

How did Sony envisage a market for its Walkman, or more recently, what enabled RIM, a leading high-tech Canadian company, to define a market for its two-way wireless handheld, Blackberry? Competitive market pressures together with the rapid pace of technological development to make innovation increasingly important in firms' overall strategies. With shortening product life cycles, breakthrough products are becoming an essential source of revenue. Forward-looking companies are combining technologies and trends to create the products of tomorrow.

新力 (SONY) 當年怎樣能洞悉先機，預測到龐大的隨身聽 (Walkman) 市場，或是較近期，RIM(一間先進的加拿大高新科技公司)憑甚麼能以 Blackberry 為名的產品開創雙向無線手持式設備市場？市場的競爭壓力加上突飛猛進的科技發展，促使「創新」日益成為各公司策略中的重要元素。隨著產品的壽命周期日趨短暫，富突破性的產品，便成為了業務收益的主要來源。

眼光遠大的公司，懂得將科技和市場趨勢合二為一，為明天締造廣受歡迎的產品。

撰寫此書，旨在向總經理和產品設計專才，推介一套開發突破性產品的新方法。提及的詳盡步驟是嶄新而實用的，當中兼及各種互動的變數，諸如瞬息萬變的市場結構，顧客所需的學習和行為轉變，科技的演進，基礎設施的擴展，新競爭者的加入和政府規例的改革等等。

This book is targeted for general managers and product design specialists. It offers a new methodology for developing breakthrough products. The approach is novel yet practical and offers a comprehensive methodology to include dynamic factors such as changing market structures, requisite customer learning and behaviour changes, the evolution of technology, growth of an infrastructure, entry of competitors, and changes in government regulations.

創造脫穎而出的突破性產品

漢密·羅理, 曾慶才

Developing Breakthrough Products That Break Through

Hamid Noori, Albert H. C. Tsang

HKSAR Government Industrial Support Fund Project

"Developing Educational Materials to Encourage and Facilitate Hong Kong Manufacturers for Quality Transformation." (ISF Project no. AF/3/98)

香港特別行政區政府工業支援資助計劃

"開發優質教材以推動香港製造業的優質變革" (編號 AF/3/98)

ISBN 962-442-196-X



9 789624 421965

優質變革系列

Quality Transformation Series
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First published 2001
2001 年初版

ISBN 國際統一書號 962-442-196-X

Developing Breakthrough Products That Break Through

(創造脫穎而出的突破性產品)

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Published by

City University of Hong Kong
Department of Manufacturing Engineering and Engineering Management

Funded by

HKSAR Government, Industrial Support Fund Project no AF/3/98

Designed and printed by

Media Production Unit, City University of Hong Kong

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Foreword

隨著顧客的需求日趨多元化及產品信息的傳播速度增快，全球各地市場的競爭情況變得更加激烈。面對這種挑戰，企業經營者皆努力不懈，去發掘世界市場上的致勝之道。突破性產品正是設計師、製造商及行銷者所追求的目標。

顧客希望從市場上獲得的價值可用五個英文字母來概括：T (Technology) 科技、Q (Quality) 品質、R (Responsiveness) 敏捷的反應、D (Delivery) 付貨表現及C (Cost) 成本。很明顯，一個供應商如果不能在有利可圖的情況下，以顧客所能接受的價格如期交付優質貨品，它將無法在市場上長期生存。

餘下的兩個因素，即科技與敏捷的反應，對企業能否在環球市場內獲得競爭優勢，其重要性與日俱增。衡量科技與敏捷反應的兩個重要指標就是創新和時間的掌握。

創新無疑是所有企業獲取持久活力的要素。創新的範圍並不局限於新產品，它亦可包括新的服務及新的營商方法。在商務上，任何方面的創新皆會對既有的市場均勢帶來極大的沖擊，其效應能誘使消費者改變他們的選擇，令競爭對手處於被動狀態。

創新必須與時間互相配合才可以成功，創新的本質就是變革，而後者的成敗乃取決於實施的速度及其是否切合時宜。若採取行動的時間不恰當，會令應當大有可為的創新意念得不到預期效果。另一方面，我們又必須快捷地推出具突破性的產品。

書中介紹的突破性產品的開發方法，對那些正計劃從原件製造 (OEM) 轉形為原創設計製造 (ODM) 的經營者尤其有用。謹此誠意向各位推薦這本饒有意義的書。

序言
盧偉國博士
粵港科技產業促進會會長

The global market has become increasingly competitive with diversified customer demand and rapid flow of product information. Enterprises are trying to identify new weapons to win in the global market. Designers, manufacturers and marketers are searching for breakthrough products.

The values that customers look for in the market can be summarized in five letters: T (Technology), Q (Quality), R (Responsiveness), D (Delivery) and C (Cost). One could hardly imagine a supplier would stay long in the market if he could not deliver quality goods on time at a price acceptable to the customer while remain profitable. A lot has been discussed in the management world regarding quality, delivery and cost. These three factors have become necessary conditions for survival in the market. However, by themselves, they are no longer sufficient.

The remaining two factors, i.e., T and R — technology and responsiveness, are becoming more important as success factors for companies to compete in the global market. Two important measurements of technology and responsiveness are Innovation and Time.

Innovation is indeed the key to long-term vitality of all enterprises. Innovation does not just mean new products but also new services and new ways of doing business. Innovation along any business dimension can dramatically upset competitive balance by enticing consumers to change their choices and by putting competitors on the defensive.

Time is crucial to the success of an innovation. Innovation involves change, and change is measured by time. Untimely execution impairs successful innovation. We need breakthrough products as quickly as we can.

This book offers a practical methodology for developing breakthrough products. It is particularly useful for businesses wishing to make the transition from original equipment manufacture (OEM) to original design manufacture (ODM). I sincerely recommend it to you.

Dr. W.K. Lo
President,
Guangdong-Hong Kong Association for the Promotion of Technology Enterprise

Foreword by the series editor

系列主編序言

優質變革系列

不斷增加的競爭壓力、動蕩不定的商業環境、持續變化的市場需求和日益提高的質量要求使得全球製造業的營運更為複雜。這些壓力迫使製造商集中精力制定可行的策略和戰術以獲得和保持競爭力。香港正在經歷由低成本組裝轉到高附加值製造的重要轉型期。為了成功轉型，香港製造商必須比它們的競爭者更快及更便宜地提供更高質量的產品。實施有效的質量策略和管理是成功的一個關鍵因素。

“優質變革系列”是在香港特別行政區政府工業支援基金支持下所制作的質量推廣和教育材料，其中包括：與質量有關的小冊子、錄像和其他媒體。它的目標是使公司主管明白推行質量提升的重要；介紹現代質量改進工具、模式和方法給香港製造商；和提供香港的最佳質量管理實踐的案例。

隨着這個系列的發行，我們希望能夠鼓勵和促進香港製造商進行優質變革。

錢桂生博士
系列主編

Quality Transformation Series

Global manufacturing competitiveness has been complicated with the accelerating pressures of industrial transformation, dynamic trading conditions, ever-changing market demands and uplifting quality requirements. These pressures have sharpened the industry's focus on developing viable strategies and tactics in gaining and retaining their competitiveness. Hong Kong is now undergoing a critical transformation from low-cost assembly to high-value-added manufacturing. For a successful transformation, Hong Kong manufacturers must provide better quality products faster and cheaper than those of their competitors. Adoption of effective quality strategies and practices is one of the crucial factors for success.

This "Quality Transformation Series" is supported by the HKSAR Government Industrial Support Fund to develop promotional and educational materials, such as booklets, video and other multi-media in quality topics. It aims to make the company executives more aware of their crucial role in leading successful quality transformation in their companies; to introduce modern quality improvement tools and methodologies to Hong Kong manufacturers, and to provide examples of best quality management practices in the Hong Kong environment.

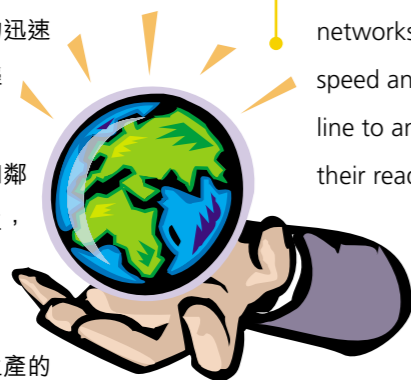
With the launch of this series, we hope to encourage and facilitate Hong Kong manufacturers in making the quality transformation.

Dr. K S Chin
Series Editor

Prologue

引子

香港已發展成為亞太區內的製造業控制中心。過去二十年，香港製造業享有驕人的增長，箇中原因是，港資企業已蛻變為管理環球生產網絡的專家。這些企業的競爭優勢，乃來自其對轉換生產線製品的迅速靈活反應，以滿足瞬息萬變的市場需求。此外，在中國大陸和鄰近國家僱用廉價勞工，亦為其中一大優點。



靈活的生產，跨域生產的協調技巧，長駐境外工廠工作的優秀管理人才及其國際視野，在在皆是香港製造業過往的成功因素[1]。因此，港資製造商大都以原件製造 (OEM) 或外加工商形式，為其業務夥伴生產一些成熟及廣受歡迎的產品。根據香港貿易發展局1997年公佈的數字顯示，估計約佔七成本地出口，均來自以特許或合約形式，為海外製造商生產的業務。

Hong Kong has developed itself into a manufacturing control centre in the Asia Pacific region. Its manufacturing sector has enjoyed enviable growth in the past two decades as Hong Kong-based enterprises transformed themselves into experts at managing globalised production networks. The competitive advantage of these firms has been in the speed and agility with which they were able to shift from one product line to another in response to rapid changes in the market, as well as their ready access to low-cost labour in Mainland China and in neighbouring countries.

Flexibility in production, skills in coordinating production among various sites, managerial talents of expatriate managers posted in plants outside Hong Kong, and internationalism have been identified as some of the key factors of past achievements for Hong Kong's manufacturing industry [1]. Thus, in most cases, Hong Kong manufacturers have been involved in making mature, market-tested products via original equipment manufactures (OEMs) or subcontracting relationships with business partners. According to the Hong Kong Trade Development Council, in 1997 an estimated 70% of domestic exports were derived from licensing and contract manufacturing for overseas manufacturers.

Today, it is realised that this success cannot be sustained if Hong Kong enterprises continue to engage in labour-intensive, low technology mass manufacturing; this strategy can be easily replicated by competitors in developing countries. To ensure continued prosperity, the manufacturing industry has to develop the ability to focus more on high value-added activities such as product design.

The transition from OEM to ODM (original design manufacture), however, is difficult, as it requires skills in design and testing, knowledge of international standards, and marketing [1]. While the ability to produce products determines the success of OEMs, the aptitude to create the right products is the key to success of ODMs. These high performing enterprises are adept at creating breakthrough products that will become order winners tomorrow. They are less enthusiastic in emphasising the production of standard goods that require less skill and can be done almost anywhere. The rewards of developing breakthrough products are huge, as are the risks. The search for an effective methodology that will enhance the hit rate of these high-risk endeavours becomes an issue of great importance to ODMs. This is the theme this book strives to accomplish.

