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Strategic foresight using a modified Delphi with end-user participation: A case study of the iPad's impact on Taiwan's PC ecosystem

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ABSTRACT

Taiwan is a personal computer (PC) manufacturing powerhouse, producing desktop (DT) computers, notebooks (NB), and netbooks (NetB). However, the emergence of tablets such as Apple's iPad, has threatened the PC market's prospects and significantly affected Taiwan's PC ecosystem. This study proposes a modified Delphi with end-user participation to provide strategic foresight for firms in Taiwan's PC ecosystem. The results show that these firms can adopt the following three strategies in response to the impact of tablets: (1) brand and service innovation, (2) focus on cloud technology and marketing products to China, and (3) cooperating with digital leisure and entertainment industry. We believe that this modified Delphi with end-user-participation model is a valuable foresight tool for products with a short life cycle, such as consumer electronics and fashion products.

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1. Introduction

In 2007, the Market Intelligence & Consulting Institute reported that 90% of global notebooks were manufactured by Taiwanese OEM (Original Engineering Manufacturer) firms [1]. However, the competitive strategy employed by firms in Taiwan's PC ecosystem is relatively uninteresting, that is, large-scale production and low production costs. With a noticeably low profit margin, firms in this ecosystem cannot conduct much value-adding innovation in research and development (R&D). Recently, Taiwanese OEM firms have faced another challenge, this time from the rise of tablets, such as iPad, leading to a sharp decline in sales and a further drop in profit margins. A report by Goldman Sachs predicted that iPad may endanger 40% of the PC market [2].

In responding to the challenge, this study conducts a strategic foresight for the sake of Taiwanese PC related firms using a modified Delphi with end-user-participation (EUP). An important function of strategic foresight is to analyze multiple possible future realities, that is, using the assumed multiple conditions to predict multiple future realities [3–5]. Strategic foresight has been widely applied to analyze possible impacts of future uncertainty. Regional and national governments use strategic foresight to maintain the competitive advantage of local enterprises [6]. Currently, usage of strategic foresight to improve firms' competitive advantage continues to increase, and numerous studies have explored how to conduct strategic foresight effectively [7,8]. By analyzing the mid- and the long-term impacts of a certain emerging event, enterprises can make appropriate decisions. A study reported that a large European enterprise used strategic foresight to analyze the potential market [9]. Another study stated that Latin American countries used strategic foresight to determine future technological and scientific developments. That study also used Colombia, Brazil, and Mexico as case studies, promoting the use of strategic foresight to reinforce their competitiveness [5].

The most commonly used strategic foresight approach involves constructing certain scenarios and then obtaining expert judgments regarding possible future realities. In this regard, the Delphi approach has been used to forecast the likelihood and timing of future events by eliciting opinions from expert groups and converging one result through anonymity, iteration with

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controlled feedback, and statistical group responses [10,11]. The Delphi approach has been widely applied in diverse fields, including technology foresight and strategic foresight. In addition, the Delphi approach can be applied in various situations, including those with minimal historical information and those with multiple factors [12,13]. A conventional Delphi survey requires experts to act as anonymous panelists [14]. Guided by a moderator, experts conduct forecasts regarding certain issues [15,16]. The moderator compiles the experts' responses and provides feedback in continuous rounds to obtain one forecast result by converging the experts' opinions.

Though been used widely to provide forecasts [14], the Delphi method has become the subject of several criticisms. One study suggested that expert opinions were typically overly optimistic [17]. This phenomenon occurs not only in the field of academia, but also in corporate management. Specialized experts tend to provide more optimistic predictions. One study indicated that the reason experts provide overly optimistic predictions in a Delphi is because of their specialized backgrounds, Delphi statements, and Delphi questionnaires [18]. A study demonstrated that short-term forecasts were comparatively optimistic, whereas long-term forecasts were relatively pessimistic [15]. Another study highlighted the correlation between the experts' proficiency and their degree of optimism. Their results indicated top experts in Germany and Austria were more optimistic than those from other countries [17]. Geels and Smit suggested that overly simplistic predictions in a Delphi hinder future applications of the forecasted results because experts neglect the correlation between society and technology [19]. Additionally, because consumers are typically more concerned with the problems, obtaining consumer opinions in a Delphi enhances the practicality of the forecasted results [20]. One study about the banking industry found that financial experts in a top management team indeed provide superior performance in a stable environment; however, during a financial crisis, financial experts may negatively affect performance. This is because of a lack of heterogeneity and differing perspectives in top management teams [21]. A study integrated the opinions of experts and consumers through a Delphi and suggested that a self-help strategy can be more effective for eliminating depressive symptoms [22].

