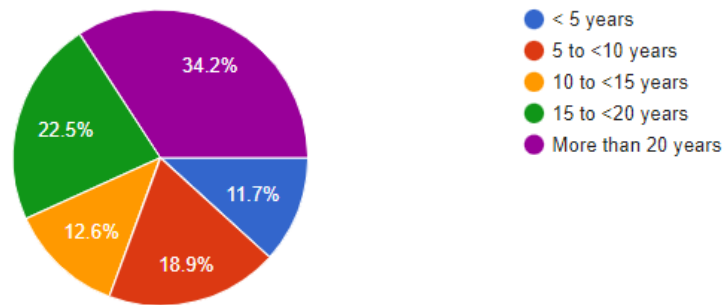


Figure 4.4 Industry Experience of Respondents

The majority of our respondents have solid experience in the current or similar industries and well distributed across different duration so their decision of innovation adoption should be representative for the high technology industries in Hong Kong as a whole.

4.2.5) Experience in Current and Similar Management Role

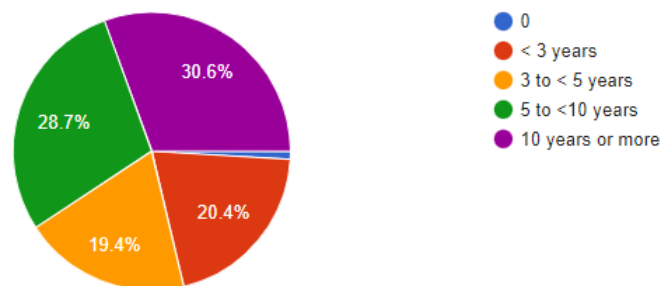


Figure 4.5 Experience in Management Role of Respondents

Technological decision made by our participants should be supported by professional judgement since 79% of our respondents have substantial experience (> 3 years) in current management role.

4.2.6) Years of Company Establishment

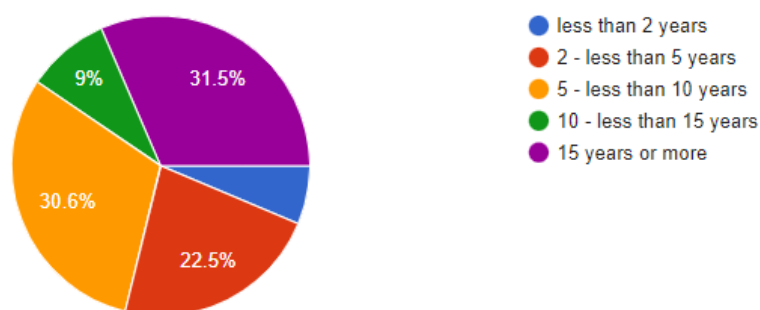


Figure 4.6 Years of Company Establishment

More than 71% of our companies have been established for more than 5 years, meaning that they have moved beyond the turbulent startup stage and need to think and grow strategically.

Based on the composition of our respondents, it should provide us with a solid foundation for analyzing the attitude of Hong Kong high-tech entrepreneurs.

4.3) Validation of the Proposed Model

This section summarized the steps taken in validating the proposed model through the use of correlation matrix, cronbach alpha and primary factor analysis. Subsequently inputs that may not be relevant contributors to our model development analysis will be removed. This is critical because the model needs to meet with the various statistical requirement specified such as SRMR ≤ 0.08 , RMSR ≤ 0.08 (acceptable) or ≤ 0.05 (good), CFI ≥ 0.95 ; IFI ≥ 0.95 ; TLI ≥ 0.95 . In addition, GFI, which represents a measure of fit between the hypothesized model and the observed covariance matrix should contain a value of ≥ 0.9 to ensure an acceptable model fit (Hu & Bentler, 1999). Jamovi v2.2.5 is the processing tool used for our analysis.

4.3.1) Unreliable Data Identification and Removal

Initial feedback from respondents were screened without biased for integrity and results that consists of inconsistent data (e.g. industry experience > 15 years but age is < 30) has been filtered as first step of data validation.

4.3.2) Descriptive analysis

The descriptive analysis summary is shown below and the data distribution pattern does not exhibit any significant abnormalities. The measured mean value of Entrepreneurial Orientation, Transformational Leadership and Learning Orientation are all above average, meeting the entry requirement of holistic management f (H1 $\cap$ H2 $\cap$ H3) as defined within the 3H model. The company performance reported was also showing an above average value which is aligned with the ideal performance - management scenario suggested by 3H. More importantly, the level of inbound open innovation metrics was also higher than the average value, justifying the possibility that coherent existence among the three management elements can deliver organization performance within an inbound open innovation context.

Descriptives	Optimism	Innovativeness	Insecurity-Inverted	Discomfave	InboundOIlevel	EOrientation	TFLeadership	LOrientation	Tenure	ExperienceInIndustry	Position	Age	CompanyPerformance
N	110	110	110	110	110	110	110	110	110	110	110	110	110
Missing	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean	4.26	3.87	2.85	2.92	3.95	3.66	3.95	3.89	3.65	3.50	4.35	3.13	3.63
Median	4.25	4.00	2.75	3.00	4.00	3.63	4.00	3.88	4.00	4.00	5.00	3.00	3.50
Standard deviation	0.651	0.702	0.802	0.619	0.544	0.466	0.581	0.574	1.15	1.43	0.915	1.02	0.669
Minimum	1.00	1.00	1.25	1.00	2.33	2.50	1.60	2.25	1	1	1	1	2.00
Maximum	5.00	5.00	5.00	4.75	5.00	5.00	5.00	5.00	5	5	5	5	5.00

Table 4.1 Descriptive Analysis Summary

4.3.3) Independent Variables Reliability Verification through Cronbach Alpha Analysis

For elements that are composed of several questions, namely individual characteristics such as optimism, innovativeness and insecurity as measured by TRI, our study has confirmed they are internally consistent (> 0.7) while discomfort was found to be inconsistent (< 0.7) so discomfort will be discarded from our model. With a cronbach alpha of > 0.7 , the scale has shown it contains sufficient internal reliability (Nunnally, 1978). Discomfort may exhibit inconsistency due to the competitive and fast moving nature of the high technology industry where individual discomfort towards new technology is not a strong enough reason to reject new technology adoption by entrepreneurs due the survival need of their business. As such, discomfort will be removed from further analysis. Result of Inbound open innovation adoption preference is also included in the analysis and the result was confirmed to be consistent.

Element	Optimism	Innovativeness	Insecurity	Discomfort	Inbound Open Innovation Adoption
Cronbach Alpha	0.82	0.83	0.73	0.61	0.73
Remark	Kept for further analysis	Kept for further analysis	Kept for further analysis	Removed from analysis	Kept for further analysis

Table 4.2 Cronbach Alpha Analysis Summary for Independent Variables as Calculated by Jamovi

Management and organizational elements such as entrepreneurial orientation, learning orientation and level of transformational leadership were also validated by Cronbach Alpha and the results showed the instrument used produced internally consistent results and valid for further analysis.

Element	Entrepreneurial Orientation	Learning Orientation	Transformational Leadership
Cronbach Alpha	0.70	0.86	0.77
Remark	Kept for further analysis	Kept for further analysis	Kept for further analysis

Table 4.3 Cronbach Alpha Analysis Summary for Management Variables

4.3.4) Correlation Matrix Result

As shown in the generated correlation matrix below, it is encouraging to see there are strong relationship between personal characteristics surveyed by our instrument such as Optimism, Innovativeness and Inbound Open Innovation adaptiveness, with the management elements such as learning orientation, leadership, entrepreneurial orientation and organizational performance. The correlation between all factors was also significantly less than one, indicating support for discriminant validity. On the other hand, the correlation matrix results did not indicate any highly correlated variables, while evidence of common method bias usually results in extremely high correlations (≥ 0.90) (Bagozzi et al., 1991). Hence, collected results suggest that common method bias is not a serious threat in our study. The derived results exhibit strong empirical support for the proposed relationship in our model. Finally, as suggested by the correlation matrix, the only personal characteristics that is not significantly related to entrepreneurial orientation and transformational leadership under the context of inbound open innovation is personal feeling of insecurity towards new technology so it will not be included in our model.