時至今日，若香港的企業選繼續停留於人力密集和低技術的大量生產模式，上述的優勢實在很難以維持，因這策略很易被發展中國家的競爭對手所仿效。為了確保有持續的前景，製造業應集中較多精力發展高增值的項目，如產品設計。

但是，由原件製造 (OEM) 轉形為原創設計製造 (ODM) 是很困難的，因為需要懂得設計和測試的技巧，對國際標準有認識和掌握市場脈搏[1]。OEM業務的成功要素是擁有所需的生產能力，可是ODM業務的成功卻端賴於製造迎合需要的產品之能力，這些企業典範皆是創造廣受市場歡迎的突破性產品之能手。它們不會著重生產一些只需低技術及隨處皆可生產的標準產品。開發突破性產品能帶來豐厚的回報，但是風險也極高，因此尋求一套有效的方法以提升這種高風險項目的成功率便成為當務之急。這亦是寫此書的主旨。

摩托羅拉 (Motorola) 於1983年推出全球首部商品化的流動電話，它透過配套的通訊基礎設施，令使用者能與任何接觸到一台電話的其他人士互相通話。這種改變了世人通訊方式的突破性產品，已成為摩托羅拉業務中利潤豐厚的一環。可是該公司共花了十多年時間和一億五千萬美元方才完成其開發工作。究竟可有良方以縮短該產品的開發時間，降低其投資成本和提高它在市場上的成功機會？

負責新產品開發工作的行政人員，時刻要面對的挑戰是管理變幻莫測及難以捉摸的產品和市場。他們的目的是在適當時機推出合適的產品。但是怎樣才可以確定和符合這些產品所需的開發條件？

就突破性 (在市場上獨一無二的) 產品而言，其夭折率無疑是十分令人關注的問題。但是其回報也頗為可觀。市場的競爭壓力加上突飛猛進的科技發展，促使「創新」日益成為各公司策略中的重要元素。從研究所得，突破性產品皆有潛質成為一間公司最成功及收益最高的產品 (服務)。1989至1993年間，做了一個突破性產品對新產品盈利的統計，當中發現新

Introduction

簡介

In 1983, Motorola introduced the world to the first publicly available cellular telephone, supported by a communications infrastructure that allowed users the wireless capacity to stay in touch with anyone who had access to a telephone. The introduction of that “breakthrough” product came after more than a decade of development and a cost of US\$150 million. This product has changed the way the world communicates and has grown into a highly profitable part of the Motorola business. Nevertheless, are there things that could have been done to alleviate the financial costs and/or reduce the development time, while increasing the certainty of the success of the product?

New product development executives face the challenge of managing product and market uncertainty and ambiguity every day. Their goal is to introduce the right product at the right time. But how are these product development conditions determined and met successfully?



In the case of breakthrough products - those unique to the market - failure rates can be expected to be particularly problematic. The rewards, however, are significant. Competitive market pressures together with the rapid pace of technological development make innovation increasingly important in firms' overall strategies. Studies have shown that breakthrough products have potential to be the most successful products (services) a company can launch and may provide the highest returns. During the 1989-1993 periods, breakthrough products accounted for 10% of new product introductions but generated 24% of the profits from new products. With shortening product life cycles, breakthrough products are becoming an essential source of revenue. Furthermore, the development of breakthrough products is a strategically essential step in meeting the challenges of global competition and leadership in the marketplace. Forward-looking companies are combining technologies and trends to create the products of tomorrow.

Consider the impact the development of breakthrough products has had on the following firms: Motorola (cellular phones), Sony (consumer electronics), and Corning (fibre optics). Each of these firms' ability to understand the future of their markets and the applications of the products they were developing helped them redefine and create markets. What drove this knowledge? According to recent research it was a “probe and learn” process in which early versions of the product were introduced or tested, information was gathered and the next iteration was developed. This, however, can be a very long and expensive process. Are there other approaches that would allow firms to accelerate their learning to develop the “right” breakthrough products in a more expeditious manner?



推出的產品中只有10%具突破性，可是它們所賺取的利潤卻佔所有新產品總利潤的24%。隨著產品的壽命周期日趨短暫，富突破性的產品便漸漸成為業務收益的主要來源。再者，在面向環球化競爭和奠定市場領導地位的大前提下，開發突破性產品乃相應的策略部署中的不二法門。眼光遠大的公司，懂得將科技和市場趨勢合二為一，為明天締造廣受歡迎的產品。

想一想開發突破性產品對以下各公司的深遠影響：摩托羅拉 (流動電話)，新力 (電子消費品) 和康寧 (光纖技術)。以上每一間公司都具備瞭解未來市場和應用自行開發產品的能力，以重整市場規律或開創新市場。究竟如何孕育這種智能？根據近年的研究所得，「探索和學習」過程便是其中竅門。這便是將產品以試探形式引入市場，並收集資料以對其設計在下一版本中作出改良。但這是漫長而昂貴的過程，是否有其他方法能將所需的學習時間縮短，令開發合適的突破性產品之工作得以早日完成？

What Makes

「突破性產品」如何突圍而出？

Breakthrough Products

新力當年怎樣能洞悉先機，預測到龐大的隨身聽 (Walkman) 市場，或是較近期，RIM (一間先進的加拿大高新科技公司) 憑甚麼為其以Blackberry命名的產品開創雙向無線手持式設備市場？

設計與創新對反應敏捷的公司在防止客戶流失、提高顧客忠誠度及最終令業務蒸蒸日上各方面有極顯著的作用。請參閱圖一。

How did Sony carve out a market for its Walkman, or more recently, what enabled RIM, a leading high-tech Canadian company, to define a market for its two-way wireless handheld, Blackberry?

Design and Innovation play an important role in enhancing customer retention and loyalty, and ultimately in the success of fast response companies – see Figure 1. Excellent design will create a better image, better cost performance, better time-to-market, and better quality and service.

設計與創新對反應敏捷的公司在防止客戶流失、提高顧客忠誠度及最終令業務蒸蒸日上方面有極顯著的作用。優良的設計能塑造出一個較美好的形象，達致較高的成本效益，縮短推出市場所需時間及提升質量與服務水平。舉例：RIM無線手持式設備能傳送或接收電郵。它那精心設計的鍵盤，旋鈕，清晰明亮的顯示屏及直接又友善的菜單介面，使編寫及翻查資料變得輕而易舉。

Design and Innovation play an important role in enhancing customer retention and customer loyalty, and ultimately in the success of fast response companies. Excellent design will create better image, better cost performance, better time-to-market, and better quality and service. For example, RIM Wireless Handhelds™ allow the users to send and receive wireless email. Creating and retrieving information is amazingly simple using the optimised keyboard, thumb-operated trackwheel, easy-to-read backlit screen and intuitive menu-driven interface.



圖一 開發突破性產品以鞏固與客戶的關係

Fig.1 Developing Breakthrough Products as a Means to Enhance Customer Retention

優良的設計能塑造出一個較美好的形象，達致較高的成本效益，縮短推出市場所需時間及提升質量與服務水平。

在競爭激烈的市場上推出一種新產品 (或服務) 是一件極富策略性的工作，因為它對一

Introduction of a new product (and service) into a competitive marketplace is a highly strategic task whose execution has a great impact on the firm's success and survival. Companies that have successfully integrated different design activities into a robust and comprehensive process benefit enormously in a variety of ways as indicated in Figure 2.

Break Through?

Accordingly, successful development and introduction of new products in today's competitive marketplace is one of the key issues faced by a firm. However, development of merely *new* or *improved* products/services is no longer sufficient for ensuring firm survival. Innovation must assume an increasingly important role in a firm's overall strategy.

Development Time	30-60% Less
Engineering Changes	65-95% Reduced
Scrap and Rework	75% Reduced
Defects	30-85% Fewer
Time to Market	20-90% Less
Field Failure Rate	60% Less
Service Life	100% Increased
Cost of Quality @99% Defect Free	60% Reduced
Overall Quality	100-600% Higher
White-Collar Productivity	20-110% Higher
Return on Assets	20-120% Higher

Fig.2 Results of Integrated Product Development Application (From Japanese and North American Companies)

While one can find different definitions for breakthrough products (BTPs), in this book we define BTPs as those which are 'really new' to the market and contain some or all of the following attributes:

- Involve notable changes to existing products and processes
- Are used to establish new core products or define a new market
- Can incorporate revolutionary new technologies or materials
- Offer unique customer benefits
- Result in higher initial exposure to financial risk
- Are tied to emerging customer trends
- Require customer learning
- Cause changes in customer behaviour

間公司的成功與存活有著深遠的影響。將各種設計活動成功地融合為一個穩健而全面的過程，可為公司帶來多方面豐厚的成果。請參閱圖二。

縮短開發時間	30-60%
減少工程改動項目	65-95%
減少廢料及翻工	75%
減少次品	30-85%
縮短上市所需時間	20-90%
降低失效率	60%
延長使用期	100%
降低99%無次品率之品質成本	60%
提升整體質量水平	100-600%
提升白領生產力	20-110%
提升資產回報率	20-120%

圖二 採用綜合產品開發過程的成果 (數據來自日本及北美公司)

顯而易見，在當今高度競爭的市場上，成功開發及推出新產品是企業管理的重要課題之一。可是，開發缺乏創意或僅屬改良版本的新產品或服務不再能夠長期保證一間公司得以存活。創新就成為了公司整體策略中日益重要的部份。

突破性產品的定義眾說紛紜，而書中所採用的定義，乃是那些在市場上別具創意並擁有部份或全部下列特點的產品：

- 需要顯著地改變既有產品及程序
- 用以建立新的核心產品系列或開創新的市場

- 應用嶄新科技或材料
- 為顧客提供獨特的利益
- 導至前期的經濟風險提高
- 緊貼顧客的新趨向
- 需要顧客學習新事物
- 促使顧客作出行為上的改變

突破性產品比傳統產品要承擔較高風險，因為當中涉及很多不明朗因素，比如產品的本質、公司是否有足夠能力有效益及有效率地生產這產品、市場接受程度及最終對公司盈利的貢獻。突破性產品不會對社會產生即時的沖擊，但假以時日，它們會令使用者大大改變其活動方式，從而發揮廣泛的影響力。新力的隨身聽、北方電訊 (Nortel) 的 Vista 350 和 3M 的告示貼都是突破性產品的好例子。請參閱圖三。

突破性產品 (如右圖所示北方電訊 Vista 350 電腦及無線電傳送集成設備) 有如下特色：開拓或擴展一種新的產品類別，或觸發跨類別競爭 (個人電腦對比電腦主機)；在客戶眼中，它是新生事物 (錄像機)；用戶必須學習新事物 (互聯網)，公司亦要重新安排銷售網及重組組織架構；開創條件以孕育新建構及附件產品 (多媒體產品/軟件及個人電腦)。

BTPs (like Nortel Vista 350 Computer Telephony Integration (CTI) solution shown in this picture) are those which: create or expand a new category and/or create cross-category competition (personal computer vs. mainframes); are new to customers (VCRs); often require substantial customer learning (Internet), raise issues related to channels of distribution and organisational responsibility; and create the potential for new infrastructure and add-ons (multimedia products/software and personal computers).



圖三 突破性產品的特色
Fig.3 Characteristics of Breakthrough Products

當新產品是從現有產品演變出來，或其目標市場及需求早已被確定，將它推出市場是一件較輕而易舉的事。在這情況下，公司已經擁有或已有能力發展製造該產品所需的專門技能。同時，容易蒐集得來的初集資料 (primary data) 與次級資料 (secondary data)

A BTP is associated with greater risk than less innovative products because it involves more uncertainty in terms of the nature of the product itself, the organisation's capacity to effectively and efficiently produce the product, market acceptance, and ultimately, profitability. BTPs do not have an instantaneous impact on society, but over time they drastically change user activities and are widely influential. The invention of Sony's Walkman, Nortel's Vista 350, and 3M's Post-it are examples of BTPs – see also Figure 3.

The task of introducing a new product into the market is relatively easy when the product is a variant, an extension of an existing product, or when the market segment and its needs have been identified. In this case, the firm either has or is able to develop the necessary expertise relevant to the product. The availability of primary and secondary data sources also helps in designing a strategy for the successful launch of such new products.

However, the task becomes much more complex when the concerned product (or service), in addition to being new, is also a breakthrough. Resulting from an altogether new concept, the product meets not only the existing needs, but also could address needs that have not been identified or articulated as yet. The launching of BTPs runs into the problem of an undefined market. And the existing techniques of

collection and processing of primary and secondary data are not of much help in working out a successful strategy for introduction of BTPs.

The innovativeness that distinguishes BTPs also makes their corresponding product/service markets particularly difficult to forecast or estimate. Traditional tools of market research, both quantitative and qualitative, fail to take into consideration a number of factors. Consumers are generally not aware of the needs that revolutionary products will meet. Or, products may have applications beyond those initially envisioned. Substantial customer taming is often a pre-requisite for the use of these products. Alternatively, product success may depend on the infrastructure that is in place. BTPs require a forecast method that will account for the voice of the customer, technological changes, information diffusion, price issues, infrastructure support, as well as potential competition.