In summary, four problems that occur in a Delphi have been documented: First, expert groups may exert social pressure on group members to agree with the majority [23]. Second, improperly designed questionnaires may lead to ambiguous Delphi results [24]. Third, questionnaires may contain excessive statements and response variables. Questionnaires with overly lengthy and complex questions are difficult for experts to complete, decreasing the quality of the Delphi output [18]. Fourth, Delphi forecasting requires significant time and cost, which results in difficulties explaining the Delphi results from a current perspective [25,26].

None-the-less, the Delphi approach is extremely useful for forecasting potential needs, particularly when applied to strategic and technology foresight [27]. Moreover, scholars from Korea, Japan, Germany, and India have used this approach to conduct national forecasts [28]. One study used an Internet-based Delphi to collect a greater volume of opinions from experts to improve supply chain flexibility [29]. Additionally, a study integrated a Delphi method, scenario analysis, and substitution model to forecast the development of organic light-emitting diode televisions (OLED TVs) [30]. In another study, the Delphi approach was combined with an analytic hierarchy process (AHP) to identify key areas in the information technology (IT) industry [31].

However, another issue has been raised towards the current practice of foresight. One study argued that studies on foresight have focused less on understanding effects and responses to environment uncertainty [32]. Environment uncertainty refers to a lack of accurate information in a firm's micro and macro business environment, which subsequently hinders the firm's ability to detect changes and effects [33–35]. Conversely, the firm's uncertain environment is argued to be the primary indicator for managers to detect emerging opportunities and react in a timely manner [36–38]. This led to a series of studies on environment scanning, which suggests that managers should scan the environment to detect and respond to emerging events and changes [39–41].

To cope with the increasing environment uncertainty in our attempt to use the Delphi approach, in this study, we also adopt environment scanning by seeking advice from various experts. Additionally, we notice that the life cycle of electronic products is shortening and the age of end users is becoming younger. For example, the recent popular innovative applications of information technology, such as Facebook, Skype, and YouTube, were not initiated by seasoned experts at all, but by young and creative college students. We thus infer that experts may well verse in technical knowledge but prone to neglect consumers' sentiments. To address these problems, we further extend our sources of opinion to include that from an important group of end users of PC related products, namely college and graduate students.

The rest of this paper is organized as follows: Section 2 describes Taiwan's PC ecosystem. Section 3 details the process of conducting strategic foresight using a modified Delphi with end-user participation. Section 4 reports the results of the strategic foresight for the firms in Taiwan PC ecosystem. Finally, Section 5 presents the discussion and conclusion of this study.

2. Overview of Taiwan's PC ecosystem

A business ecosystem is a loose network comprising suppliers, dealers, outsourcing companies, and numerous other organizations that directly satisfy the needs of global consumers through integrated software, hardware, and services [42]. Whether the organizations in a business ecosystem are strong or weak, they ultimately share the same fate as that of the total network. A business ecosystem can be categorized into various business domains, and a domain may be shared by other ecosystems. The performance of a domain can influence the efficiency of its eco-domain.