Correlation Matrix		Optimism	Innovativeness	Insecurity-Inverted	InboundOILevel	EOrientation	LOrientation	TFLeadership	Tenure	ExperienceInIndustry	Position	Age	CompanyPerformance
Optimism	Pearson's r	—											
	p-value	—											
Innovativeness	Pearson's r	0.434***	—										
	p-value	< .001	—										
Insecurity-Inverted	Pearson's r	0.326***	0.200*	—									
	p-value	< .001	0.036	—									
InboundOILevel	Pearson's r	0.204*	0.251**	0.065	—								
	p-value	0.033	0.008	0.500	—								
EOrientation	Pearson's r	0.233*	0.365***	0.163	0.445***	—							
	p-value	0.014	< .001	0.089	< .001	—							
LOrientation	Pearson's r	0.235*	0.417***	0.200*	0.376***	0.528***	—						
	p-value	0.013	< .001	0.036	< .001	< .001	—						
TFLeadership	Pearson's r	0.291**	0.384***	0.136	0.400***	0.497***	0.607***	—					
	p-value	0.002	< .001	0.158	< .001	< .001	< .001	—					
Tenure	Pearson's r	-0.073	-0.094	0.026	-0.229*	-0.029	-0.128	-0.186	—				
	p-value	0.448	0.329	0.791	0.016	0.762	0.182	0.052	—				
ExperienceInIndustry	Pearson's r	-0.130	-0.003	0.040	-0.187	-0.016	-0.122	-0.146	0.533***	—			
	p-value	0.177	0.972	0.677	0.050	0.865	0.205	0.127	< .001	—			
Position	Pearson's r	0.169	0.329***	0.127	0.271**	0.325***	0.247**	0.252**	0.320***	0.109	—		
	p-value	0.077	< .001	0.185	0.004	< .001	0.009	0.008	< .001	0.257	—		
Age	Pearson's r	0.040	0.020	0.182	-0.049	0.186	-0.050	0.082	0.419***	0.547***	0.206*	—	
	p-value	0.678	0.836	0.057	0.615	0.052	0.602	0.394	< .001	< .001	0.031	—	
CompanyPerformance	Pearson's r	0.214*	0.277**	0.065	0.184	0.287**	0.417***	0.344***	-0.001	-0.189*	0.182	-0.127	—
	p-value	0.025	0.003	0.499	0.054	0.002	< .001	< .001	0.968	0.048	0.057	0.185	—

Note. * p < .05, ** p < .01, *** p < .001

Table 4.4 Correlation Matrix Analysis for Variables Collected

Research Question One: Is it possible to identify a set of personal and managerial characteristics to explain organizational performance under an inbound open innovation context?

Company performance was found to be positively correlated to optimism and significantly correlated to entrepreneurial orientation, learning orientation and transformational leadership positively

Research Question Three: Is it possible to for different management factors identified above to combine coherently to support Inbound Open Innovation?

Inbound open innovation adoption was shown to be positively and significantly related to entrepreneurial orientation, learning orientation and transformational leadership while entrepreneurial orientation, learning orientation and transformational leadership was also positively and significantly correlated to each other.

4.3.5) Validation via Principal Components and Confirmatory Factor Analysis

Subsequent analysis was conducted using principal components analysis and confirmatory factor analysis to ensure the data collected were significant for further analysis and results was listed as below.

4.3.5.1) Confirmatory Factor Analysis (CFA)

Factor analysis is a possible mean to suggest dimensions because it can be used to confirm if the number of dimensions conceptualized can be verified empirically (Churchill Jr, 1979). CFA was used in our study because Technology Readiness Index and the measurement of entrepreneurial orientation, learning orientation and transformational leadership are well established models. Since we are trying to extend the coverage of these known hypotheses to overlap with each other under the 3H framework, the adoption of a CFA approach for model validation sounds reasonable.

One Factor CFA result from Jamovi is listed below when three TRI elements (Optimism, Innovativeness, Insecurity), Level of Inbound Open Innovation Adoption, three management characteristics (EO, LO, Transformational Leadership) and Organizational Performance are included. Model of fit obtained is $\chi^2(110) = 26.7$; $p = 0.143$; SRMR = 0.056, RMSEA = 0.055; CFI = 0.965; TLI = 0.951 and the result helps to establish that the required convergent validity, discriminant validity, and reliability of the constructs reported by these traditional fit indexes were within the acceptable range.

One Factor Confirmatory Factor Loading

Factor Loadings							
Factor	Indicator	Estimate	SE	95% Confidence Interval		Z	p
				Lower	Upper		
Factor 1	Optimism	0.263	0.0655	0.1349	0.392	4.02	< .001
	Innovativeness	0.388	0.0673	0.2567	0.520	5.78	< .001
	InboundOIlevel	0.280	0.0527	0.1769	0.383	5.32	< .001
	EOrientation	0.315	0.0425	0.2313	0.398	7.40	< .001
	LOrientation	0.446	0.0501	0.3478	0.544	8.90	< .001
	TFLeadership	0.431	0.0512	0.3310	0.532	8.42	< .001
	CompanyPerformance	0.315	0.0654	0.1870	0.443	4.82	< .001
	Insecurity-Inverted	0.199	0.0823	0.0379	0.361	2.42	0.016

Table 4.5 One Factor Confirmatory Factor Loading

It is also worth noting the SRMR, RMSEA, CFI and TLI all improved when Insecurity is removed from CFA, giving hints for later analysis. Moreover, the significant of the results degraded when tenure in

the company, age of entrepreneur and experience in industry were included in the CFA model, meaning these three parameters do not make a significantly positive contribution to this particular construct.

4.3.5.2) Principal Component Analysis

Three unique component groups appear when eigenvalues > 1 is used as filter. With the low level of correlations, these components were shown to be independent by Jamovi.

Inter-Component Correlations			
	1	2	3
1	—	0.00	0.00
2		—	0.00
3			—

Table 4.6 Inter-Component Correlations under Principal Component Analysis

Detailed component loading based on varimax rotation is captured and listed below. It is clear that Innovativeness and Level of Inbound Open innovation adoption attached strongly with organizational performance and the three management characteristics (EO, LO and Transformational Leadership). As expected, TRI elements and Tenure/Experience in Industry grouped nicely as separate component groups

Component Loadings				
	Component			Uniqueness
	1	2	3	
Optimism			0.778	0.333
Innovativeness	0.490		0.521	0.488
Insecurity-Inverted			0.778	0.387
InboundOILevel	0.625			0.544
TFLeadership	0.769			0.368
LOrientation	0.799			0.332
EOrientation	0.776			0.376
CompanyPerformance	0.564			0.671
ExperienceInIndustry		0.863		0.248
Tenure		0.860		0.253

Note: 'varimax' rotation was used

Table 4.7 Principal Components Analysis Results Generated by Jamovi (Eigenvalues > 1)

4.3.6) Model Construction Using Path Analysis

After confirming the validity of our data, we proceeded to the model creation stage. The model construction technique used in this study is from the path analysis function under the structural equation modelling (SEM) analysis feature of Jamovi. SEM analysis is based on the principles of interpreting multiple regression econometric, path and factor analysis (Bollen & Long, 1993) and defined to accommodate models that include measurement errors in both dependent and independent variables, multiple indicators, reciprocal causation, simultaneity, interdependence and latent variables (Marcoulides & Schumacker, 2013). Our study has gathered many academic suggestions from previous researches and our model is an extension of Russell and Russell (1992) which is already a systemic structure so SEM can be applied directly to test our theory rather than going through exploratory analysis. As such, SEM was chosen over other approaches for our investigation since it helps researcher to conduct simultaneous

testing of the whole structure of relations with their relations and effects assessed (Kerlinger, 1986). Failure to model systematic measurement errors leads to biased and inconsistent estimates of the key parameters if they exist.

Goodness-of fit indices and significance tests provided our study with a valuable way in finding a structural equation model that can be accepted in a preliminary sense. Maximum likelihood is also used in our data analysis because it is the most popular fitting function for structural equation models as it caters for a formal statistical test of overall model fit for overidentified models and its estimates are scale invariant and scale free in general (Schermelleh-Engel et al., 2003). Since path analysis, factor analysis, structural equation modeling, and related multivariate statistical methods are all based on maximum likelihood or generalized least squares estimation used for covariance structure modeling (Bentler & Bonett, 1980), our result analysis will also utilize all these elements in search of the relevant elements.

Based on the distribution of our electronic surveys, the number of responses collected were able to achieve the minimum of 10 cases for every parameter that's estimated in our model. As such, given strong correlations exist within our model and the total number of valid responses (110) is sufficient to produce meaning model according to Kline (Kline, 2015), the chi square test result will be a reasonable measure of fit which also enable the use of path analysis as a valid modelling approach.

4.3.7) How Fitting is the Proposed Model

Our research performs structural equation modeling (SEM) approach to test the hypotheses, using maximum likelihood estimation techniques to test the model. The measures from the dataset were refined by assessing their unidimensionality and reliability where Maximum Likelihood factor analysis was used. During the model optimization process, insecurity and optimism were also dropped as part of the independent variables from our analysis as this improves the reliability and significance of our model. Instead, tenure of entrepreneur in the company and his/her experience in current and related industries were added to improve the overall reliability of the model in predicting organizational performance.