This book proposes an approach to address the issues related to development and introduction of BTPs. After an initial discussion on the limitations of existing techniques in dealing with BTPs, we will explain the concept of the proposed Umbrella Methodology. We will detail this framework and describe its structural characteristics, explaining how the proposed approach deals with different aspects of BTPs. Some practical measures that must be taken for implementation of this methodology will also be highlighted at the end.

有助於制訂一套策略，以成功地把這種新產品推出市場。

相比之下，開發突破性的新產品/服務是極為複雜的工作。因為這種產品的構思是嶄新的，它不但能迎合既有的需求，也能滿足鮮為人知及尚未清楚說明的需要。推出突破性產品時，要面對有關尚未成形市場的問題。那些常用於收集和處理初集資料及次級資料的技巧，對制訂一套將突破性產品成功地上市的計劃，作用不大。

基於其始創本質，預測突破性產品/服務的市場尤其困難。傳統的定量及定性市場調查工具皆未能考慮到多種因素，比如用戶對該產品所能滿足的需要大多一無所知。又比如別具創意的產品其用途或會超越起初構想的應用範圍。向用戶多加誘導通常是促使人們使用這種產品的先決條件。在其他情況下，這種新產品的成功端賴既已存在的相關基礎設施。突破性產品所需的市場預測方法，必須考慮的因素包括顧客的心聲、科技的變革、信息的擴散、價格、基礎設施的支援及潛在的競爭對手。

本書將會提出一套「綜合法」以應付那些關於開發及推出突破性產品的問題。首先，對於現時應用在突破性產品上的常用技巧的缺點會有所討論，隨後將會說明「綜合法」的概念。筆者將會詳述「綜合法」的架構及其結構性特徵，並說明如何使用這方式以處理各種突破性產品的事宜。最後，在實踐過程中必須採取的相應行動，書中亦進行了探討。

umbrella methodology

Problems Associated with Forecasting Market Acceptance for BTPs

預測突破性產品的市場接受程度並非易事

有很多定性 (比如購買意欲調查、市場模擬、專題小組座談[focus group]、特爾菲[Delphi]法則、具名小組討論程序[nominal group process]等) 和定量 (比如時間數列分析、多元線性迴歸法、推理單位模型[logit model]、揉合分析法[conjoint analysis]等) 技巧已被引用於產品投入市場前的預測。可是，這些工具都並不適用於突破性產品。

突破性產品與那些從現有產品演變或延伸出來的新產品兩者之間的主要分野在於前者並無前車可鑑。由於沒有相似的產品和服務作先

A number of techniques, both qualitative (e.g., purchase intention surveys, simulated test markets, focus groups, Delphi method, nominal group process, etc.) and quantitative (e.g., time series analysis, multiple linear regression, logit models, conjoint analysis, etc.) have been used for pre-market forecasting for new products. However, BTPs, by definition, are different and hence, these techniques cannot be effectively applied.

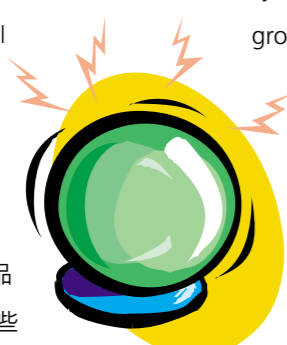
Unlike those new products which are generally variants or extensions of existing products, BTPs do not have any predecessor. Absence of historical data on similar products and services, in the case of BTPs, inhibits the application of *quantitative* forecasting techniques. The use of conventional *qualitative* forecasting techniques may not yield satisfactory results either because these tools make substantial use of

customer input. Customers, however, are neither aware of the attributes of BTPs, nor are they familiar with the future environment in which those BTPs will be introduced. In fact, it has been argued that customers' familiarity and experience with existing products and services adversely affect their ability to conceive of BTPs, which offer an entirely new set of benefits and potential uses and address needs that are unarticulated as yet.

To make the forecasting methods more amenable to BTPs, innovative methods for capturing the customer's voice and purchase intentions have been developed recently. *Information Acceleration* methodology and drawing on *Lead Users* representing customer's voice are examples of these innovative methods (see [6] for a complete discussion on these techniques). However, as shown in Figure 4, these improvements only

驅，因此以往績為依據的定量分析法便不能應用於突破性產品上。另一方面，傳統的定性分析法也許亦不能產生令人滿意的結果，因為這些程序極度依賴顧客提供的信號，可是顧客卻並不認識突破性產品的特色，同時也不容易想象到這些產品上市時的環境。突破性產品能為用戶提供一整套全新的利益和應用範圍，並可滿足尚未清楚說明的要求。但是顧客的認知和經驗都局限於現有的產品上，因而產生的慣性思維大大降低了他們領悟突破性產品優點的能力。

近年已發展出一些較適用於突破性產品的創新方法以蒐集用戶心聲和購買意欲。信息加



速法 (Information Acceleration) 及透過先進用戶 (Lead Users) 以瞭解用戶心聲便是這些新方法的好例子 (參考文獻 [6] 對這些方法有詳盡的討論)。但是正如圖四所顯示，這些改進只能處理部份有關預測突破性產品被市場接受程度的問題。

該圖顯示這些嶄新方法在分析過程中大多不能夠揉合動態因素，如市場結構改變、顧客所需的學習及行為改變、科技的演進、基礎設施的成長、新加入戰圈的競爭對手及政府條例的變革等。由於突破性產品的本質特殊，在發展有效的預測方法時，必須小心考慮以上提及的實際問題。書中建議的「綜合法」正可彌補現存技巧在這方面不足之處。

「綜合法」提供了一套全面的程序，以運用從現存技巧或其他來源收集得來的資料，處理突破性產品的事宜。

partially address the problems associated with forecasting market acceptance for BTPs.

The Figure demonstrates that most of the proposed innovative forecasting techniques used are unable to accommodate dynamic factors such as changing market structures, requisite customer learning and behaviour changes, the evolution of technology, growth of an infrastructure, entry of competitors, changes in government regulations, etc. Given the inherent characteristics of BTPs, these factors are very important practical considerations and must be accounted for when developing any effective forecasting technique. In this context, we propose that our Umbrella Methodology (UM) goes beyond the limitations of existing techniques and deals with many of the unaddressed issues.

The proposed UM provides a more comprehensive approach to deal with BTPs. It draws upon information collected from various sources which include the existing methodologies.

		方法 Methodology	擴散模型 Diffusion Models	景象法 Visioning Techniques	先進用戶分析 Lead User Analysis	信息加速法 Information Acceleration	設身處地法 Empathetic Design	融入顧客 Customer Immersion
特性 Attribute								
市場 Market	予顧客新鮮感 New to Customers			★	★	★	★	
	與日漸成形的趨勢息息相關 Tied to Emerging Trends	✘		★	★	★	★	✘
	改變市場結構 Shift Market Structures			✘				
	需要顧客學習新事物 Require Customer Learning			✘		✘	✘	✘
	需用較長時間擴散 Longer Diffusion	★		✘				✘
產品 Product	不可預測的演變 Unpredictable Evolution			✘				
	獨立於現有產品/服務 Outside Product/Service Hierarchy	✘		★	★	★		
	主流設計尚未面世 Precede Dominant Design			✘				
	提供獨特利益 Offer Unique Benefits			★	✘	★	★	
技術 Technology	創造/改變基礎設施 Infrastructure Creation/Change			★		★		
	新技術 New Technologies	★		★		✘	★	
	新程序 New Processes	★		✘		✘		

★ 表示這方法明顯地能處理有關問題 Indicates the Methodology explicitly addresses this issue
✘ 表示這方法或能處理有關問題 Indicates the Methodology could potentially address this issue

圖四 現存方法應用於開發突破性產品時的比較
Fig.4 A Schematic Comparison of Existing Methodologies in BTPs Development

Umbrella Approach to BTPs Development

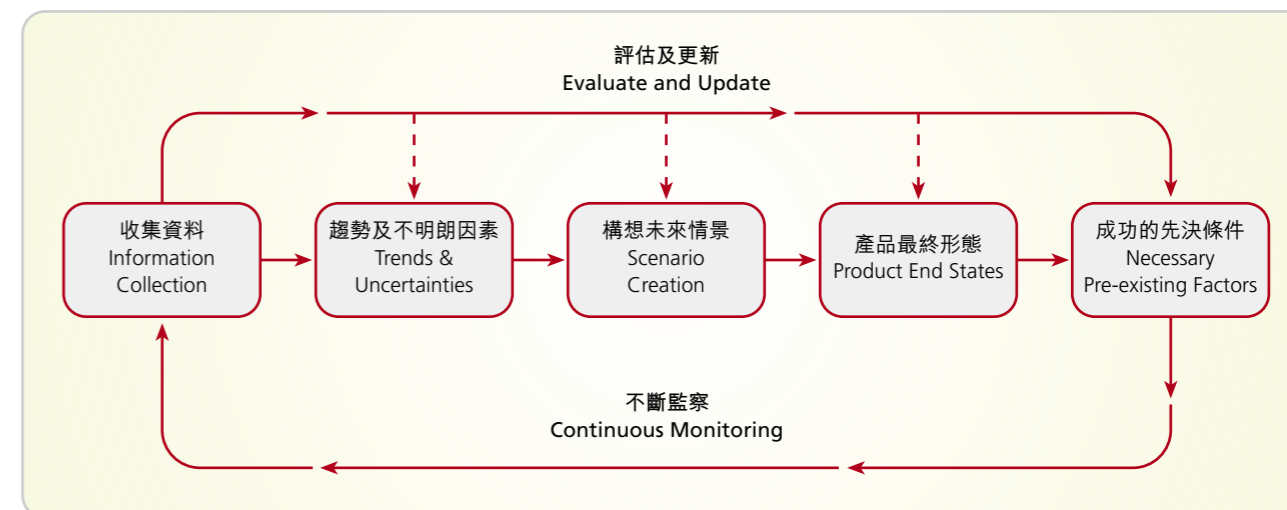
利用「綜合法」來開發突破性產品

As indicated, for complex BTPs, a number of their embedded capabilities may be unclear, misunderstood, or even unknown by customers at the time of purchase, leading to an appreciation of the products' latent capabilities some time in future. To address this issue, our proposed UM consists of four primary components:

- 1) Information collection — gathering information about competitors, industry, and the macro environment, which helps in conceptualising scenarios and uncertainties.
- 2) Scenario analysis — creating a series of potential futures (in order to limit the uncertainty), then working back and allowing them to impact how new products are developed.
- 3) Backcasting — determining the paths along which each future might evolve and relating them to the present.
- 4) Continuous Environmental Monitoring — discovering the future as it actually unfolds.



These individual yet interdependent steps together facilitate the forecasting process for BTPs. They cover the entire time period of BTPs development from idea conceptualisation to product introduction. It must be kept in mind that these steps do not form a linear process. Rather, the approach is iterative in nature and involves reevaluating and updating each component as and when new information becomes available. A map of the methodology is given in Figure 5 followed by a short description of the four steps.