The PC ecosystem in Taiwan has numerous firms that manufacture original components for various electronic products and a number of firms that are developing their own brand [2]. Fig. 1 shows the global PC output from 2005 to 2010. PC include desktops (DT), notebooks (NB), and netbooks (NetB). Since 2007, the DT market has been eroded by NB and NetB. Until 2010, DT

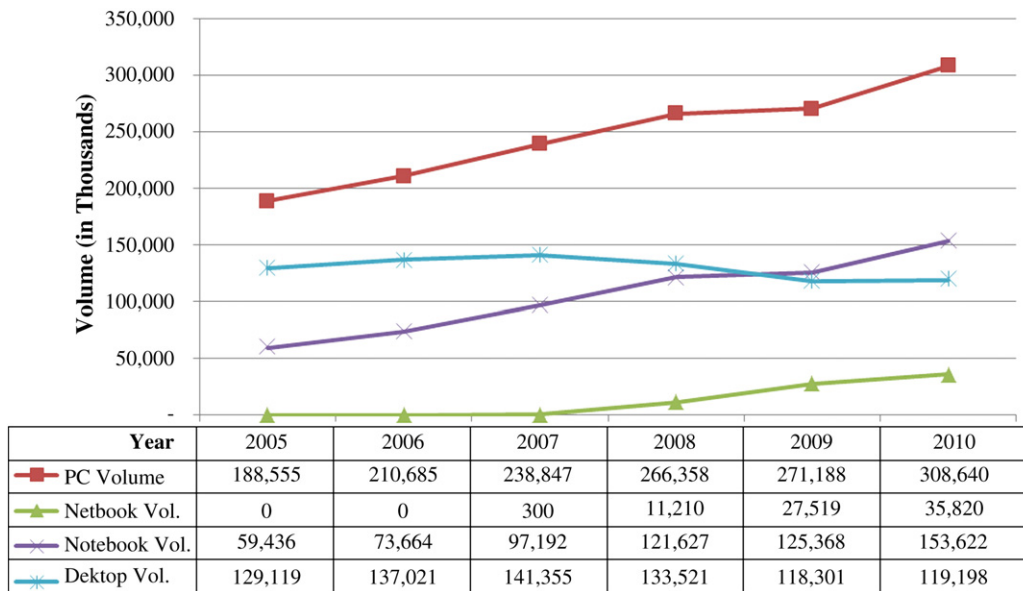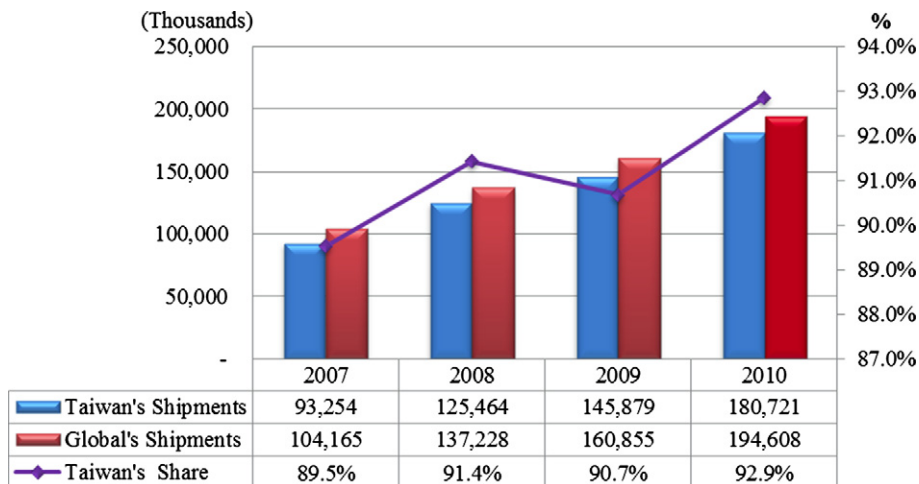| Year	2005	2006	2007	2008	2009	2010
PC Volume	188,555	210,685	238,847	266,358	271,188	308,640
Netbook Vol.	0	0	300	11,210	27,519	35,820
Notebook Vol.	59,436	73,664	97,192	121,627	125,368	153,622
Dektop Vol.	129,119	137,021	141,355	133,521	118,301	119,198

Fig. 1. Global PC output. Source: http://mic.iii.org.tw/aisp/reports/reportdetail_register.asp?docid=1902.

output was lower than the NB output. However, the international market shares of Taiwan's leading PC companies, Acer and Asus, increased sharply because of high sales of NetB in 2007.