Parameters estimates

Dep	Pred	Estimate	SE	95% Confidence Intervals		β	z	p
				Lower	Upper			
TFLeadership	EOrientation	0.513	0.1071	0.30319	0.7230	0.412	4.79	< .001
TFLeadership	Innovativeness	0.193	0.0711	0.05395	0.3328	0.234	2.72	0.007
LOrientation	Innovativeness	0.132	0.0637	0.00714	0.2570	0.161	2.07	0.038
LOrientation	EOrientation	0.324	0.1021	0.12392	0.5241	0.263	3.17	0.002
LOrientation	TFLeadership	0.410	0.0827	0.24811	0.5722	0.415	4.96	< .001
EOrientation	Innovativeness	0.180	0.0560	0.06998	0.2896	0.271	3.21	0.001
EOrientation	InboundOILevel	0.323	0.0723	0.18177	0.4652	0.377	4.47	< .001
CompanyPerformance	LOrientation	0.374	0.1228	0.13371	0.6150	0.323	3.05	0.002
CompanyPerformance	TFLeadership	0.173	0.1214	-0.06509	0.4109	0.151	1.42	0.154
CompanyPerformance	Tenure	0.110	0.0575	-0.00291	0.2223	0.190	1.91	0.056
CompanyPerformance	ExperienceInIndustry	-0.107	0.0464	-0.19817	-0.0163	-0.230	-2.31	0.021

Table 4.8 Parameters Weighting Details at 95% Confidence Intervals

Reliability of our model improves by 10% while other statistical indicators within the model remain significant and highly acceptable value when both tenure and industrial experience are included as predictor of organizational performance. Age of entrepreneur and the position factor do not provide any enhancement to the validity of our model. Interestingly, industrial experience relates negatively to

performance under an inbound open innovation context. One possible explanation is entrepreneurs may prefer finding their own innovation method due to pride and persistence instead of quick adoption of external technology and such delay due to this persistence has negatively impacted organisational performance. As such, continuous technological and psychological training may be required for high technology SMEs entrepreneurs to improve their willingness to adopt technology quickly.

The fit of the final model is satisfactory ($\chi^2(110) = 12.1$; $p=0.353$ SRMR=0.049, RMSEA = 0.031; CFI = 0.993; IFI = 0.993; TLI = 0.986; RNI = 0.993; NNFI = 0.986; NFI=0.933), suggesting that the nomological network of relations fits the data and the validity of the measurement scales (Churchill, 1979). Since SRMR is also less than .05, it indicates a good fit has been achieved by our model (Hu & Bentler, 1995). The goodness-of-fit statistics (GFI = 0.999; MFI 0.995) obtained also indicate a strong model and supported the hypothesized 8 factor structure. (One TRI element - Innovativeness, 3H management elements, organizational performance, level of IOI, tenure and industry experience) model.

Research Question Two: Based on the elements identified in Question One, can these elements be placed into a management framework to predict the likelihood of future organizational success for high technology SMEs so longitudinal analysis can be conducted periodically and consistently?

As shown by the path analysis and structural equation model above, the elements identified in research question one can be fitted into a reliable model to predict the likelihood of organizational performance and is shown in the section below.

4.3.8) Final Model Configuration and Weighting

The final model configuration and the respective weighting is summarized in the figure below

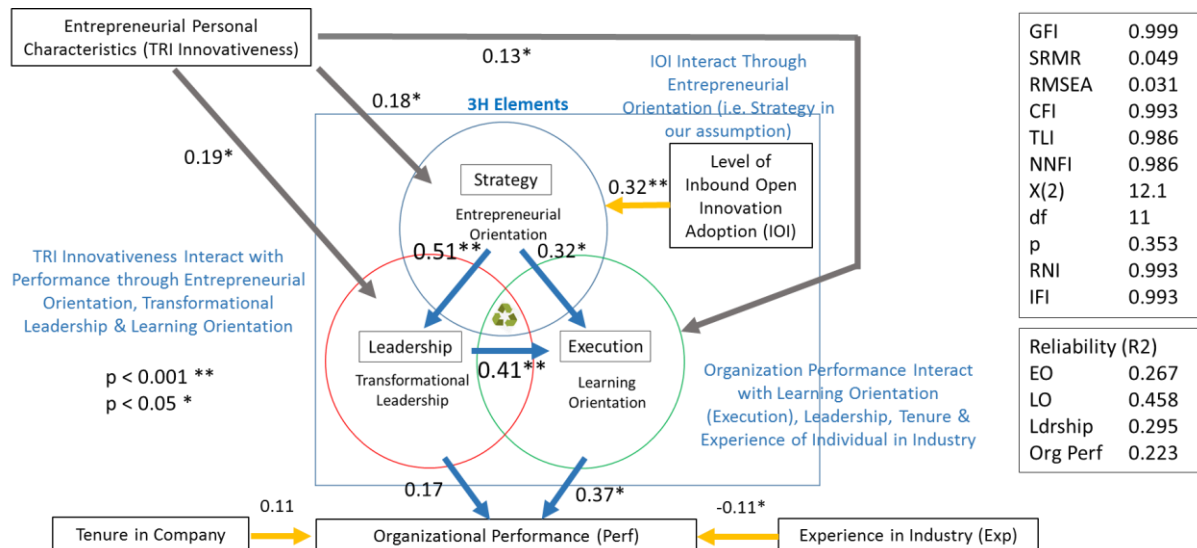


Figure 4.7: Final Model with Configuration and Weighting

As our model exhibits good fit under a large number of validation indices, the addition of moderating variables was not necessary to strengthen our reliability. This is consistent with observation that moderator variables are introduced when there is an unexpectedly weak or inconsistent relation between a predictor and criterion variable (Baron & Kenny, 1986) which is not our case here.

4.3.9) Summary of Hypothesis Validity for High Tech SMEs in Hong Kong

- 1) Managerial Optimism, as measured by TRI, has positive impact on Organizational Performance** (not confirmed)
- 2) Managerial Innovativeness, as measured by TRI, has positive impact on Organizational Performance** (confirmed as indirect relationship)
- 3) Managerial Insecurity, as measured by TRI, has negative impact on Organizational Performance** (not confirmed)
- 4) Managerial Discomfort, as measured by TRI, has negative impact on Organizational Performance** (not confirmed)
- 5) Positive Correlation exists between EO, Transformational Leadership, LO and Organizational Performance**
 - H5a – Entrepreneurial Orientation is positively related to Organizational Performance (confirmed)
 - H5b – Transformational Leadership is positively related to Organizational Performance (confirmed)
 - H5c – Learning Orientation is positively related to Organizational Performance (confirmed)
 - H5d – If Entrepreneurial Orientation, Transformational Leadership and Learning Orientation are all positive, organizational performance is also positive (confirmed)
- 6) Inbound Open Innovation Positively Related to 3 Core 3H Management elements**
 - H6a –Entrepreneurial Orientation is positively related to the Level of Inbound Open Innovation (confirmed)
 - H6b –Transformational Leadership is positively related to the Level of Inbound Open Innovation (confirmed)
 - H6c –Learning Orientation is positively related to the level of Inbound Open Innovation (confirmed)
- 7) Research Question One: Is it possible to identify a set of personal and managerial characteristics to explain organizational performance under an inbound open innovation context?** (confirmed)
- 8) Research Question Two: Based on the elements identified in Question One, can these elements be placed into a management framework to predict the likelihood of future organizational success for high technology SMEs so longitudinal analysis can be conducted periodically and consistently?** (confirmed)
- 9) Research Question Three: Is it possible to for different management factors identified above to combine coherently to support Inbound Open Innovation?** (confirmed)

Chapter 5 – Discussion

Based on analyzing the collected data, our study has successfully explained or proposed solutions to the research questions raised in Chapter two. More importantly our findings also extended the relationships identified by other researchers (Popa et al., 2017; Wang et al., 2015; Lichtenthaler, 2011; Dahlander & Gann, 2010; van de Vrande et al., 2009 and Singh et al. 2021) within the inbound open innovation and organizational performance context. The contribution of our study from different aspects is discussed below.

5.1) Successful identification of personal and managerial characteristics that can explain organizational performance under an inbound open innovation context

Leveraging findings from many previous researches, we have successfully identified three major management elements, namely, entrepreneurial orientation, learning orientation and transformational leadership that are highly relevant to achieve better organizational performance under an innovation driven environment. The summaries of these researches can be found in Chapter 2, section 2.2.2.4 and Chapter 3, section 3.2.1. More importantly, our result has clearly demonstrated personal characteristics of entrepreneurs towards new technologies, namely innovativeness and optimism as measured by TRI 2.0, is highly related to the success of organizational management as suggested by Paramasura and Colby (2015). Through our empirical analysis, our model has successfully confirmed both innovativeness and level of preference towards innovation adoption as independent antecedents and through the mediation by the three major management elements identified, it is possible to determine organizational performance operating under an inbound open innovation environment. The significant correlation between innovativeness and optimism may have embedded the role of optimism within innovativeness in our model.

Our study also confirmed the reliability of performance prediction improves when entrepreneurial tenure and experience in industry are included into the model. According to our model, predictability of organizational performance under an inbound open innovation context increases when top management has longer tenure but decreases with more experience in the industry. One possible explanation is longer tenure means entrepreneur is likely to be more successful in knowing how to navigate in the industry through better understanding of the company strength and weakness so it is positively correlate to performance. On the other hand, organizational performance is negatively correlated to industry experience of the entrepreneur operating under an inbound open innovation environment possibility due to belief in using his own ability to resolve problems rather than making changes and adopt external factors through inbound open innovation.