圖五 「綜合法」的流程
Fig.5 Methodology Map

顧客在購買複雜的突破性產品時，對其潛能大多不甚明瞭、有所誤解或聞所未聞，故此需假以時日才可意識到其中的優點。可以有效地處理上述問題的「綜合法」有以下四個步驟：

- 1) 收集資料 — 收集有關競爭對手、業界甚至周遭環境的資料，可有助於構想情景和不明朗因素。
- 2) 情景分析 (Scenario Analysis) — 為了減低不明朗程度而構想一系列可能發生的未來情景，再從這些情景往後返思以判斷它們對開發新產品的影響。
- 3) 返回現狀 (Backcasting) — 找出達至每一種未來情景的演變路向，並與現況連貫起來。
- 4) 不斷監察周遭環境 — 在未來漸漸呈現眼前時已洞悉先機。

這四個互相影響的步驟有助於突破性產品的預測工作。當中考慮的範圍跨越由設計理念至推出市場的整個突破性產品開發過程。必須指出一點是這些步驟並非單純地組成一個直線的流程，而是每當收集到新資料時，整個程序會再度運行以重估及更新當中內容。整個程序如圖五所示，跟著是這四個步驟的簡短說明。

步驟一 — 收集資料：為界定及分析未來可能出現的各種情景 (Future Scenarios) 而需要蒐集的資料，包括業界的重要成員或相關的利益集團、標準作業模式等等。回顧相關市場的演進歷程亦有助於深入瞭解該業界的宏觀及微觀環境。當收集到足夠資料時，便可根據一系列的趨勢及不明朗因素而演繹出多種未來情景。以摩托羅拉的個案為例 (書中稍後將會提及)，在產品開發期間存在的多種因素，對產品的未來市場皆具有潛在的影響力。箇中影響未來趨勢或不明朗情況的主要因素如圖六所示。

Step 1 — Information Collection, Trends and Uncertainties: In order to define and analyse the future scenarios, information is collected about the industry (the key players or interest groups, standard practices, etc.) as well as the macro and microenvironments in which the industry operates. A review of the historical evolution of the relevant market can be helpful in getting important insights into the industry. Once sufficient information has been collected, a set of key trends and uncertainties is developed to define different scenarios. In the Motorola case example that we will present later, there were a number of factors at work during the development period that would have influenced the future market for the product. Some of these key influences and their role as a trend or uncertainty are outlined in Figure 6.

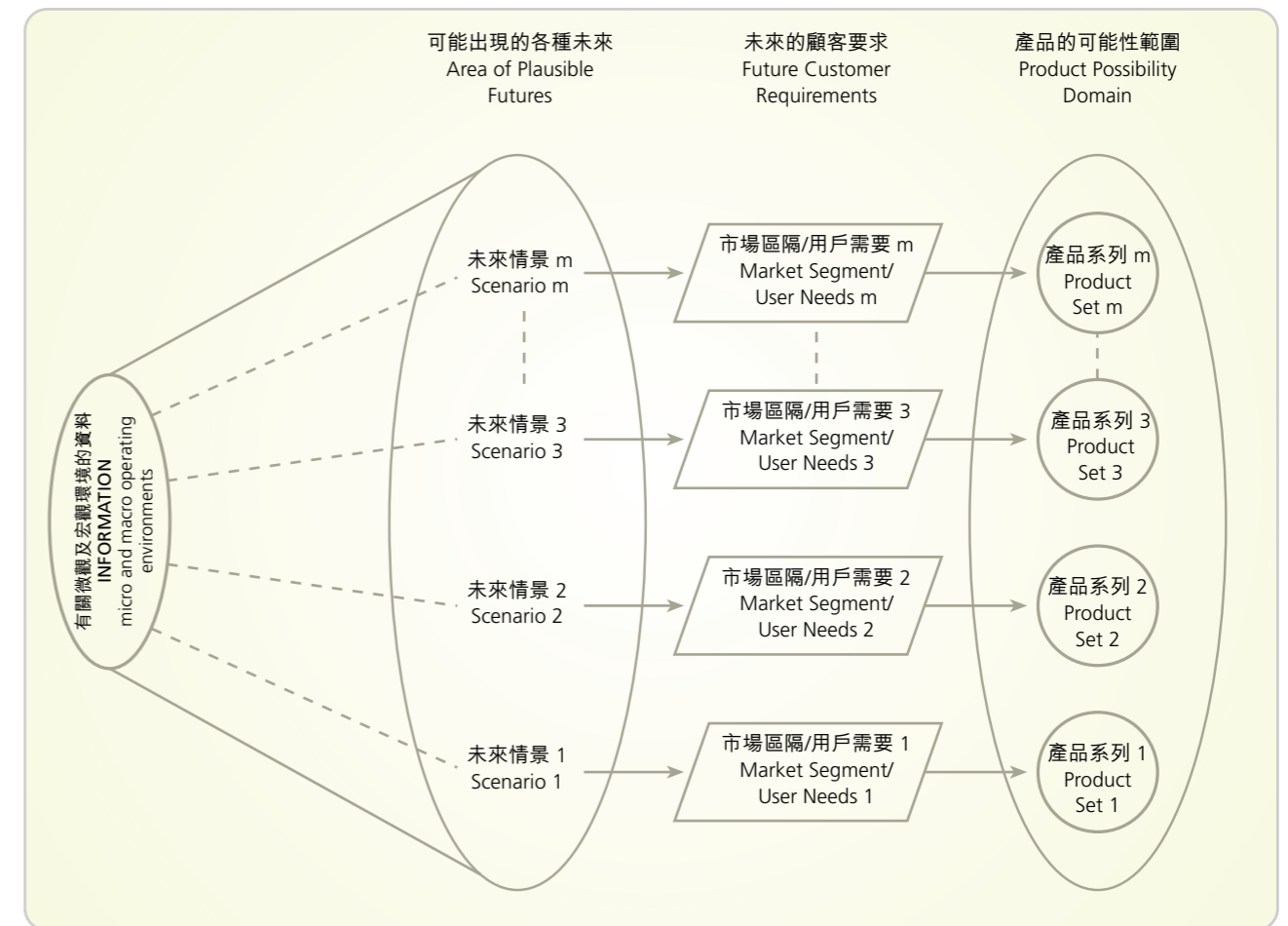
影響因素 Influence	趨勢 Trend	不明朗情況 Uncertainty
流動無線電話的供應正作高速增長，釀成無線電頻譜過度擠迫，引致客戶對既有的通訊服務水平有所不滿。 The demand for mobile radiotelephone service was growing rapidly. Overcrowding of the radio spectrum was leading to increased dissatisfaction with the existing service.	✓	
各種無線電通訊服務的分別漸趨模糊並開始互相重疊。 The boundaries between the different applications of radio communications service were blurring and beginning to overlap.	✓	
手持式設備 (雙向無線電通訊器和傳呼機) 的銷量會繼續超越流動配備，同時微形化電子技術會不斷有所進展。 Sales of portable products (two-way radios and pagers) would continue to exceed those of mobile units and microelectronics technology will continue to advance.		✓
開放形經濟漸成為主流，擴闊了環球化市場的範圍。 The trend toward more open economies was expanding access to global markets.		✓
聯邦通訊局 (FCC) 正為分配無線電頻譜於各種應用範圍 (電視、警務、的士、無線電通訊等) 而費煞思量。 The Federal Communications Commission (FCC) was struggling with alternative allocations of the radio spectrum for a number of competing uses (television, police, taxis, radio communication).	✓	
FCC 會否需用五年以上時間才可就無線電頻譜分配問題作出最終決定？ Will the FCC take longer than five years to finalise the allocation of the spectrum?		✓
無線電通訊業過往是以美國電報電話 (AT&T) 和摩托羅拉主導的雙頭壟斷市場，而維持其競爭格局日漸成為業界當務之急。 The market structure of the wireless communications industry was essentially a duopoly (AT&T and Motorola) and concern with preserving competition was growing.	✓	
FCC 會否就無線電頻譜分配問題作出最終決定，使業界有足夠頻道以提供各種形式的通訊服務？ Will the FCC finalise allocation of the radio spectrum amongst competing uses such that radio common carriers have sufficient access?		✓
流動及手提無線電話的滲透範圍會否超越現存的工商業市場？ Will the market for mobile and portable radiotelephones extend beyond the existing commercial and industrial markets?		✓
功能最多 (因而價錢亦較高) 的手提無線電話能否廣為顧客接受，從而帶來最豐厚的收益？ Will the cellular telephone with the most features possible (and therefore, a higher price) optimise customer adoption?		✓

圖六 摩托羅拉個案中的主要影響因素
Fig.6 Motorola Key Influences

Step 2 — Scenario Analysis: On the basis of these trends and uncertainties, we can conceive a number of plausible scenarios that may characterise the future of the industry relevant to BTPs. Scenario analysis involves imagining different worlds where, as a result of various sets of customer future requirements, alternative versions of the product will be successful. Here, product versions indicate product differentiation based on technical attributes and functionality. The process of scenario analysis enables the company to reduce uncertainty by describing possible and plausible outcomes. Each scenario will be characterised by a set of trends, from which the decision maker can develop future customer requirements and possible product sets enabling him/her to make better-informed decisions by accounting for a broader range of possibilities. Figure 7 illustrates the link between environmental information and the ultimate product introduction decision.



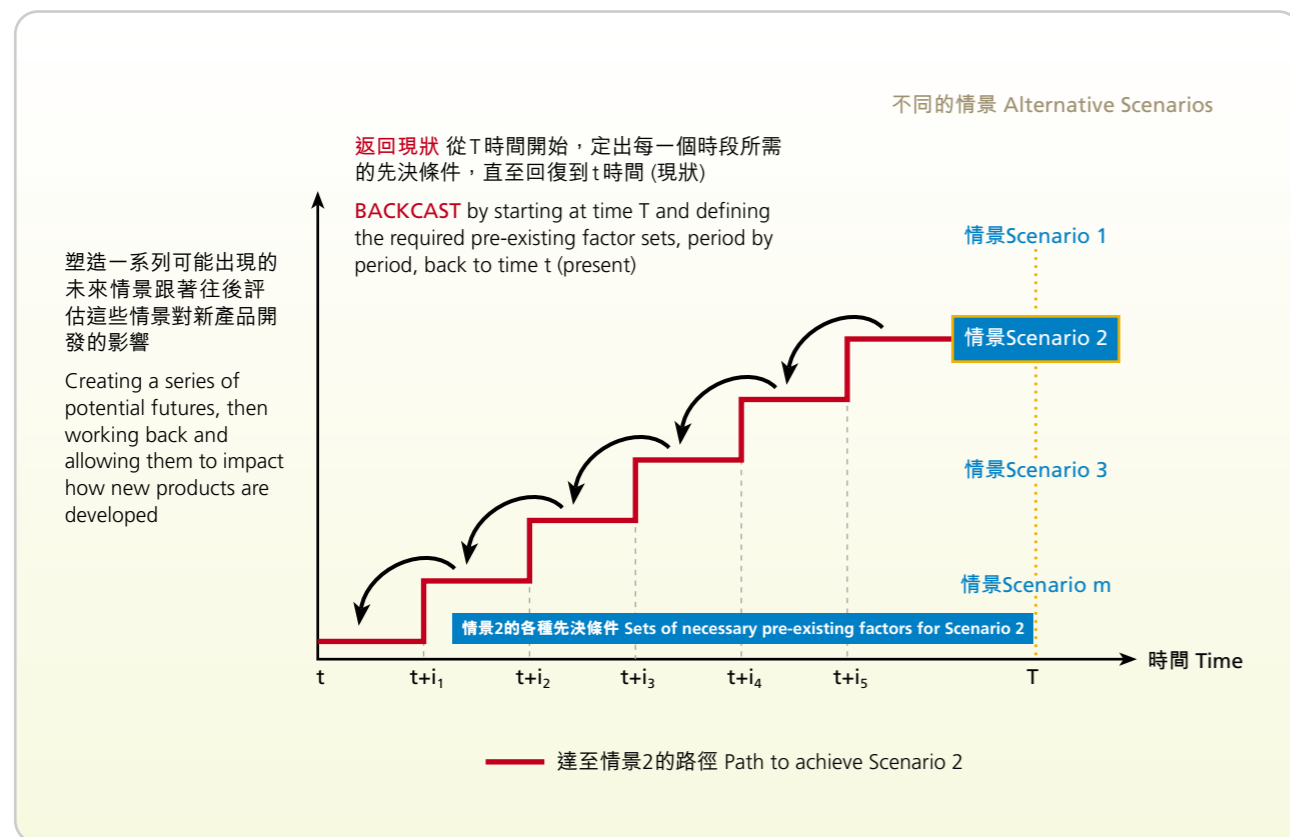
步驟二 — 分析未來情景：基於以上種種趨勢及不明朗因素，可以對與該突破性產品有關的產業前景作出多個推測。不同的未來境況各有其獨特的客戶未來要求組合，因而獲至成功的產品，其設計版本亦各異。設計版本所指的是構成產品各有差異的技術特性及功能。未來情景分析涉及將可能發生的情況加以陳述，以減低不明朗程度。每一個未來情景顯示一組趨勢，決策者可從而推斷出未來的客戶要求及迎合所需的產品系列。這過程要求對多種可能的情景加以考慮，務求作出明智的決定。環境資料與產品上市的最終決定之間的聯繫如圖七所示。



圖七 環境資料與產品上市決策的關係
Fig.7 Linkage Between Environmental Information and the Product Introduction Decision

步驟三 — 返回現狀：完成多種可能前景的構想及找出適應個別情景的產品後，跟著要做的工作便是找出途徑將現狀連貫至個別的前景，當中所指是令某種未來情景得以實現而必須採取的步驟和先決條件等。請參考圖八。這個過程起初乃用以制定能源政策，但近年其應用範圍已擴展至策略管理、競爭情報及新產品開發等等。這步驟並不是用來預計實現某種前景的機會率，而是用以作出部署，為實現某種未來而鋪路。故此每一條返回現狀的路徑，均以某種產品及令其成功的未來環境作為前提。

Step 3 — Backcasting: Once we have constructed a domain of different possible sets of product, each corresponding to a given scenario, the next step in the proposed method deals with backcasting. Backcasting defines a path between the present and a possible future, so as to determine what steps must be taken, or what events must be realised, in order for that future to take place – see Figure 8. From its original applications in energy policy, the backcasting technique has recently been used in the areas of strategic management, competitive intelligence, and new product development. The technique does not determine probability for future scenarios, rather it delivers a hypothetical sequence of events linking the possible future with the present. Therefore, the path is a function of the end product and the future world in which it is assessed to be successful.