With the increasing market shares of NB and NetB, and the active development of the NB outsourcing domain in Taiwan's PC ecosystem, Taiwan's PC industry has comprised ninety percent of the total global NB output since 2008 (Fig. 2). The outsourcing PC domain has been replaced with that of NB. However, because global outsourcing shares have almost reached the maximum, the historical high output growth of 30–40% cannot be maintained. The business model of NB outsourcing in Taiwan emphasizes more on economies of scale in the future.

The core organizations of an ecosystem play a key role in that system. The core organizations in Taiwan's PC ecosystem are those big enterprises such as Hon Hai, Compal, Quanta, Acer, and Asus. The total revenue of these five organizations in 2010 reached an impressive amount of NT$5 trillion (US$173 billion), accounting for as high as 37% of Taiwan's GDP in 2010.

Since the rise of Wintel, Taiwan has facilitated Wintel's hardware outsourcing in the PC ecosystem. Under the conditions of emphasizing production efficiency and lower costs, Taiwan's manufacturers lack the basic technology and software development capabilities. With the advancements of Apple and Google, Taiwan's PC manufacturers have provided services to different domain

	2007	2008	2009	2010
Taiwan's Shipments	93,254	125,464	145,879	180,721
Global's Shipments	104,165	137,228	160,855	194,608
Taiwan's Share	89.5%	91.4%	90.7%	92.9%

Source: http://proj3.moeaidb.gov.tw/nmipo/edm/Event/20100527/2.pdf

Fig. 2. Taiwan's NB output between 2007 and 2010. Source: http://proj3.moeaidb.gov.tw/nmipo/edm/Event/20100527/2.pdf.

ecosystems. Foxconn, a subsidiary of Hon Hai, is the outsourced hardware manufacturer of Apple; Acer and Asus use their own brand, Android; and Compal and Quanta remain the outsourced hardware manufacturers of Wintel. Currently, these Taiwanese manufacturers are attempting to transform from manufacturing to designing brands. For example, the HTC Corporation founded the HTC brand; Quanta established the Quanta Research Institute, which focuses on cloud technology; and Acer and Asus are implementing a me-too strategy integrated with cloud computing to increase the added-value of their products. Regarding the competition among Wintel, Google, and Apple, Taiwan's PC industry is a significant player in the global PC ecosystem.

Three indicators can be used to assess whether an ecosystem is healthy, namely productivity, niche creation, and robustness. Productivity refers to a business network's ability to continuously use technologies and other innovative materials to lower costs and produce new products. Organizations in Taiwan's PC ecosystem primarily adopt vertical integration to lower production costs. However, with NB's low gross profit margin and limited available components for vertical integration among the present NB manufacturers, the NB outsourcing domain has begun to pursue large-scale economies and diversify business. For example, pursuit of economies of scale reached a peak in 2010; Taiwan's NB output was produced primarily by Compal and Quanta. As the NB market matured, the obstacles for manufacturers other than Compal and Quanta were more challenging. Regarding diversified business development, these two companies adopted other industrial characteristics instead of remaining original design manufacturers (ODM). Although they used component module move and service (CMMS) for marketing, they continued to focus on end outsourcing.

Niche creation refers to the diversified capability to increase meaning, which can be used to assess the potential for creating new niches. Through observing the practical applications of new technologies in various businesses and products, we can understand the diversity of an ecosystem. When a healthy ecosystem creates a new niche, the existing niche may not survive. Reducing the diversity of certain eco-domains is beneficial for other domains to create new niches. For example, the collapse of business niches related to host computers stimulated the new domains of PC- and client–server networks. With the introduction of the iPad, Asus and Acer developed their own tablets, and Foxconn has collaborated with Apple on the iPad and iPhone, joining the iPad trend. This indicates that domains related to tablets have begun to increase in Taiwan's PC ecosystem.