5.2) Predicting the likelihood of future organizational success by combining impactful elements into organizational management framework

Organizational environment is central to all management aspects (Boyd et al., 1993) and its perception is related to organizational structures, processes, technologies and decision making. Through the inclusion of entrepreneurial attitude towards inbound open innovation adoption, our model has successfully made provision in accounting for the impact of external environment on SME strategy as suggested by Russell (1992). Furthermore, as shown by our model, external environment does not directly impact performance because attitude towards inbound open innovation does not play any direct role in performance. Instead, inbound open innovation impact entrepreneurial orientation which is responsible

for strategic planning and this echoes the model developed by Boyd et al. (1993:212). This happens because under an unstable environment, such as those experienced by high technology industries, formal planning is more open to change (Brews & Hunt, 1999) so the adoption of new knowledge is an important change agent for strategic planning.

Furthermore, our study has successfully enhanced the model developed by Russel and Russel (1992) by applying it to Hong Kong SMEs under an inbound open innovation context. Supported by empirical findings, a structural model has emerged that includes and corresponds to many theories and hypothesis published over previous decades, correlating the relationships between entrepreneurial orientation, learning orientation and transformational leadership. A few examples were highlighted below, including those proposed by various scholars such as Zahra (1999), Wang (2008), Zhou (2005), Teece (1997, 2004) and Garcia-Morales (2008) as shown in the figure below.

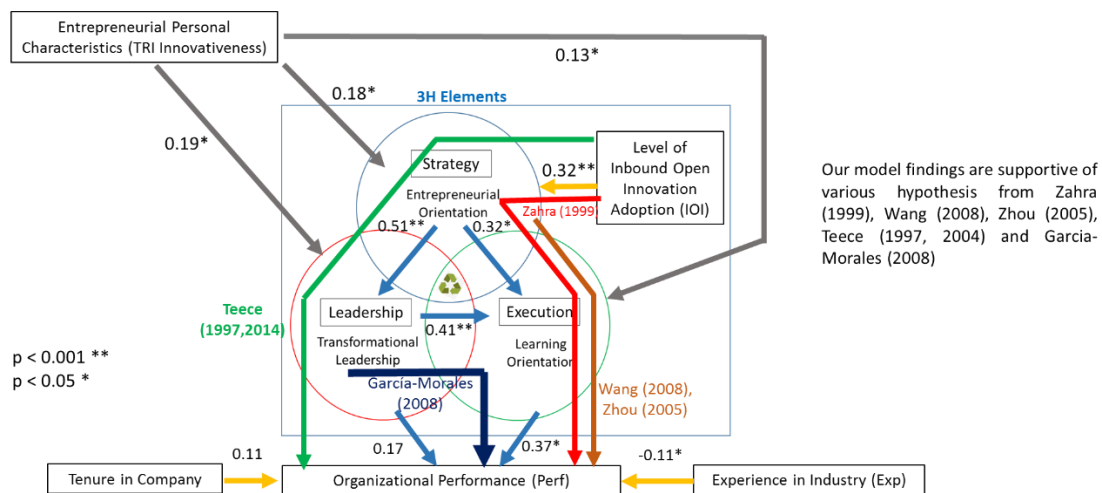


Figure 7.1 3H Based Management Model & Other Proposed Relationship

Finally, by including entrepreneurial orientation, learning orientation and transformational leadership as part of the management framework as suggested by 3H, our model helps to explain the role of management approach in mediating the relationship between external environments, which is represented by adoption attitude of inbound open innovation, personal attitude of entrepreneur towards new technologies, and organizational performance. In fact, the statistically significant relationship between entrepreneurial orientation, learning orientation and transformational leadership, makes 3H a credible framework in addressing the management requirement for inbound open innovation.

5.3) Possibility of different management factors working coherently to support inbound open innovation

Another major contribution of our model is the identification of causal relationships between different paths of management and innovation motivation. For instance, the increasing the acceptance level of external knowledge through inbound open innovation will enhance the impact of innovativeness and eventual performance of organization. This is consistent with the findings where regular entrepreneurship training sessions led to improved business knowledge, practices and revenues when they were given regularly to entrepreneurs over a period of one to two years (Karlan & Valdivia, 2011). Our model has also shown by encouraging entrepreneur to think more innovatively about technology, it will increase the strength of entrepreneurship, the learning orientation of company and leader is likely to

adopt a more transformative approach. Such finding is similar to those from Dibrell where firms' formal strategic planning processes and planning flexibility are positively associated, and each is positively related to innovativeness (Dibrell et al., 2014).

In addition, by leveraging the 3H management framework as the core, our study was able to empirically establish the relationship shown in the previous section, providing a visible model for entrepreneurs to utilize when combining different management elements to achieve the best organizational performance outcome. For instance, our model has expanded the understanding of how innovativeness interact with different management aspects, such as learning and leadership, and explain how likely performance can be impacted or altered through different combinations. As such, coherent outcome can be acquired if different factors that correlate positively to organizational performance are synchronized constructively.

5.4) Sustaining coherence through a balanced and continuous optimization approach

Variations in the speed of learning, different degree of asset specialization, breadth of path dependencies and environmental factors can provide partial explanation to the competitiveness of organization. However, how these elements are balanced through a management framework is critical for the creation of sustainable competitive advantages in organizations. This also implicitly support the relevance of using a multi-dimensional framework like 3H in the analysis and monitoring of corporate performance. In comparison, owing to the diversity of agents, industries and national circumstances, evolutionary economic models will always remain in a constant state of flux as it lacks sufficient understanding of some of the key relationships, such as innovation and their diffusion. These complexities clearly calls for the continuous optimization of models through empirical research to strengthen its validity and scope of application (Freeman, 1994:491).

Based around the 3H model, our study has confirmed the significant relationship between entrepreneurial orientation, transformational leadership and learning orientation, so the possibility of using 3H framework to drive organizational performance is supported. Organization should continue to operate these three functions, namely allocation of scarce resources, exploitation of underutilized resources by entering into new activities and create new competences through learning in a parallel and balanced manner to succeed in innovation systems as learning is fundamental and central in a national innovation systems approach but often overlooked in a business system approach (Lundvall, 1999).

Nevertheless, resource based view is static in nature (Arend & Bromiley, 2009) and requires further modification as a long term strategy especially for firms operating under a dynamic market environment (Eisenhardt & Martin, 2000; Wang & Ahmed, 2007). Strategic direction should aim at continuously upgrading the company resources and capabilities as it is essential for maintaining the competitive advantages of the corporation. In fact, resource based view is seen recently as lacking thorough ability to explain how and why certain firms can create competitive advantage under a business environment of rapid and unpredictable change (Eisenhardt & Martin, 2000) such as those surrounding technology SMEs. This shortcoming of resource based view becomes more obvious from a wider, even national system perspective since entrepreneurship a dynamic and institutionally embedded interaction between entrepreneurial attitudes, ability, and aspirations, by individuals that drives the allocation of resources through the creation and operation of new ventures (Acs et al., 2014).

On the other hand, through appropriately adapting, integrating, and reconfiguring internal and external organizational skills, resources, and functional competences, dynamic capabilities can be developed and incorporated into the organization to fill in the resource gap. The adoption of a dynamic capability view helps to explain changes in valuable resources, asset values and provide a practical view to understand how firms can optimize effectively as competitive environment changes at increasing rates (Arend & Bromiley, 2009).

5.5) Enable the deployment of tools that can conduct longitudinal study periodically to review the status and likelihood of continual success of inbound open innovation

Our proposed model has uncovered a new topic for future scholars on how organizational performance can be benchmarked and improved over time by encouraging the adoption of inbound open innovation and influencing the preference of entrepreneurs towards new technologies. Analysis will involve making measurement both longitudinally and empirically. Such approach is made possible because all the instrument deployed by this study are grounded on previous studies and can be re-applied in future studies. Since our study has confirmed personal characteristics of top management do not directly translate into organizational performance even in the case of SMEs, future researchers must pay attention to the mediating role of management framework, like 3H. Through including analysis on how personal characteristics interact with innovation, our study has fulfilled the suggestion made by scholars to explore how micro level variables (for example, trust, personality characteristics and employee engagement) operate in the workplace as supporting or obstructing factors under an open innovation environment in SMEs. (Singh et al. 2021)

As innovativeness is affecting all three management elements covered by 3H, it is more effective to implement innovation through a multi-faceted approach under an inbound open innovation environment due to the multiple causal relationships identified between different path of management and innovation motivation. For instance, the introduction of knowledge about entrepreneurship will enhance the final impact of inbound open innovation (Karlan & Valdivia, 2011). At the same time, by encouraging entrepreneur to think more innovatively about technology, it will also increase the strength of entrepreneurship, the likelihood of company becoming more learning oriented and the adoption of a more transformative approach in leadership. Hence, instead of just educating entrepreneurs to be more learning oriented, their learning appetite can also be improved by increasing their knowledge and interest in entrepreneurial orientation and transformational leadership. This holistic management approach is made possible because it echoes the fundamental theory suggested by the 3H framework. As such, our study has provided empirical evidence that the application of such framework is relevant and practical under the Hong Kong high technology SMEs operating environment.