圖八 「返回現狀」的模型
Fig.8 Visual Backcasting Model

Step 4 — Continuous monitoring of the environment: The success of backcasting analysis depends on conscientious continuous environmental monitoring. Signals emanating from customers, the general market, and the macro environment must be continuously monitored and the obtained information must be used to update and validate the scenario analyses. This enables firms to incorporate the latest information available into product development processes and to make decisions accordingly. The firm's ability to gather and rapidly respond to new knowledge about technical and market information as a project evolves would depend on availability of a flexible product development process.

Assumptions of the Proposed Method

The Umbrella Methodology is based on a number of explicit assumptions regarding the firm and its present and future operating environments.

First, each scenario represents a plausible and desirable future end-state. Plausibility refers to the firm's technological abilities and other conditions that must exist in order for that end-state to be realised. Being technically capable alone does not ensure that all other conditions have been met for the product to be successful. Other conditions include the existence of a necessary infrastructure to support the product, the regulatory environment that permits and/or encourages use of the product, and the development of social values consistent with market acceptance. Therefore, in defining end-states in the model, we assume that the firm has considered all conditions necessary to achieve plausible outcomes. Also, each end-state should be desirable, and represent a goal that the firm wishes to achieve, although each may be associated with different levels of desirability.

The second assumption concerns the 'stepping stones' between present and future states. Pathways that join each point in time must be plausible and internally consistent. Pathways largely depend on factors that are beyond the firm's control. This constraint must be taken into consideration

步驟四 — 不斷監察周遭環境：毫不間斷地監察周遭環境是「返回現狀」的步驟賴以成功的要素。源源不絕來自顧客、市場和周遭環境的信號經收集後，必須用以更新及驗證那些情景分析結果。公司可利用這些最新的資料來安排產品開發事宜及作出所需決策。隨著一個項目的展開，公司必須對收集得來有關技術及市場的信息作出迅速反應，而一個富彈性的產品開發程序正是獲取這種能力的條件。

「綜合法」的假設

「綜合法」是基於一些有關公司及其日後作業模式演化歷程的假設。

首先，每一種情景代表一種可能實現的理想最終景象。這裏所指的可能性乃根據為實現某一最終狀況而需擁有的技術和必須存在的其他因素而作出判斷。令產品得以成功，除技術外，還要配合其他因素。因此在定下模型內的各種最終狀況時，需要充分考慮多方面的條件以促使這些狀況得以實現。這些條件包括經已存在的產品配套設施、容許或鼓勵廣泛使用這種產品的管制法規及促進產品被市場接受的社會價值。同時，每一種最終景象都會是公司期望完成的目標。但是各種最終景象卻有不同的受歡迎程度。

第二項假設是關於那些將目前連貫至未來狀況的「踏腳石」。每條貫通某一時刻的路徑必須可行和並無自相矛盾的地方。當一間公司要定下路徑時，必須要瞭解影響這些路徑的因素，大多是不受公司控制的。此外，那些達至個別情景的先決條件，亦須在考慮的時間範圍內有實現的可能。

第三個假設是達至各種最終景象的情景，是由公司特有的能力和長處而作出推斷，絕非由一般性的技術展望作為根據。如此，種種推斷出來的情景乃是瞭解市場、公司和未來的結果[7]。

最後，這模型是由兩種技術所構成。第一種是基礎技術 (base technology)，即公司所選用的科技平台。第二種是互補性技術 (complementary technologies)。這些技術都是使別具特色的產品設計得以實踐的先決條件。在「綜合法」中，我們假定在開始 (t=0)時，公司已下定決心挑選了一種技術作為日後將會推出的產品/服務的平台。在那時選用的技術是否已經完全成熟並不重要¹。作出這種決定之前必須經過一些定量或定性分析以確定對公司而言，被選用的技術是切實可行和有利於未來的計劃。這些工具包括一種預測科技發展的方法，例如成長分析圖、趨向分析、分層分析程序 (AHP)，科技發展路向，或具名小組討論程序 (NGP)[3]。將基礎技術演化為構想中的結果，具備可持續的互補性技術至為重要²。這個模型會指示出在相應時段，這些互補性技術應已存在，以確保技術的演進可配合產品的開發。

「綜合法」是以資訊為本的方法，故此管理人員和員工們務必有效地收集、分析和應用新的資料方可成功。同時，擁有靈活性高的產品 (服務) 開發和引入市場程序也是關鍵之一。

¹ 微型處理器 (microprocessor) 開始被應用於個人電腦時，該種技術尚未完成其演化過程。事實上時至今日，微型處理器技術仍然不斷在演化中，使更多電晶體能放在晶片上以增加它的功率、記憶能力和功能。

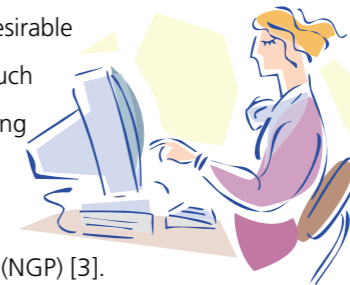
² 再以微型處理器為例，微型化和精準技術 (micron technology) 就是相關的互補性技術。

Product Development

when the firm is defining these pathways. Furthermore, delineated pre-existing conditions, necessary to reach a scenario, should also be consistent with the time frame of the analysis.

Thirdly, we assume that scenarios for end-states are based on firm-specific capabilities and competencies, rather than on general technological forecasts. Thus, end-state scenarios must be the result of an understanding of the marketplace, the company, and the future [7].

Finally, the model is defined to consist of both a base technology, which is the firm's chosen technology platform, and the complementary technologies. All these technologies are considered to be the pre-existing factors that enable the firm to include particular features in the product. In the UM, we assume that at time 't = 0', the firm has made a commitment to a particular technology that will be the platform from which subsequent products/services will be launched. It is not important that the chosen technology be fully evolved.¹ This commitment must have been based on a quantitative or qualitative analysis carried out at the firm level to ensure that the technology is both viable and desirable for the firm's future purposes. Tools used for such an analysis can include a technological forecasting method, such as growth curve analysis, trend analysis, analytic hierarchy process (AHP), technology roadmap or nominal group process (NGP) [3].



The availability and viability of complementary technologies are important for the firm to translate the base technology into the defined end-states.² These complementary technologies are defined in the pre-existing factors at corresponding time intervals in the model, which ensures an overlap between technology evolution and product development.

As UM is an information-based approach, it depends heavily upon the ability of managers and employees to effectively collect, analyse, and act on new information. This approach requires flexible product (service) developments and introduction processes.

¹ For example, the acceptance of microprocessor technology for use in personal computers occurred long before the evolution of that technology was complete; indeed, microprocessor technology continues to evolve today, as more transistors are fitted onto each chip, increasing power, memory and performance.

² Returning to the example of microprocessors and personal computers, miniaturisation and micron technology represent complementary technologies.

model description

Model Description and Graphical Representation

模型描述及其示意圖

This section deals with operationalisation of the Umbrella Method for BTPs as well as a graphical representation of the model in a four-scenario case. The scenarios are generated from the chosen technology platform, and the identified trends and uncertainties. From each uncertainty stems several outcomes, each corresponding to an alternative scenario specification. However, it is not necessary or desirable to identify all possible outcomes; instead a more general description is useful (for example, future interest rates may be high, medium or low, as opposed to 12.6%, 6.2% or 3.4%).

Outcomes for the environmental uncertainties identified during scenario analysis will lead to different scenarios. Average cumulative weights are used to represent the probabilities of specific uncertainties necessary to realise the defined end-state of a scenario. They are determined by consensus of a panel of experts. The 'average cumulative weight of a positive response' can then be calculated for the uncertainties in each scenario. The average cumulative weight will in turn allow for mapping the product possibility domain which contains the products (and their relevant attributes) to be considered for introduction.³

在這部份，我們會詳細解釋「綜合法」的細節，並將一個具有四種情景的個案，用圖象方式來表達有關的模型。這些未來情景是根據已被採用的技術平台及已確定的趨勢和不明朗因素而推測出來的。每一個不明朗因素都有多個可能的結果，而這些結果各自會引至不同情景的出現。可是，我們並不需要把所有可能的結果都找出來，只要用較粗略的方式來表達已足夠（比如預測未來的利率將會是高、中或低，而不是12.6%、6.2%或3.4%）。

經過未來情景分析的過程，可以辨別出多種可能出現的情景。各種不明朗因素的某種組合會促成當中一種情景的實現，而構成這組合的個別條件，其發生的或然率可用經專家小組一致意見而得出來的「平均累計權數」(average cumulative weights) 來表達。這些平均累計權數可用以顯示不同設計版本的产品其推出市場的可能性範圍³。

不斷地監察未來事件的發展，有助於判斷那一種產品是最佳的選擇。用以表達這個模型的圖表如圖九所示。

³ This is similar to the process outlined in [8]: Two extreme and one middle-of-the-road scenarios are considered and each scenario is profiled in terms of the weight given to a 'yes' answer for each uncertainty question. The resulting map highlights the differences between the scenarios on the basis of the assessments of the identified uncertainties.

³ 這個程序與第8項文獻所描述的很類似：考慮兩個極端及一個中間路線的情景。每一個情景的剪影都是用一組權數 (weight) 來表達出來，而每一個權數就是對某個不明朗問題的正面答案的認同程度。經這個程序而作出來的圖表可以清晰地顯示出各個情景的可能性的差異。



graphical representation

搜尋影響未來的變數及它們之間的相互關係時，必須利用到來自各方的信息。這些信息來源包括決策者、機構內其他成員及外間人仕(如顧問)。顧客、供應商等反映的意見也會很重要。信息加速法和先進用戶分析等工具在這方面可大派用場。

Which product is ultimately chosen is a function of the future events realised through the process of continuous monitoring. Figure 9 shows a graphical depiction of this model.