Robustness refers to the ability of an ecosystem to confront unexpected impacts and changes. An organization in a strong ecosystem is relatively able to predict the future, and the relationships in the ecosystem can mediate future impacts. Taiwan's PC ecosystem has undergone a number of crises, including the Taiwan Strait missile crisis (cross-Strait political change), Taiwan's 921 earthquake (natural disaster), the Y2K (software fault), the Internet bubble (overestimated Internet market), and the 2008 financial crisis (sharp change in the capital market). Currently, as high as 90% of the world's electronic products, such as NB and iPad, depend on the computer ecosystem in Taiwan; whether organizations in the NB outsourcing domain can address this impact is the focus of this study.

3. Research method and design

The purpose of this foresight is to assess and respond to the impact of iPad on Taiwan's PC ecosystem. In this study, we propose a method that integrates a case competition and a panel discussion for data collection.

3.1. Research design

We hosted a foresight case competition to collect non-expert opinions from college and graduate students of various majors to mitigate the decision-making problems of expert groups as addressed in [43]. By incorporating the opinions of this major consumer group, the practicality of foresight proposals can be improved. Through this case competition, we hope to avoid the problems caused by poorly designed questionnaires and overly complicated questionnaire content. The purpose of the panel discussion, on the other hand, is for experts to digest and integrate the diverse foresight strategies as offered by these young contestants that may help to mitigate the problems such as overly optimistic strategic foresight as suggested in [17–22]. These results in turn are used by experts to stimulate ideas and increase their understanding of the mainstream opinions of the end-use participants, hereafter EUPs.

To facilitate the exchange of opinions, we publicly invited students to form teams and participated in this foresight case competition. Based on the creativity and practicality shown in the proposals submitted, a group of experts then selected the top six teams to advance into the final stage of contest. During the final stage of contest, these six teams were able to interact with the committee, which comprised experts from the PC industry. Based on the recorded dialogue between the experts of review committee and all contestants, we then carefully compiled their strategies and viewpoints regarding the industry's overall direction.

3.2. Five-step method of the modified Delphi

The detailed procedure of conducting the Delphi with EUPs in this study comprises the following five steps (Fig. 3).

3.2.1. Step 1: Proposing issues to be addressed
We added Step 1 to the process of a conventional Delphi. The purpose of this step is to propose preliminary strategic foresight issues to be discussed in the case competition. First, the invited experts exchange their opinions on the issues regarding strategic foresight with the moderator via e-mail. The moderator then compiled their opinions and proposes a strategic foresight project.
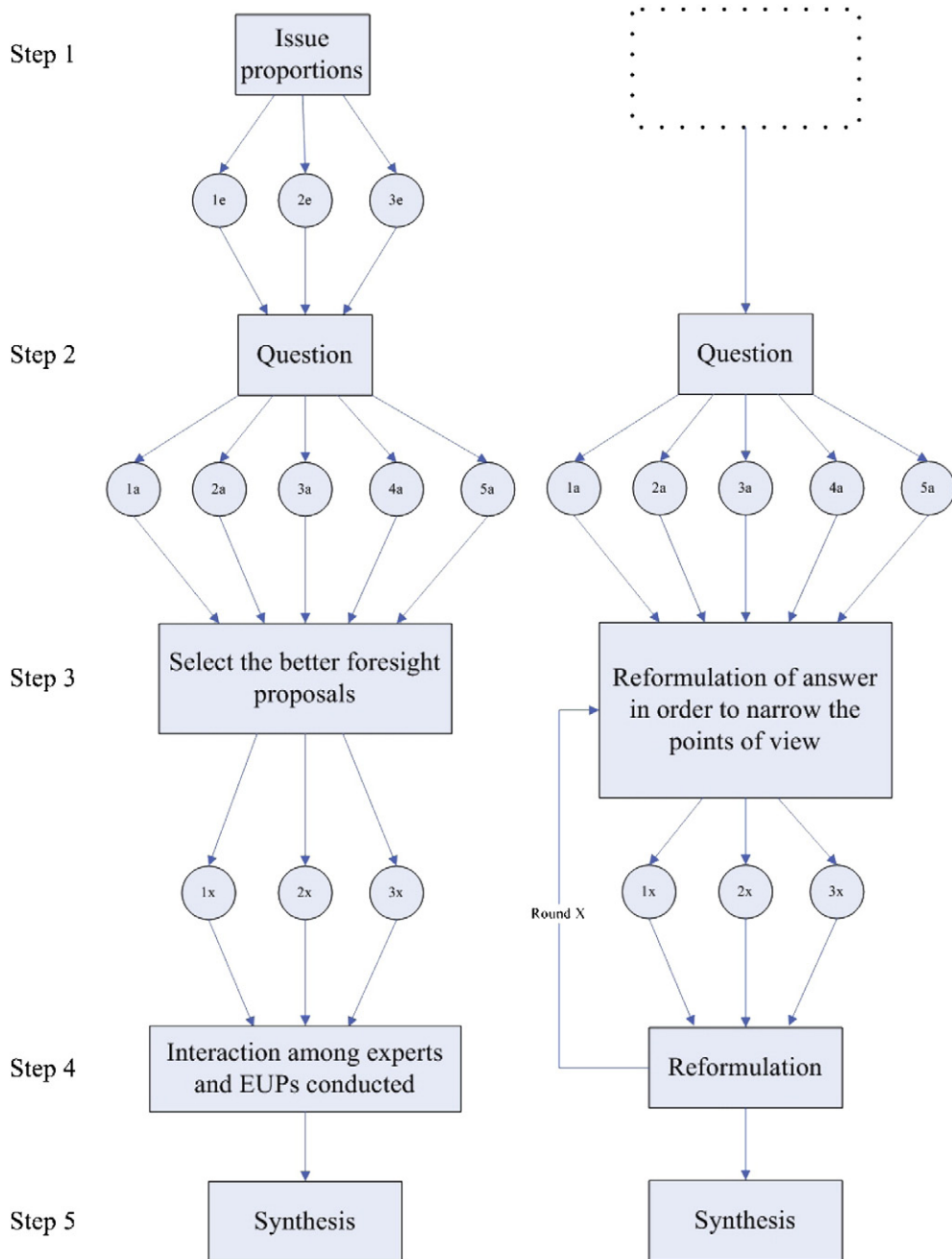
Fig. 3. The Delphi with EUPs used in this study vs. a Conventional Delphi.