From an organizational management improvement perspective, by establishing the relationship between organizational performance, management approach, preference of inbound open innovation adoption and entrepreneurial attitude based around the 3H framework, our study has shown it is possible to enhance different elements within the management structure, namely strategy, leadership and execution in a holistic rather than individual manner. By conducting the survey instruments periodically and regularly, management can capture the instantaneous status of the organization from an inbound open innovation readiness perspective and benchmark it again information collected at different times. This will enable management to utilize the methodologies provided by 3H to adjust individual

management elements as well as other critical inputs accordingly to ensure continuous organizational success within the inbound open innovation context.

5.6) Organisational Performance Outcome (OP) as Suggested 3H Framework OP

Through the introduction of transformational leadership to traditional evolutionary economic models, the 3H framework can be an exciting instrument to increase organizational innovativeness by leveraging transformational leadership as an efficient intervention element alongside entrepreneurial orientation and learning orientation. With its flexibility, 3H enables top management to exercise strategic leadership, building dynamic core competences, focusing and developing human capital. By equipping management with the framework to exercise effective controls, 3H also helps them to adopt new technologies, employing valuable strategies either through exploitation or inbound open innovation, and implementing new organization structures with culture to foster learning and innovation.

As all three management elements are rated as above average based on our surveyed result, the entry condition of holistic management $f(H1 \cap H2 \cap H3)$, as defined by the 3H model, has been met (Yu, 2022). In addition, both organizational performance and inbound open innovation shows their positive presence and also graded as above average by the survey participants. Such result is encouraging as it indicates holistic management can exist when both organizational performance and inbound open innovation level are satisfactory. The various optimization approach that can take based on the 3H framework is listed below where H1 is defined as transformational leadership, H2 represents entrepreneurial orientation and H3 is learning orientation of the organization.

1. $f(H^1 \cap H^2 \cap H^3)$ Adequacy of all 3H domain factors and effective intersection of all 3H domains – Ideal case of holistic management as both necessary and sufficient conditions are fulfilled.
2. $f(H^1 \cap H^2 \cap H^3)$ Deficiency of Hand domain factors
3. $f(H^1 \cap H^2 \cap H^3)$ Deficiencies of Head and Hand domain factors
4. $f(H^1 \cap H^2 \cap H^3)$ Deficiency of Heart domain factors
5. $f(H^1 \cap H^2 \cap H^3)$ Deficiencies of Heart and Head domain factors
6. $f(H^1 \cap H^3 \cap H^2)$ Deficiency of Head domain factors
7. $f(H^1 \cap H^2 \cap H^3)$ Deficiencies of Heart and Hand domain factors
8. $f(H^1 \cap H^2 \cap H^3)$ Have all necessary but insufficient condition due to weak intersection of H1 and H2
9. $f(H^1 \cap H^2 \cap H^3)$ Have all necessary but insufficient condition due to weak intersection of H2 and H3
10. $f(H^1 \cap H^3 \cap H^2)$ Deficiency of Hand domain factors and weak intersection between H1 and H3
11. $f(H^1 \cap H^2 \cap H^3)$ Have all necessary but insufficient condition due to weak intersection of all 3H
12. $f(H^1 \cap H^2 \cap H^3)$ Deficiency in all three H factors and weak intersection among all three H domains

5.7) Possibility of Self Reinforcement

Our 3H based model has shown the self-reinforcement potential of strong entrepreneurial orientation on learning and leadership. This is supportive of and supported by findings from the double loop learning model suggested by Argyris, (1977 & 2003) when organizations correct the errors by changing its managing approach or values when mis-match emerges. This double loop analogy happens if entrepreneurs can recognise the need for strategy adjustment driven by changes in the external

environment or entrepreneurial preference during the adoption of inbound open innovation as shown by our model. Our model also demonstrated the importance of including awareness towards inbound open innovation adoption as part of the corporate strategy adjustment consideration. Ideally, this can be used as a preventive and forward planning management approach for strategy adjustment in a regular manner. It is also possible outbound open innovation will enable learning orientation and leadership to drive entrepreneurship but that needs to be confirmed by future studies.

Chapter Six Conclusion and Limitation

6.1) Conclusion

It was widely recognized that open innovation is an important element to enhance organisational performance (Chesbrough & Appleyard, 2007:57) but it was not well established on how it interacts with different management elements. Although entrepreneurs from high-tech companies are widely assume to be innovative, the relationship between their innovativeness and organizational performance has not be structurally analyzed within the Hong Kong high-tech SMEs landscape before this study. However, our study has empirically shown innovation is significantly and positively related to superior performance (Vincent et al., 2004). Furthermore, by focusing our study on the interaction between inbound open innovation adoption, personal characteristics of entrepreneurs toward new technology and management elements, such as 3H, we have developed a statistically significant model, based on Russell and Russell (1992), to explain how openness towards inbound open innovation adoption and attitude towards new technology from top management become indirect drivers of organizational success and company performance. In trying to address the missing link between entrepreneurial characteristics and organizational performance, our study is the first empirical attempt to identify relevant characteristics of Hong Kong high-tech SMEs under an inbound open innovation environment. As expected, attitude of entrepreneur towards inbound open innovation adoption and new technology is not directly responsible for organizational performance. Instead, as shown by our investigation, the relationship between attitude and performance needs to be mediated by management framework as suggested by numerous scholars, such as Rogers (2003), who predicted that intention and preferences will need to be converted to corporate action plans in form of strategy and executed through leadership guidance and other relevant behaviour.

By using the 3H framework as a starting reference, we have proven the feasibility of applying it to the management of inbound open innovation by substituting entrepreneurial orientation as Head, learning orientation as Hand and transformational leadership as Heart. This supports our summary of previous research studies where there is a strong possibility of combining these three elements constructively to deliver coherent performance. Our results also confirmed the existence of a causal chain in determining the effect of inbound open innovation on organizational performance (Zahra 1999) which can be enhanced by entrepreneurial innovativeness. With multiple factors exhibiting partial rather than full mediation, it supports the idea that multiple elements are involved in determining corporate performance which fits nicely into the 3H framework because it assumes different elements can co-exist to support a holistic implementation of organizational management. Our findings also extended the scope and the effectiveness of previous inbound open innovation concept (Chesbrough, H. 2003) which failed to elaborate on how it can be incorporated to improve organizational performance.

It is also encouraging to observe 3H framework playing an important role in mediating and linking technology readiness of entrepreneurs, through innovativeness towards new technology, and company performance. Our model has also shown the level of entrepreneurship can be increased by encouraging embracement towards inbound open innovation. As such, programs that can increase level of inbound open innovation adoption provide potential ingredients towards the ultimate goal of improving company performance. Nonetheless, such achievement can only be achieved if checkpoints are put in place to ensure 3H and entrepreneur attitudes are adjusted accordingly as a response to the level of increase by inbound open innovation adaption

As shown by our model, it is possible to establish a causal relationship between the level of inbound open innovation adoption and entrepreneurship which ultimately influence the level of transformational leadership and learning orientation to drive organisational performance. The important role of learning orientation as a mediator between transformational leadership and performance is also confirmed by our study. This is consistent with the previous findings (García-Morales et al., 2008; Bass & Avolio, 2000) and our study also expanded the findings by Wang (2008) in three ways. First, learning orientation mediates the relationship between entrepreneurial orientation and organizational performance within the Hong Kong high-tech SMEs context. Second, through applying the 3H framework, our study has added transformational leadership as a second mediator into Wang's model successfully so leadership and learning orientation are both mediators for entrepreneurial orientation in forecasting high-tech SMEs performance. This is despite the fact learning orientation remains the more dominant mediator over transformational leadership.

In addition, our model has confirmed Nelson's proposal that entrepreneurial orientation could be regarded as an antecedent of innovation performance which helps to explain why firms perform differently (Nelson, 1991). Furthermore, our result supports the claim that entrepreneurial orientation is the main predictor for performance because it leads to better performance over time (Madsen, 2007). On the other hand, our model has also confirmed innovativeness have a positive influence on business performance (Hughes & Morgan, 2007) of Hong Kong high tech SMEs. Lastly, our study has also confirmed the relevance of foundation factors within TRI 2.0 in explaining organisational performance as forecasted by Parasumara under an inbound open innovation environment (Parasumara & Colby, 2015). Through the use of TRI 2.0 as a survey instrument and a longitudinal analysis tool to predict the likelihood of SMEs' future performance on a periodic basis is now available to assess the effectiveness of inbound open innovation.