Identification of the actual variables and their relationships should be carried out using information from all possible sources: the decision-

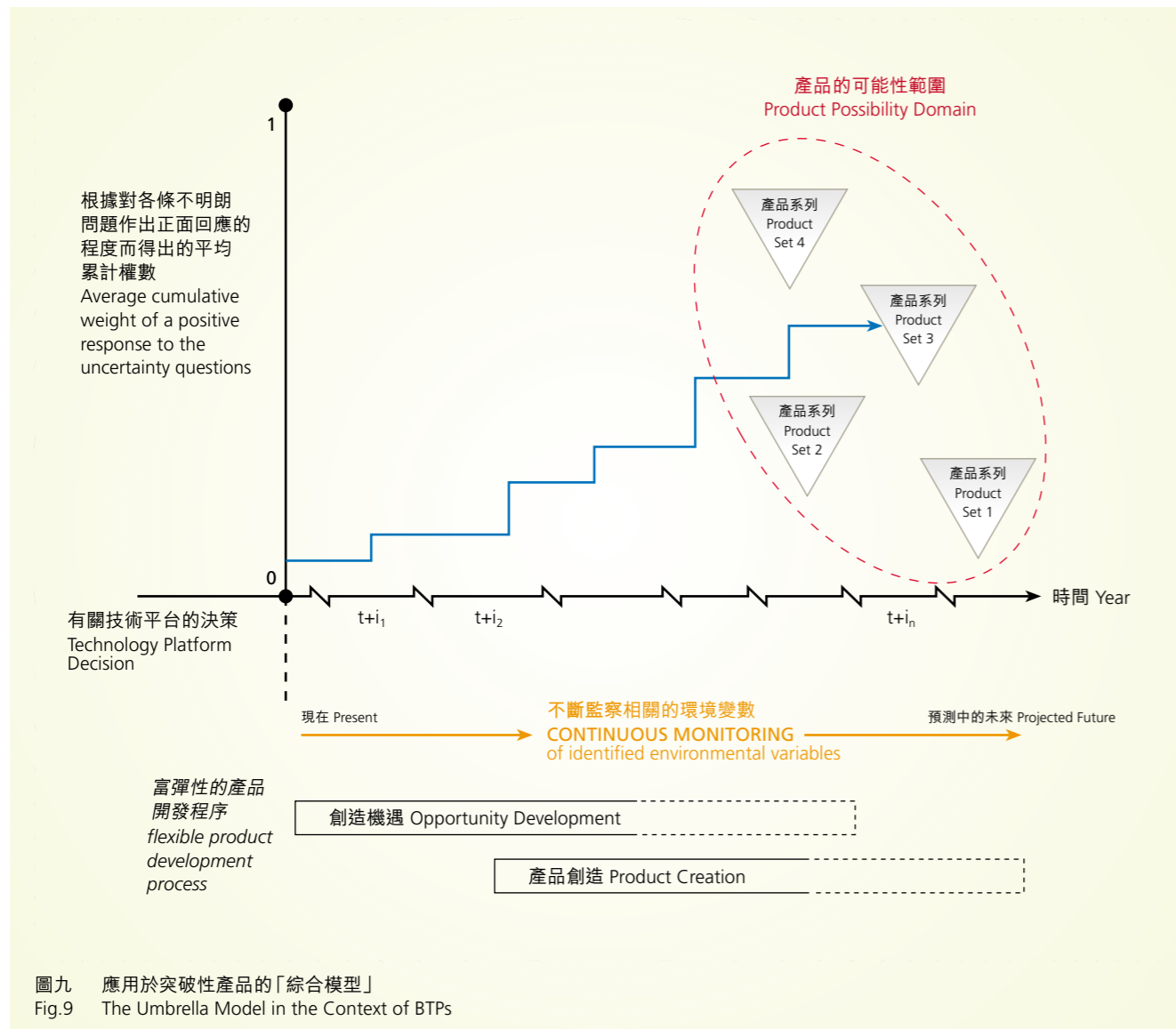
Occurrence of the scenario may be predictable to an extent but only continuous monitoring will reveal the actual time span required. Hence, the abscissa in Figure 9 is divided into continuous time intervals, although not necessarily drawn to scale in duration, rather than discrete time periods. From this model, it is amply evident that BTPs ought to be developed in accordance with the evolution of environmental factors, which may or may not have firm-controllable time implications. This is different from the normal practice of time-dependent product development. For example, the information that a competitor is pursuing R&D in an area related to the development of the proposed BTP has implications for both the direction and speed of the company's product development schedule. In other instances, time may not be entirely within the company's control as may be the case for the introduction of enabling regulation and infrastructure development.

(但不一定按正比例標出)的時間段落。這模型充分展示出開發突破性產品時，必須眼看四面，耳聽八方，按環境因素的演化而進行。過程中所需時間，部份可能並非是公司所能控制的。這方面與慣常按預先規劃的時間而進行的產品開發程序並不相同。例如情報顯示其中一個競爭對手的研究發展動向，涉及公司發展中的突破性產品的範圍，那麼進程表內有關產品開發方向及速度的規劃便需加以檢討。在另一種情況下，一間公司並不能完全控制事件發生的時間，比如是啟助法規 (enabling regulation) 的訂立和基礎設施的發展等。

圖九是產品系列3的發展軌跡。當中所示各個情景，都是經過專家小組對趨勢和不明朗因素作出分析後才定出標在圖上的位置。

用於構想情景、勾劃可能路徑和監察環境等的優質信息，是這套方法的成功要素。這些信息可取自初集或次級資料。

圖十展示一種昔日的突破性產品 — 摩托羅拉流動電話 — 應用「綜合法」的例子。個案中的資料來源包括摩托羅拉大學檔案、過往數據和一篇內有曾參與該產品開發工作的公司高級行政人員的訪問資料的博士論文[4]。在這個模擬練習中，我們假設有一隊由摩托羅拉行政人員(及一些外間人仕)組成的團隊於1960年代後期曾聚首一堂，討論將蜂巢式技術(Cellular technology)應用於流動電話的意念和提議。團隊成員皆來自不同背景，同時，他們已被賦予權力，可根據既有資料(如凌駕一切的趨勢和已知的不明朗因素)作出所需的決策。在每一個步驟裏，為達至示



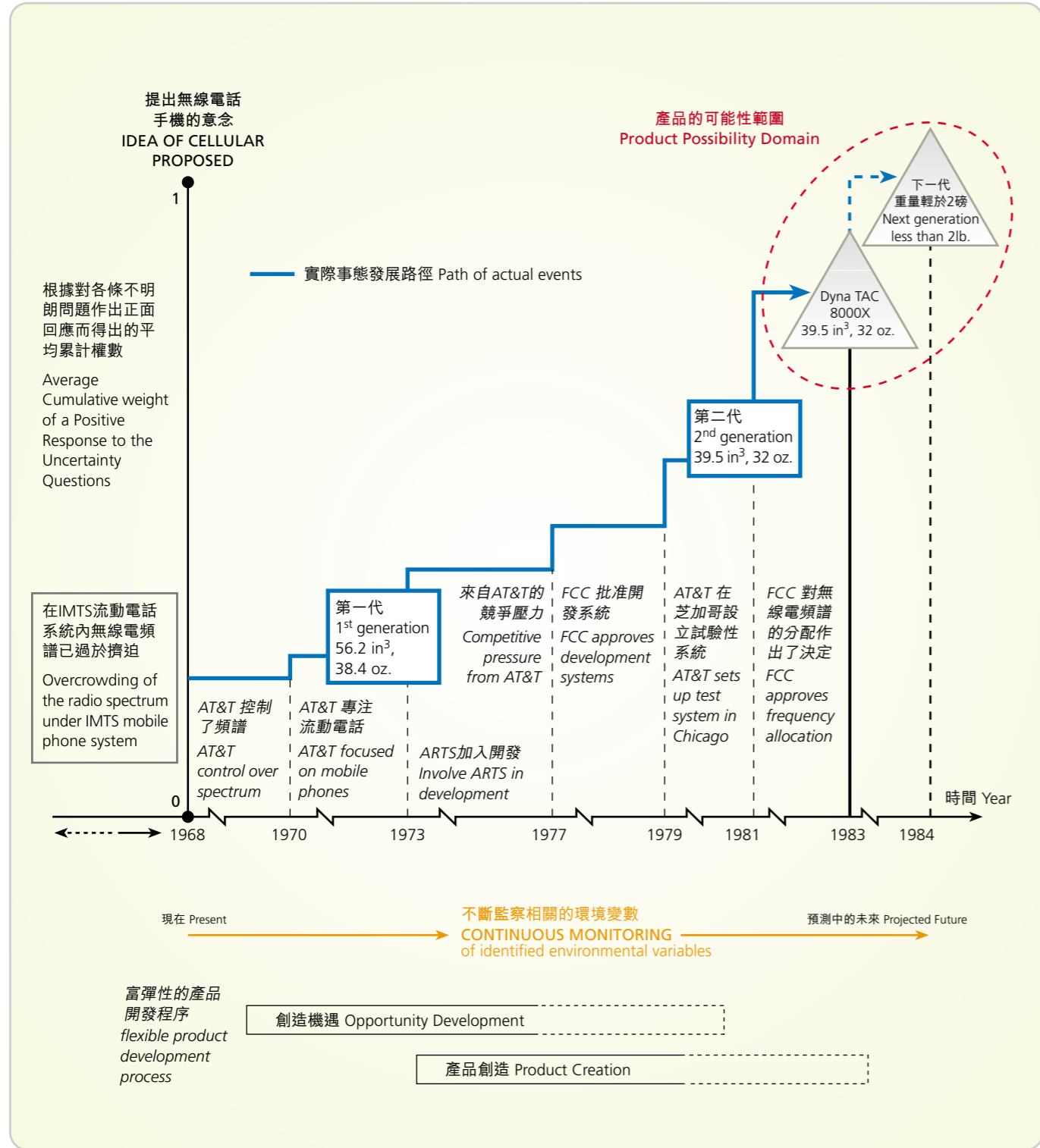
我們在某程度上，或可成功地預測到未來的情景，可是只有經過不斷地監察才可以知道事態發展所需的確實時間。因此圖九的橫座標所顯示的並非是離散的時空，而是連續

makers and other members of the firm, as well as non-members (e.g., consultants). Feedback from customers, vendors and others may also prove important. Tools such as information acceleration and lead user analysis may be used for this purpose.

Figure 9 also shows a trajectory for Product Set 3. It should be noted that the placement of the scenarios on this map would be a function of the trend and uncertainty outcomes agreed to by the panel of experts.

From the practical point of view, the success of this method hinges on the quality of information used for constructing scenarios, for outlining potential pathways, and for monitoring the environment. This information can be obtained from either 'primary' or 'secondary' sources.

Figure 10 presents an example of the Umbrella Method applied to a historic BTP - the Motorola cellular telephone. It is based on data obtained from documents in Motorola University Archives, historical data sources, and a PhD thesis [4], which includes interviews with top Motorola executives at the time of the cellular phone's development. In the simulation exercise, it was assumed that a team of Motorola executives (and outsiders) came together in the late 1960s, when the idea and proposal on the application of cellular technology for use in the mobile phone system was underway. Members of the team were assumed to have diverse backgrounds and they were in a position to make decisions as needed, based on the information available. The framework was



圖十 「綜合法」應用示範：摩托羅拉無線電話手機
 Fig.10 Application of the Umbrella Framework to the Motorola Cellular Phone

then applied from their perspective, in terms of overriding trends, available information and identified uncertainties. The key information elements, necessary to reach the illustrated end-state, are indicated at each step in Figure 10.

Working backward from the end-state in which the third generation phone (Dyna-TAC 8000X) is introduced, we can define the necessary, pre-existing events. In particular, before the cellular phone could be marketed, the Federal Communications Commission (FCC) of the U.S.A. had to approve spectrum frequency allocation, defining who the industry participants were going to be. This Figure and its components illustrate how the Umbrella approach can be fit to the introduction of a breakthrough product.

範的最終狀況而需要掌握的關鍵性資料如圖十所示。

從推出第三代手機 (Dyna-TAC 8000X) 的景象往後找出返回現狀的途徑，可判斷出所需的先決條件。舉例說，在無線電話推出市場之前，美國聯邦通訊局須就無線電頻譜分配問題作出了決定。這個決定影響到業內那些成員能有條件投入該市場。圖十及其組成部份充分顯示出「綜合法」是很適用於突破產品上市規劃的工作。



Structural Characteristics of the Umbrella Method

「綜合法」結構上的特徵

「綜合法」與其他通用的產品開發技巧相比之下，前者能給予更佳的效果。這方法特別之處在於將時間視為一連續的變數，及有系統地收集資料，以減低開發突破性產品的風險。這方法結構上的主要特徵會在下文中作出討論，而它較其他方法優勝之處，可從圖十一中獲悉概略。

環境意識

「綜合法」可促使管理人員在產品開發過程中考慮較廣泛的問題，以提高對重要環境力量的警覺性。除客戶研究所得之外，不斷變遷的環境因素也會影響新產品預測的準確性。隨著新產品投入市場而引發的競爭形勢改變和市場波動，就是這些變遷的例子。在開發突破性產品期間，持續及有效地評估周遭環境，可以增加新產品的成功機會。這些資料可加深公司對眼前和潛在市場的認識。另一方面，突破性產品往往需要較長的開發時間，因此在這過程中任何環境因素的重大的變化，都有可能影響到預測該產品的初期市場接受程度的準確性。

With its systematic approach to BTP development, the Umbrella Methodology provides benefits over existing techniques. In particular, its consideration of time as a continuous variable, and its systematic approach to information collection as a means for reducing risk in the development of BTPs are significant. The key structural characteristics of this proposed methodology are discussed below and its advantages over other techniques are outlined later in Figure 11.

Environmental awareness

The Umbrella Methodology approach helps managers to focus on a broader range of issues in the product development process, and thereby increase their awareness of important environmental forces. The accuracy of any new product forecast is affected not only by the customer research inputs used, but also by the environmental factors that evolve after the product's launch, such as competitive forces and market volatility. A continuous and effective assessment of the firm's operating environment during the BTPs development process may improve the product's likelihood of success. This information can be used to improve the firm's understanding of its existing and potential markets. Since BTPs often take much longer to develop than less innovative products, significant changes in those environmental forces during the product development process may impact the ultimate success of any forecasting method in predicting initial market acceptance of the product.

產品融入市場的過程會受多種因素影響。有關產品擴散的文獻指出，周遭環境（法規、宏觀趨勢）、目標客戶群（消費者或工業用戶、利基[niche]或大眾化）、進入障礙（資源、專門化）、產品特質（相對優點、相融性、複雜性、可觀察/溝通度）和採用者所意識的風險（績效/財務、專業/社群）都是決定高科技或電訊產品擴散速度的主要元素 [2]。在進行情景分析時，環境因素可分類為社會方面（人口統計資料、價值觀、生活方式）、經濟方面（宏觀、微觀、公司特有）、政治方面（選舉、立法、執法）或技術方面（直接、間接、啟助性）。

現時有關突破性產品開發的研究，焦點集中於攝取用戶心聲，以作行銷前市場預測之用 [6]。這些分析方法重則忽略了環境因素的重要性，輕則錯誤地假設這些因素的演化歷程是可以預先確定的。因此，採用一種較恰當的方法，讓決策者可以作出策略性的抉擇以左右環境演化，便成為當務之急。

雖然並非所有環境因素都可以加以預測或可受一間公司的行動所影響，可是我們建議的方法最少可令公司意識到眼前和未來可能出現的市場環境及其顧客的潛在需求。運用這方法來開發突破性產品可平衡科技的推動力和市場的牽引力。再者，運用「綜合法」來設計突破性產品，可考慮多方面的資料。這些資料來源包括先進用戶分析及資訊加速法等等。

以預測未來為根據的方法

上文提到，傳統的預測方法是以前和目前的數據來預測未來，但卻沒有考慮任何新

A number of factors may influence the product adoption process. For example, product diffusion literature has indicated that the firm's environment (regulation, macro trends), the target group (consumer/industrial, niche/mass), the company barriers (resources, specialisation), the product characteristics (relative advantage, compatibility, complexity, observability/communicability), and the perceived risk of adoption (performance / financial, professional / social) were key determinants in high-tech / telecommunications product diffusion [2]. In practice, the environmental factors to be considered in a scenario analysis can be classified as social (demographics, values, lifestyles), economic (macro, micro, company-specific), political (electoral, legislative, regulatory) or technological (direct, indirect, enabling).

The focus of current research in breakthrough product and service development centred around obtaining customer voice inputs for pre-market forecasting exercises [6]. However these approaches, at worst, tend to ignore the importance of environmental forces, and at best, operate under the belief of environmental determinism. Consequently, taking a more proactive approach in which the decision-makers can make strategic choices to control the evolution of their environments seems desirable.

While not all environmental factors can be forecasted or influenced by the actions taken by firms, our proposed method at least makes firms aware of both their present and potential future market environments, and therefore, customers' potential needs. This allows them to achieve a balanced approach to BTP development, acknowledging the technology push and market pull forces at work. In addition, our proposed UM approach for the design of BTPs can incorporate information from many sources, including that collected through techniques such as lead user analysis and information acceleration.

Future focused approach

As discussed earlier, since traditional forecasting involves the prediction of the future based on the past and present, it virtually ignores any new

environmental forces in today's highly competitive, rapidly changing marketplace. It therefore has limited uses. On the other hand, our proposed UM will provide:

- The ability to envisage customers' future needs and link them with current product development strategies
- An alternative means by which to better gauge the market readiness for and acceptance of breakthrough products and services
- A more flexible and dynamic process for managing the timing of new product introduction
- A systematic approach to facilitate management's communication and learning about the process of charting new product/market opportunities
- An enhanced ability to gauge and manage the risk associated with new products, to lay 'side bets', to manage re-deployment initiatives, etc

Use of secondary information

While primary information has the advantage of being firm specific, secondary sources can adequately fulfil information requirements in the proposed UM. For instance, current and forecasted values for general, economic, social, political, and technological variables are accessible from government publications and from research reports of other organisations. Even competitive analysis can be undertaken using only secondary data (see [9] for an illustration). Thus, product design issues, customer voice, and supplementary secondary information may prove useful for ensuring objectivity and consistency with overall market trends.

Thus, a great deal of the information required to implement the Umbrella Method can be quite easily collected. This is particularly true in today's 'information age' which is characterised by the breadth of timely information available on the Internet, and through on-line research databases such as Lexis-Nexis.

的環境因素。在現今競爭激烈和瞬息萬變的市場，這些變數是不容忽視的。「綜合法」可提供以下優點：

- 可以預見顧客未來的需求，並利用這些資料以制訂現行的產品開發策略
- 提供另一種方法以判斷市場是不是已有足夠條件迎接突破性產品及服務，並估計顧客的接受程度
- 可以運用一個更具彈性和更富機動性的程序以制訂新產品上市的時間
- 提供一種有條不紊的方法，以利管理層的溝通及掌握發掘新產品或市場機遇的途徑
- 提升判斷及處理新產品風險、計劃保險措施、進行重新部署安排等等的能力

次級資料的應用

「綜合法」所需的資料，皆可以從次級資料中獲得。例如有關整體、經濟、社會、政治及科技的變數，其目前和預測的數據都可以從政府刊物和其他機構的研究報告中得到。甚至競爭性分析也可以完全依賴次級資料而進行（參考文獻 [9] 中的實例）。如此，有關產品設計的考慮、顧客心聲和增補的次級資料，皆有利於保持客觀性及避免與整體的市場趨勢脫節。另一方面，初集資料也有其優點，那就是這些都是一間公司特有的資料。

我們正處於資訊時代，多方面而合時宜的資料都可以從互聯網和例如 Lexis-Nexis 的聯線科研資料庫取得。因此，「綜合法」需用的資料，大多可以輕易地收集得到。

上文曾經提及突破性產品開發時面對的一些問題，是現有的技巧所不能解決的。圖十一概略地說明我們建議的方法如何可以幫助處理這些問題。圖中亦指出處理個別問題的

Earlier, we highlighted issues of concern in BTP development that cannot be addressed using existing techniques. Figure 11 outlines how the proposed method helps to improve the BTP development process. In addition, this Figure indicates which other techniques address the

需要處理事項 Issue to be addressed	「綜合法」可發揮的作用 How the Umbrella approach can help	其他技巧 Other Techniques
顧客並不知道突破性產品所能滿足的要求 Customers are not aware of the needs BTPs will meet	<ul style="list-style-type: none"> 找出主要的趨勢和不明朗因素，令管理階層知道顧客未來的要求 by identifying key trends and uncertainties management becomes aware of what customers' future needs might be 認清這些要求有部份是受環境影響的 by recognising that needs are, at least partially, conditioned by environment 不會純粹使用會有慣性思維的顧客所提供的資料 by not relying solely on customer input, which may be biased by current experiences 	LUA, IA
變化中的市場結構隱含著產品可能有 多種用途的玄機 Changing market structures implies that products may have more than one application	<ul style="list-style-type: none"> 想像令產品在一個或多個市場內得以成功的各種未來，以促使管理人考慮多個版本的計劃 by imagining different futures where products can be successful in one or more markets and forcing managers to consider alternatives 	LUA
需要顧客學習新事物 Customer learning is required	<ul style="list-style-type: none"> 找出現有顧客所缺乏的知識，使公司可以採取主動向他們進行教育 by identifying where current customer knowledge is deficient and allowing the firm to actively take action to educate customers 	IA
可能需要改變顧客的行為 Changes in customer behaviour may be necessary	<ul style="list-style-type: none"> 使公司知道在每一種情景下，令產品得以成功所需的行為改變 by allowing the company to see what behavioural changes are necessary for product success under each scenario 一旦找出所需的改變，公司可以使用游說、廣告等方式以影響環境和顧客 by realising that once the necessary changes are identified, the company can influence the environment and customers by lobbying, advertising, etc. 	IA
啟助性的設施必須經已存在，產品才可以上市 Introduction depends on the existence of an enabling infrastructure	<ul style="list-style-type: none"> 澄清所需的基礎設施及有關的部署，以令突破性產品能有效地滿足顧客的要求 by clarifying what infrastructure needs will be and how they must be positioned to allow the BTPs to effectively meet customer needs 意識到這些需要後，公司會清楚知道部署這些基礎設施的可行辦法 by making the company aware of these needs alerting it to the possible ways of ensuring the infrastructure will be put in place 	IA
競爭日趨白熱化 Competition is becoming more and more intense	<ul style="list-style-type: none"> 不斷監察環境，對競爭對手的行動保持警覺性，並密切留意這些對手的一舉一動 by alerting the company to actions of competitors through continuous monitoring of the environment and allowing it to trace the path competitors seem to be following 令公司留意到較易被忽略的間接競爭對手 by alerting the company to indirect competitors who may otherwise have been ignored 	不能處理 Not addressed
引進新科技時，通常會涉及法規的制訂或修改 Government regulations are often involved when new technology is being introduced	<ul style="list-style-type: none"> 對那些可能衝擊產品上市的政治運動提高警覺，以便安排游說活動 by raising awareness of the political movements which may impact on product introduction and help manage the lobbying process 	不能處理 Not addressed

LUA = 先進用戶分析 Lead User Analysis
IA = 信息加速法 Information Acceleration

圖十一 處理突破性產品開發事宜
Fig.11 Addressing the Problems in BTPs Development

identified issues. The usefulness of these other techniques in meeting the identified challenges of BTP development is studied in [6].

The usefulness of the UM arises from three key characteristics. First, it raises the level of awareness within the firm, alerting management to changes in the environment that may impact the product development process. It also creates an awareness of how environmental trends and uncertainties can influence the needs customers will have in the future, and indicates what changes in the product development strategy will be necessary to meet those needs. Secondly, it provides a systematic approach that clearly maps the necessary steps from the successful product introduction point to the present. Therefore, it reduces the uncertainty associated with developing BTPs without relying on forecasting techniques. The Umbrella approach does not focus on identifying a *most likely* scenario given current conditions, but rather on alternative scenarios, each of which may be more or less likely under different environmental conditions.

Finally, the integrative nature of the Umbrella Method provides benefits over using a single approach. Taking advantage of a number of techniques helps increase the information in the model and hence, its accuracy. In addition, the Umbrella Method is flexible in its inputs, given the accessibility of secondary information. Therefore, a model that is operational using only secondary information more easily accommodates resource constraints, which might otherwise impede the quality of the forecast made.