As most SMEs face resource constraints, ranging from financial, technological and managerial, due to their small size, operation model identified by our study is likely to improve SME competitiveness and address both external and internal issues challenging small businesses on an ongoing basis. By using entrepreneurial orientation, transformational leadership and learning orientation as our strategic (head), leadership (heart) and execution (hands) elements based on the 3H framework, our study has successfully developed a model that correlates entrepreneurial attitude towards inbound open innovation, new technology, management approach and potential organisational performance. This offers broad implications of high technology SMEs organisational management because by expanding the comfort level of innovation adoption, organisational can enjoy the possibility of future performance improvement if the leaders can also enhance their management contribution through better strategy settings which is mediated by transformational and heartfelt leadership as well as upgrading execution ability through the encouragement of creating a learning oriented organisation. This easy to understand operating model can also be used by high technology entrepreneurs to continuously audit and improve the delivery of organizational performance by ensuring business success under an inbound open innovation driven environment. More importantly, any deviations from the recommended orientation can also be identified at an earlier stage and perhaps even in the antecedent level so remedial actions, such as tailored training and personal coaching of management, can be proposed and implemented to address the root cause.

6.2) Limitation

Although we have started our study of open innovation from the lens of an evolutionary economist and expand it through the 3H management framework to make it more balance, further improvement of the new approach should be possible if neighboring disciplines, such as psychological research, are included to conduct further assessment. Non economic or management background expert could provide a more objective and certainly more independent view on some fundamental issues. Even though our study has successfully identify the interaction between learning orientation, transformational leadership and entrepreneurial orientation, we are yet to confirm the possibility of learning orientation driving transformational leadership and entrepreneurial orientation as well as transformational leadership driving entrepreneurial orientation to achieve organizational performance enhancement as suggested by the coherent inbound open innovation cycle. This could be the result of using inbound open innovation as a context where knowledge becomes an execution focus function instead of a wealth creation element as in the case of out bound open innovation. Under outbound innovation, knowledge is creating new selling opportunities so entrepreneurial strategy may be subsequently adjusted to acquire new market opportunities but this should be left for future studies to investigate.

Moreover, due to the scoping of this research, no investigation into the challenges facing the actual implementation of 3H under an inbound open innovation context is conducted. However, through sufficient and effective preparation, 3H framework should provide top managers a credible platform for implementing inbound open innovation by using the entrepreneurial orientation, transformational leadership and learning orientation as its core elements. Furthermore, as our study suggests tenure and experience did not impact directly in strategy, transformational leadership and learning orientation, such findings make continuous training and introduction of inbound open innovation to entrepreneur an important topic to counter the negative impact of industrial experience. The overall speed of organizational evolution can be improved by keeping entrepreneurs afresh of changes and new innovation happening externally rather than only focusing in-house and past experience. However, establishing how tenure and experience impact the management framework, such as 3H, and the identification of additional element that may be able to link directly to these two factors could be an interesting research topic for future studies. Finally, the key informant method was used for data collection so the data reflects the opinions of only one person and our study is focused on SMEs. Future studies could consider including a research designs that support data collection from multiple participants within an organization and also covering the contribution of inbound open innovation for larger organizations.

Appendix One - Detail of Questions used in Survey

i) Introduction Statement

We would like to invite your kind participation to take part in a survey for a management research study which is part of a doctoral research project. This survey will only take around 10 - 15 minutes. The aim of this study is to develop a Hong Kong specific entrepreneurial profile for people managing technology companies in Hong Kong. Your valuable feedback will be important for this project so that we can recommend enhancement programs for future entrepreneurs. All answers collected will remain anonymous and confidential at all times and only be used for this research.

By submitting your feedback, you are consenting to be a participant of our study where all data will remain anonymous and confidential as we will not identify you individually from your answers in accordance to the guideline approved by the ethics review committee of the University of Wales TSD. As this survey is completely voluntary, should you feel uncomfortable and do not want to respond, you are also free to do so. Thank you for your time and please feel free to leave any further comment here. (我們誠邀閣下參與一個管理研究項目的調查。這項調查只需要大約 10-15 分鐘。本研究的目的是對香港科技公司的管理人員進行剖析調查,為未來新一代的香港企業家提供更好的指導。所有收集的答案將會保持匿名和保密,並且僅用於本研究。通過提交您的回應,閣下同意成為我們研究的參與者。所有數據將根據 University of Wales TSD 的道德審查委員會批准的指引下保持匿名和保密。如果您不想回答,您也可以選擇不提交和離開。謝謝你的寶貴參與和回應。)

ii) Level of Inbound Open Innovation

In our firm, for our new product development, we (five-point scale: 1=“strongly disagree” and 5=“strongly agree”) (Sisodiya, S.R., Johnson, J.L. and Grégoire, Y., 2013)[560] & (Singh, S.K., Gupta, S., Busso, D. and Kamboj, S., 2021)[558] (likert 7) (IOI)

1. We constantly scan the external environment for inputs such as technology, information, ideas, knowledge, etc.* (IOI – 1)

2. Our firm actively seek out external sources (e.g., research groups, universities, suppliers, customers, competitors, etc.) of knowledge and technology when developing new products. (IOI – 2)

3. We believe it is good to use external sources (e.g., research groups, universities, suppliers, customers, competitors, etc.) to complement our own R&D.* - one question is removed

4. Our company often bring in externally developed knowledge and technology to use in conjunction with our own R&D. (IOI – 1)

ii) Performance Metrics of Innovation (five-point scale: 1=“strongly disagree” and 5=“strongly agree”) (PMI)

1) Our new product introduction has increased over the last 5 years (Calantone, R.J., Cavusgil, S.T. and Zhao, Y., 2002) [461] (likert 7) (PMI - 1)

2) Our company meets our sales performance and return on investment targets. (Venkatraman, N. and Ramanujam, V., 1986) [412] & (Bontis, N., Crossan, M.M. and Hulland, J., 2002)[437] (likert 7) (PMI - 2)

3) The organization has obtained high sales growth in the main products/services and markets. (García-Morales, V.J., Llorens-Montes, F.J. and Verdú-Jover, A.J., 2006)[582] (likert 7) (PMI - 3)

4) We have been able to expand our existing customer base this year. (Hughes, M. and Morgan, R.E., 2007)[411] (likert 7) (PMI - 4)

iii) General Background Information

(1) Age of respondent – (Dawes, J., 2008) [598] (2) Age of Firm – (Pérez-Luño, A., Wiklund, J. and Cabrera, R.V., 2011) (3) Size of Firm (4) Education Level (5) Position of respondent in Company (6) Year of Experience in the industry

iv) In the area of entrepreneurial orientation

For entrepreneurial and learning orientation, the following questions will be used. (Wang, C.L., 2008)[142] (likert 7)

Market proactiveness

1) In general, the top managers of our organization favor a strong emphasis on Research & Development, technological leadership, and innovations.

2) In the past 5 years, our organization has marketed a large variety of new lines of products or services. (also related to performance) – so removed

2) In the past 5 years, changes in our products or service lines have been mostly of a minor nature. (Reverse coded)

Firm risk taking

1) In general, the top managers of my organization have a strong propensity for high-risk projects (with chances of very high return).

2) The top managers believe, owing to the nature of the environment, that bold, wide-ranging acts are necessary to achieve our organization objectives.

3) When there is uncertainty, our organization typically adopts a “wait-and-see” posture in order to minimize the probability of making costly decisions. (Reverse coded)

Firm innovativeness

1) Management actively responds to the adoption of “new ways of doing things” by main competitors.

2) We are willing to try new ways of doing things and seek unusual, novel solutions.

3) We encourage people to think and behave in original and novel ways

v) From a learning orientation perspective (wang C.L 2008 – 7 points, Baker, W.E. and Sinkula, J.M., 1999 – 5 points for LO)

Commitment to learning

1) The basic values of this organization include learning as a key to improvement.

2) The sense around here is that employee learning is an investment, not an expense.

3) Learning in my organization is seen as a key commodity necessary to guarantee organizational survival and generate our ompetitive advantage (combined with original question one)

Shared vision

- 1) There is a commonality of purpose in my organization.
- 2) All employees are committed to the goals of this organization.
- 3) Employees view themselves as partners in charting the direction of the organization.