The process of continuous monitoring helps the firm to determine the scenario which is unfolding and, therefore, to choose an appropriate BTP for introduction. Information pertaining to changes in market circumstances and alterations in the environment can be fed into the product development process, ensuring that the product meets customers' needs.

其他技巧，而這些技巧用於突破性產品開發的效用，在文獻第 [6] 項內曾有所探討。

「綜合法」有三方面的優點。首先，它能促使管理階層對可能影響產品開發過程的環境變遷提高警覺性，並意識到環境趨勢與不明朗因素對未來顧客要求的影響程度。此外它亦會指出產品開發策略應如何修改才可迎合這些要求。第二，它能有系統地勾劃出從產品成功上市的時空，連貫到目前所需的步驟。因為這方法並不是以預測為基礎，所以能減低開發突破性產品的不明朗程度。「綜合法」不會著重於根據眼前情況尋找出一個最可能出現的情景，而是構想出多個配合不同環境的情景。

最後，具整合性的「綜合法」，其功效超越單一技巧。應用多種技巧來取得更多資料，可造出更精確的模型。「綜合法」的另一特出之處是它只需要次級資料作計劃之用，令其更能在資源短缺的情況下發揮作用。若採用傳統的方法，在這種情況下作出的預測其質素將會大打折扣。

不斷地監察環境，可使公司意識到日漸呈現在眼前的情景，從而選擇合適的突破性產品上市。將有關市場和環境變化的資料應用於產品開發的過程，可確保產品能切合顧客的要求。

Precautions for Implementation of the Umbrella Method

應用「綜合法」須知

為求應用「綜合法」可得到滿意成果，進行定期性環境審查至為重要，同時亦要認識及處理以下事宜。

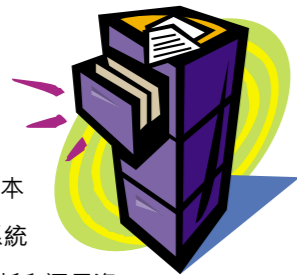
資料管理

「綜合法」是以資訊為本的。它提供了一套系統化的綱領以蒐集、分析和運用資料，從而改善及引導突破性產品的開發工作。進行環境掃描使我們能找出所有可能影響突破性產品業績的變數。這個過程要面對的挑戰在於從中挑選出最具關鍵的變數。

此外，管理人員及其員工亦必須鍛煉自己的技能和掌握所需技巧，才可以有效地處理資料蒐集和分析工作而效率亦高。設立數據庫以便迅速而準確地儲存、檢索和分析資料就是一個例子。在某些種情況下，公司可能需要新設一個專責環境掃描的職位，以及時辨認出簇新和適用的資料。

組成專家小組並使它發揮作用

專家小組的責任是辨別和分析影響產品開發的趨勢和不明朗因素，從而構想出一些未來情景。所以組織一隊見識廣博並能有效地發揮作用的小組至為重要。投資在這方面的時間和金錢雖然高昂，但如果能夠令這個方法達到理想效果，便是物有所值。



There are a number of issues that must be recognised and addressed by the firm in order to ensure the Umbrella approach is successfully implemented. It is also important to maintain a constant review of environmental factors over time.

Information management

The UM is an information-based framework. It essentially provides a systematic guideline for collecting, analysing and utilising information to improve and guide the development of BTPs. The process of environmental scanning helps to identify all of the variables that may affect the success of the BTPs. However, the key issue here is the selection of the most relevant variables.

In addition, managers and their employees must develop the skills and methods necessary to manage effectively and efficiently the information collection and analysis process. This may require, for example, the creation of a database where information can be stored, retrieved, and analysed quickly and accurately. It may also require the creation of a new position within the company, which would be responsible for continuously monitoring the environment for new, relevant information.

Creating and utilising an expert team

The team of experts is essential to the success of the approach in that they are responsible for identifying and analysing the relevant trends and uncertainties, and for generating the end-state scenarios. Consequently, it is important for the firm to create a team which is knowledgeable and which can function effectively. Such an investment, though expensive in terms of money and time, may prove essential for this approach to succeed.

The impact of organisational structures on the product development process depends on the innovativeness of the new product being developed. An empirical study revealed that participative structures such as teams are of benefit to the new product development process when that product is truly innovative.

By their very nature, teams are complex to manage. In addition, there are some well-known problems (as well as benefits) that are typically associated with using a team approach that must be addressed. For example, members may be geographically dispersed, there may be tensions across the different functions, and some members may be more dominating than others [5]. In addition, the frequency of team meetings and management of the team must be addressed. Consequently, efforts must be made to ensure the team functions effectively in its role. Methods available for achieving team consensus on relationships identified in the trends and uncertainties analysis include Delphi and Nominal Group Process (NGP), tools such as Decision Support Systems (DSS) and computer-supported co-operative work stations [2].

Since many of the factors affecting the required time for product development are outside the firm's direct control, it is important that timelines be flexible and adjustable, even though this approach is at variance with the typical focus towards time reduction [6].

Nevertheless, firms can strive for some control of forces that impact on time, in order to change the product development timeline. For example, they can lobby for or against new legislation, invest significant amounts of money in research and development of new technologies or co-ordinate efforts with other external parties to speed technology development. By its very nature, the Umbrella Method will enable firms to proactively evaluate and analyse environmental factors by continuous monitoring so as to reach the end-state where the product is successfully introduced.

組織架構對產品開發過程的影響，視乎該產品的創新程度。據一項研究所得，參與性高的組織架構如工作團隊是有助於開發別具創意的產品。

管理工作團隊是一項很複雜的事情。我們要處理一些眾所周知的團隊獨有問題（及其優點）。天各一方的成員、功能之間矛盾重重和霸氣十足的成員都是這類問題的例子 [5]。團隊聚會的頻率和其管理事宜，必須妥善處理以確保它能有效地發揮作用。特爾菲法則、具名小組討論程序、決策支援系統 (DSS) 和電腦支援協作工作站 (Computer supported co-operative work stations) 等工具，可有助工作團隊對趨勢與不明朗因素之間的關係達成共識 [2]。

影響產品發展所需時間的外來因素，很多是公司不能控制的。故此有關的時間表必須富彈性和是可以調節的。這一點與一般以削減時間為焦點的規劃，大異其趣 [6]。

雖然如此，公司對一些影響發展時間的外來因素，可在某程度上加以支配，以改變產品開發的時間表。贊成或反對新法規的游說工作、投入大量資金作研究發展新技術之用或協調外界的力量以加速技術發展步伐就是其中例子。「綜合法」內的不斷監察行動，令公司能以積極進取的態度來分析及評估環境因素，以期達至產品得以成功的最終景象。



在芸芸新產品中，突破性產品可為公司帶來最高的利潤。可是當中涉及的風險往往妨礙了它們的開發進程。在競爭日趨激烈的市場內，利用突破性產品來突出與競爭對手的分野越趨重要。因此我們需要一些工具以減低開發突破性產品時的風險。獲取知識是減低風險的主要途徑，書中推介的方法正可令管理人員做到這點。

揉合情景分析、返回現狀和環境掃描與監察等方法，可用以預測未來市場的可能發展路向，從而制訂相應於各種路向的產品開發策略。一貫及有系統的環境監察可提供環境演化的線索，令公司可以制訂應採取的策略，此乃整個程序的成功之道。

運用「綜合法」於突破性產品開發的主要優點概述如下：

Conclusion and Summary

結語

Although BTPs may be the most profitable new products that a company can produce, the high level of risk associated with them often hinders their development. As the level of market competition increases, however, it will become more important for firms to use BTPs to differentiate themselves from their competitors. Thus, there is a need for a tool that can help managers alleviate some risks of BTPs development. The primary means of decreasing risk, in any situation, is to acquire knowledge. This is precisely what the methodology presented in this book allows and encourages managers to do.

The combination of scenario analysis, backcasting, and environmental scanning and monitoring allows firms to develop detailed propositions of how their future environments may look and establish product development strategies that lead to success under each possible outcome. The key to achieving this success is consistent and systematic environmental monitoring. This process provides the clues as to which future is evolving, and therefore, what strategy the firm should employ.

The main contributions of the proposed UM in developing BTPs can be summarised as follows:

- Takes into account the high degree of uncertainty and risk inherent in this process and uses information to reduce that risk
- Considers alternative possible futures based on customers' potential future needs and links them with current product development strategies
- Accounts for the time aspect of product development — that is, the more advanced products take longer to develop and the speed of diffusion processes depends on many time-related factors which are not necessarily controllable by the firm
- Considers time as a continuous, rather than discrete, variable through continuous monitoring
- Provides a systematic approach to information analysis and collection for strategic product development

Currently available techniques (quantitative and qualitative) are unable to fully address many important aspects of BTP development. In particular, they are unable to account for the fact that there is no relevant historical data with which to conduct BTP forecasts. Also, customers are often unaware of the needs such products meet, and new infrastructure and regulations may be necessary before the product/service can be introduced. In addition, currently emerging methods aimed specifically at BTP development are also not comprehensive enough to address all aspects of the identified issues.

The Umbrella approach is particularly useful for firms participating in industries that are characterised by high degrees of uncertainty due to the following:

- Government regulations that must be met before the product can be introduced
- Rapid technological change
- Intense competition
- New infrastructure requirements

Consequently, industries such as pharmaceuticals, automobiles, telecommunications and information, and high-tech consumer goods may benefit from this approach.

- 明瞭開發過程本質上的風險和不明朗程度，並運用既有資訊以減低風險。
- 預測顧客未來的要求，從而構想各種可能出現的未來情景，並將它們連貫到目前應該採取的產品開發策略。
- 考慮到產品開發所需的時間 — 較先進的產品需用較長的時間來開發。同時，擴散的速度亦視乎很多公司不能控制的外來因素而定。
- 瞭解時間並非是離散的，而是連續的變數。每一個時間段落的長短只可以經過不斷察監才能確定。
- 提供一種個有條理的方法來收集及分析資料以展開策略性產品開發的工作。

目前通用的(定量及定性)技巧是不能全面分析突破性產品開發的重要課題。我們缺乏過往有關的數據以預測突破性產品的演化歷程。同時顧客往往尚未領悟到這產品所能滿足的需求。將產品推出市場之前，亦可能需要建立一些基礎設施和法規。此外，那些發展中的方法亦不能全面地處理所有關於突破性產品的事宜。

「綜合法」是特別適用於那些在極度不明朗的產業內經營的企業。這些不明朗因素可能來自：

- 產品推出時必須符合的法規
- 快速地變化的技術
- 激烈的市場競爭
- 新的基礎設施需求

鑑於以上的考慮，「綜合法」是十分適用於製藥、汽車、電訊、資訊和高科技消費品等產業。

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漢密·羅理是加拿大滑鐵盧市韋佛·羅利雅大學 (Wilfrid Laurier University) 商學院企業集成及科技管理講座教授及營運管理教授。他亦曾任加拿大滑鐵盧大學 (University of Waterloo) 客座教授及香港理大學製造工程學系高級研究員。目前羅理博士是加州柏克萊大學哈斯商學院 (Haas School of Business) 客座教授。1985至1994年間，他曾是韋佛·羅利雅大學先進科技及營運管理研究中心創辦理事，並於1994年成為該大學所頒發的大學研究教授獎的得主。他在業內的資歷包括曾於日本電器 (NEC) 工作歷時三年。

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Albert Tsang is Principal Lecturer and Leader of the Quality & Reliability Group in the Department of Manufacturing Engineering, The Hong Kong Polytechnic University. He had extensive working experience in the manufacturing industry, covering functions such as industrial engineering, quality assurance, and project management. Dr. Tsang is very active in promoting quality and reliability in Hong Kong. He is a founding member, past Chairman and serving Executive Committee member of Hong Kong Society For Quality (HKSQ). He had developed and conducted customised training courses on various aspects of quality and engineering management for many organisations and professional bodies. He has also provided consultancy services to organisations in public utilities, health care and government sectors on matters related to quality, reliability, maintenance and performance management. Dr. Tsang is the co-author of "Reliability-Centred Maintenance: A Key to Maintenance Excellence", another publication of the Quality Transformation Series.

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