Open-mindedness

- 1) We are not afraid to reflect critically on the shared assumptions we have made about our customers.
- 2) Personnel in this organization realize that the very way they perceive the marketplace must be continually questioned.
- 3) We rarely collectively question our own business about the way we interpret customer information.
(Reverse coded)

vi) Transformational leadership

1) I transmit the organization's mission, reason for being, and purpose to all of the employees. (García-Morales, V.J., Jiménez-Barrionuevo, M.M. and Gutiérrez-Gutiérrez, L., 2012)[347] (Likert 7) (Page 396 Carless, S.A., Wearing, A.J. and Mann, L., 2000)[472]

2) I consider the moral and ethical values before I take action. - (Behaviors Charm) (Page 450 Avolio, Bruce J., Bernard M. Bass, and Dong I. Jung)[529] (Avolio, Bruce J., Bernard M. Bass, and Dong I. Jung 1999) - a five-point response scale ranging from 1 (strongly disagree) to 5 (strongly agree) to each of the MLQ5X items (Mind garden) MLQ 5x : 1 (not at all) 2 (Once in a while) 3 (Sometimes) 4 (Fairly Often) 5 (Frequently, if not always)

3) I talk optimistically about the future and articulate/communicate a vision. (Inspirational Motivation) (Page 450 Avolio, Bruce J., Bernard M. Bass, and Dong I. Jung)[529] (Podsakoff, MacKenzie, Moorman, & Fetter, 1990)[579]

4) I re-examine critical assumptions to question whether they are appropriate. (Intellectual Stimulation): (Page 450 Avolio, Bruce J., Bernard M. Bass, and Dong I. Jung)[529] (Podsakoff, MacKenzie, Moorman, & Fetter, 1990)[579]

5) I treat staff as individuals, supports and encourages their development. (Individualized Consideration/Staff Development – labelled as “encouraging the heart” by Carless (Page 394 & Page 396 Carless, S.A., Wearing, A.J. and Mann, L., 2000)[472] (Kouzes & Posner, 1990)[594]

These are chosen because regardless of national setting, four transformational behaviors—articulating a vision, providing an appropriate model, having high performance expectations, and showing supportive leader behavior—positively affect the relationship between EO and firm performance. (Engelen, A., Gupta, V., Strenger, L. and Brettel, M., 2015)[578]

Technology Readiness Index

Optimism

- 1) New technologies contribute to a better quality of life
- 2) Technology gives me more freedom of mobility

- 3) Technology gives people more control over their daily lives
- 4) Technology me more makes productive in my personal life

Innovativeness

- 1) Other people come to me for advice on new technologies
- 2) In general, I am among the first in my circle of friends to acquire new technology when it appears
- 3) I can usually figure out new high-tech products and services without help from others
- 4) keep up with the latest technological developments in my areas of interest

Discomfort

- 1) When I get technical support from a provider of a high-tech product or service, I sometimes feel as if I am being taken advantage of by someone who knows more than I do
- 2) Technical support lines are not helpful because they don't explain things in terms I understand
- 3) Sometimes, I think that technology systems are not designed for use by ordinary people
- 4) There is no such thing as a manual for a high-tech product or service that's written in plain language

Insecurity

- 1) People are too dependent on technology to do things for them
- 2) Too much technology distracts people to a point that is harmful
- 3) Technology lowers the quality of relationships by reducing personal interaction
- 4) I do not feel confident doing business with a place that can only be reached online

Survey Question	Area Studied	Scale	Source	Remark
Age of Respondent	General Background	(<30, 30-<40, 40-<50, 50-<60, 60+)		
Years of Company Establishment	General Background	(<2, 2-<5, 5-<10, 10-<15, 15+)	Pérez-Luño, A., Wiklund, J. and Cabrera, R.V., 2011	
Total Number of Employees	General Background	(<5, 5-<10, 10-<25, 25-<50,		
Role of Respondent in Company	General Background	(Founder/CEO, Top Management, Middle Management, Expert/Individual Contributor, General Staff)		
Highest Education Level Attained by Respondent	General Background	(High School, Higher Diploma, Bachelor, Master, Doctorate)		Reversed Coded
Years of Experience in Current or Same Industry	General Background	<5, 5-<10, 10-<15, 15-<20, 20+		

New technologies contribute to a better quality of life	TRI - Optimism	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
Technology gives me more freedom of mobility	TRI - Optimism	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
Technology gives people more control over their daily lives	TRI - Optimism	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
Technology me more makes productive in my personal life	TRI - Optimism	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
Other people come to me for advice on new technologies	TRI - Innovativeness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
In general, I am among the first in my circle of friends to acquire new technology when it appears	TRI - Innovativeness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
I can usually figure out new high-tech products and services without help from others	TRI - Innovativeness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
Keep up with the latest technological developments (e.g. Blockchain, Crypto) in my areas of interest	TRI - Innovativeness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
When I get technical support from a provider of a high-tech product or service, I sometimes feel as if I am being taken advantage of by someone who knows more than I do	TRI - Discomfort	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
Technical support lines are not helpful because they don't explain things in terms I understand	TRI - Discomfort	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
Sometimes, I think that technology systems are not designed for use by ordinary people	TRI - Discomfort	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
There is no such thing as a manual for a high-tech product or service that's written in plain language	TRI - Discomfort	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point

People are too dependent on technology to do things for them	TRI - Insecurity	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
Too much technology distracts people to a point that is harmful	TRI - Insecurity	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
Technology lowers the quality of relationships by reducing personal interaction	TRI - Insecurity	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
I do not feel confident doing business with a place that can only be reached online	TRI - Insecurity	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Parasuraman, A. and Colby, C.L., 2015	Likert 5 point
I transmit the organization's mission, reason for being, and purpose to all of the employees	Transformational Leadership - Vision	Not at all, Once in a while, Sometimes, Fairly Often, Frequently, if not always	(García-Morales, V.J., Jiménez-Barrionuevo, M.M. and Gutiérrez-Gutiérrez, L., 2012) (Page 396 Carless, S.A., Wearing, A.J. and Mann, L., 2000)	Garcia Morales (Likert 7), GTL Carless (likert 5)
I consider the moral and ethical values before I take action	Transformational Leadership - Behaviors Charm	Not at all, Once in a while, Sometimes, Fairly Often, Frequently, if not always	(Avolio, Bruce J., Bernard M. Bass, and Dong I. Jung 1999)	Likert 5
I talk optimistically about the future and articulate/communicate a vision.	Transformational Leadership - Inspirational Motivation	Not at all, Once in a while, Sometimes, Fairly Often, Frequently, if not always	(Avolio, Bruce J., Bernard M. Bass, and Dong I. Jung) (Podsakoff, MacKenzie, Moorman, & Fetter, 1990)	Likert 5
I re-examine critical assumptions to question whether they are appropriate.	Transformational Leadership - Intellectual Stimulation	Not at all, Once in a while, Sometimes, Fairly Often, Frequently, if not always	(Avolio, Bruce J., Bernard M. Bass, and Dong I. Jung) (Podsakoff, MacKenzie, Moorman, & Fetter, 1990)	Likert 5
I treat staff as individuals, supports and encourages their development.	Transformational Leadership - Individualized	Not at all, Once in a while, Sometimes, Fairly	(Page 394 & Page 396 Carless, S.A.,	Likert 5

("encouraging the heart" by Carless Page 394)	Consideration/Staff Development	Often, Frequently, if not always	Wearing, A.J. and Mann, L., 2000)[472] (Kouzes & Posner, 1990)	
The basic values of this organization include learning as a key to improvement.	Learning Orientation – Commitment to Learning	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008 Baker, W.E. and Sinkula, J.M., 1999	Wang Likert 7, Baker LO Likert 5 – survey Likert 5
The sense around here is that employee learning is an investment, not an expense.	Learning Orientation – Commitment to Learning	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008 Baker, W.E. and Sinkula, J.M., 1999	Wang Likert 7, Baker LO Likert 5 – survey Likert 5
Learning in my organization is seen as a key commodity necessary to guarantee organizational survival and generate our ompetitive advantage	Learning Orientation – Commitment to Learning	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008 Baker, W.E. and Sinkula, J.M., 1999	Wang Likert 7, Baker LO Likert 5 – survey Likert 5 (combined with original question one)
There is a commonality of purpose in my organization.	Learning Orientation – shared vision	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008 Baker, W.E. and Sinkula, J.M., 1999	Wang Likert 7, Baker LO Likert 5 – survey Likert 5
All employees are committed to the goals of this organization.	Learning Orientation – shared vision	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008 Baker, W.E. and Sinkula, J.M., 1999	Wang Likert 7, Baker LO Likert 5 – survey Likert 5
Employees view themselves as partners in charting the direction of the organization.	Learning Orientation – shared vision	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008 Baker, W.E. and Sinkula, J.M., 1999	Wang Likert 7, Baker LO Likert 5 – survey Likert 5
We are not afraid to reflect critically on the shared assumptions we have made about our customers.	Learning Orientation – Open mindedness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008 Baker, W.E. and Sinkula, J.M., 1999	Wang Likert 7, Baker LO Likert 5 – survey Likert 5
Personnel in this organization realize that the very way they perceive the marketplace must be continually questioned.	Learning Orientation – Open mindedness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008 Baker, W.E. and Sinkula, J.M., 1999	Wang Likert 7, Baker LO Likert 5 – survey Likert 5
We rarely collectively question our own business about the way we interpret customer information.	Learning Orientation – Open mindedness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008 Baker, W.E. and Sinkula, J.M., 1999	Wang Likert 7, Baker LO Likert 5 – survey Likert 5 (Reverse coded)

In general, the top managers of our organization favor a strong emphasis on Research & Development, technological leadership, and innovations.	Entrepreneurial Orientation – Market Proactiveness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008	Original Likert 7 – survey Likert 5
In the past 5 years, changes in our products or service lines have been mostly of a minor nature.	Entrepreneurial Orientation – Market Proactiveness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008	Original Likert 7 – survey Likert 5 (Reverse coded)
In general, the top managers of my organization have a strong propensity for high-risk projects (with chances of very high return).	Entrepreneurial Orientation – Firm Risk Taking	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008	Original Likert 7 – survey Likert 5
The top managers believe, owing to the nature of the environment, that bold, wide-ranging acts are necessary to achieve our organization objectives.	Entrepreneurial Orientation – Firm Risk Taking	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008	Original Likert 7 – survey Likert 5
When there is uncertainty, our organization typically adopts a “wait-and-see” posture in order to minimize the probability of making costly decisions.	Entrepreneurial Orientation – Firm Risk Taking	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008	Original Likert 7 – survey Likert 5 (Reverse coded)
Management actively responds to the adoption of “new ways of doing things” by main competitors.	Entrepreneurial Orientation – Firm Innovativeness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008	Original Likert 7 – survey Likert 5
We are willing to try new ways of doing things and seek unusual, novel solutions.	Entrepreneurial Orientation – Firm Innovativeness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008	Original Likert 7 – survey Likert 5
We encourage people to think and behave in original and novel ways.	Entrepreneurial Orientation – Firm Innovativeness	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	Wang, C.L., 2008	Original Likert 7 – survey Likert 5
Our firm constantly scan the external environment for inputs such as technology, information, ideas, knowledge, etc.	Extent of Inbound Open Innovation	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	(Sisodiya, S.R., Johnson, J.L. and Grégoire, Y., 2013) & (Singh, S.K., Gupta, S., Busso, D. and Kamboj, S., 2021)	Original Likert 7 – survey Likert 5
Our company actively seek out external sources (e.g., research groups, universities, suppliers, customers,	Extent of Inbound Open Innovation	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	(Sisodiya, S.R., Johnson, J.L. and Grégoire, Y., 2013),	Original Likert 7 – survey Likert 5

competitors, etc.) of knowledge and technology when developing new products.			(Singh, S.K., Gupta, S., Busso, D. and Kamboj, S., 2021) & (Cheng, C.C. and Shiu, E.C., 2015)	
Our organization believes it is good to use external sources (e.g., research groups, universities, suppliers, customers, competitors, etc.) to complement our own R&D.	Extent of Inbound Open Innovation	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	(Sisodiya, S.R., Johnson, J.L. and Grégoire, Y., 2013), (Singh, S.K., Gupta, S., Busso, D. and Kamboj, S., 2021) & (Cheng, C.C. and Shiu, E.C., 2015)	Original Likert 7 – survey Likert 5
Our new product introduction has increased over the last 3 - 5 years	Performance Metrics of Innovation	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	(Calantone, R.J., Cavusgil, S.T. and Zhao, Y., 2002) (Brews, P.J. and Hunt, M.R., 1999)	Original Likert 7 – survey Likert 5
Our company meets our sales performance and return on investment targets during the last 3 – 5 years.	Performance Metrics of Innovation	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	(Venkatraman, N. and Ramanujam, V., 1986) & (Bontis, N., Crossan, M.M. and Hulland, J., 2002) (Brews, P.J. and Hunt, M.R., 1999)	Original Likert 7 – survey Likert 5
Our organization has obtained high sales growth in the main products/services and markets during the last 3 – 5 years.	Performance Metrics of Innovation	Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree	(García-Morales, V.J., Llorens-Montes, F.J. and Verdú-Jover, A.J., 2006) (Brews, P.J. and Hunt, M.R., 1999)	Original Likert 7 – survey Likert 5
Our company have been able to expand our existing	Performance Metrics of Innovation	Strongly Disagree, Disagree, Neutral,	(Hughes, M. and Morgan, R.E., 2007) &	Original Likert 7 – survey Likert 5

customer base during the last 3 – 5 years.		Agree, Strongly Agree	(Brews, P.J. and Hunt, M.R., 1999)	
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Appendix Two – Model Robustness Comparison

A) Reference Model – Achieved best fitting parameters with 3H element

Dependent Variable	Predicting Elements in Model	Weighting	Significance (P – value)	Fitting Model Parameters
Strategy (Entrepreneurial Orientation)	Innovativeness + Inbound OI Level	0.20 0.30	** **	X(2) : 18.4 (p = 0.43) RMSEA : 0.014 SRMR : 0.050 GFI : 0.999 CFI : 0.998 TLI : 0.996 NNFI : 0.996 NFI : 0.92 IFI : 0.998 RNI : 0.998 MFI : 0.998
Leadership (Transformational Leadership)	EO + Innovativeness + Optimism + Inbound OI Level + Insecurity	0.43 0.16 0.12 0.21 -0.10	** * 0.13 * 0.19	
Execution (Learning Orientation)	Leadership + EO + Innovativeness + Insecurity	0.49 0.34 0.11 -0.09	** * 0.12 0.31	
Performance	LO + ExpInIndustry	0.45 -0.08	** 0.06	

** @ p<=0.001, * @ p<=0.05

Observation

Model suggesting solid and significant relationships between LO with leadership and EO as well as strong relationship between Leadership and EO. However, it does not provide a full feedback mechanism for the creation of a self sustaining cycle.

B) Alternate Model One – Parameters Achieved For Supporting Self Sustaining Inbound Open Innovation Cycle with 3H Element

Dependent Variable	Predicting Elements in Model	Weighting	Significance (P – value)	Fitting Model Parameters
Strategy (Entrepreneurial Orientation)	Innovativeness + Inbound OI Level + LO	0.17 0.28 0.10	* ** 0.65	X(2) : 17.4 (p = 0.37) RMSEA : 0.029 SRMR : 0.047 GFI : 0.999 CFI : 0.993 TLI : 0.984 NNFI : 0.984 NFI : 0.925 IFI : 0.994 RNI : 0.993 MFI : 0.993
Leadership (Transformational Leadership)	EO + Innovativeness + Optimism + Inbound OI Level + Insecurity	0.36 0.18 0.13 0.23 -0.12	0.07 * 0.11 * 0.16	
Execution (Learning Orientation)	Leadership + EO + Innovativeness + Insecurity	0.52 0.23 0.13 -0.11	** 0.37 0.12 0.26	
Performance	LO + Leadership ExpInIndustry	0.37 0.13 -0.08	* 0.34 0.07	

** @ p<=0.001, * @ p<=0.05

Observation

Model suggesting bi-directional interaction between LO and EO to create self sustaining cycle with good model fitting overall. However, individual relationships may not be qualified as significant.

C) Alternate Model Two – Parameters Achieved For Supporting Self Sustaining Inbound Open Innovation Cycle with 3H Element

Dependent Variable	Predicting Elements in Model	Weighting	Significance (P – value)	Fitting Model Parameters
Strategy (Entrepreneurial Orientation)	Innovativeness + Inbound OI Level + Leadership	0.10 0.18 0.10	0.28 0.13 0.22	X(2) : 17.6 (p = 0.41) RMSEA : 0.019 SRMR : 0.048 GFI : 0.999 CFI : 0.997 TLI : 0.993 NNFI : 0.993 NFI : 0.923 IFI : 0.997 RNI : 0.997 MFI : 0.997
Leadership (Transformational Leadership)	EO + Innovativeness + Optimism + Inbound OI Level + Insecurity	-0.14 0.27 0.16 0.38 -0.15	0.80 0.051 0.09 0.06 0.16	
Execution (Learning Orientation)	Leadership + EO + Innovativeness + Insecurity	0.51 0.37 0.10 -0.12	** * 0.15 0.20	
Performance	LO + ExplnIndustry	0.45 -0.08	** 0.06	

** @ p<=0.001, * @ p<=0.05

Observation

Model suggesting bi-directional interaction between Leadership and EO to create self sustaining cycle with good model fitting overall. However, individual relationships may not be qualified as significant

Question One - Original

Is it possible to enhance evolutionary economics observation about innovation?

Quote One : “So “Neo-Schumpeterian have not on the whole succeeded in developing a behavioral theory relating firm strategy to routines and rules of thumb because business studies theorists and economists have remained too far apart.” (Page 486 Freeman, C., 1994)[513]”

Quote Two : “Open Innovation companies needed to figure out what necessary missing pieces should be internally supplied and how to integrate both internal and external pieces together into systems and architectures. Business model can be leverage as a useful framework to link these technical decisions to economic outcomes.” (Page 63 Chesbrough, H. 2003)[57]

Quote Three : Technological advance needs to be understood as an evolutionary process and evolutionary view of firm is organizational behavior stresses rationality. Evolutionary economics has open frontiers to work with other disciplines such as social science. (Page 42 Nelson, R.R. and Winter, S.G., 2002)[289] However, rationality is not true for all human behavior so there is possibility to enhance evolutionary economic model

Finally, learning orientation is innovative and experimental in nature so it should also be closely related to feeling secure and comfortable towards open innovation – Wang 2008