Next, these experts then participated in a discussion and identified controversial or ambiguous issues. Finally, the moderator constructed case materials for the foresight competition. Controversial or ambiguous issues were not deleted; instead they were reserved for the EUPs to respond to or commented on using the internet. This step serves an important role as the first convergence of expert opinions. In addition, responses and comments collected from the EUPs who participated in the case competition are believed to enable experts to amend their stereotypical viewpoints.

In total, 11 people participated in the panel discussion. The moderator, Mr. Wang, was previously a chief information officer (CIO) in a medium-sized ICT firm (with an annual revenue of approximately NT$15 billion) for 8 years. The rest 10 experts, 5 are with both academic and industrial backgrounds, and the remaining 5 are in academia only. Their specialized backgrounds are presented in Table 1.

Table 1
Backgrounds of the moderator or and the experts.

	Name	Specialization
Moderator	Wang	Industry analysis, strategic foresight, technology foresight; an academic and industrial background
Expert 1	Lu	Entrepreneurship incubation, R&D management, service innovation, intellectual property management; an academic and industrial background
Expert 2	Chen	Strategic management, corporate business strategy, entrepreneurship, organizational change; an academic background
Expert 3	Huang	Wireless multimedia transmission, wireless SOC IP testing and verification; an academic and industrial background
Expert 4	Zhang	Open innovation, R&D internationalization, academic entrepreneurship, energy service and business model development, technology indicator research, technology/service integrating innovation; an academic background, wireless multimedia transmission, wireless SOC IP testing and verification; an academic and industrial background
Expert 5	You	Information management, technology management, industrial management, computer network and communication; an academic background
Expert 6	Wen	Technology park incubator, entrepreneurial management, innovation and business models, technology commercialization; an academic background
Expert 7	Guo	Quality and service management, information extraction and business intelligence, supply chain and distribution management, high-technology innovation models; an academic background
Expert 8	Yu	Telecommunications and media policies, telecommunications technologies and service management, entrepreneurship and venture capital, trade skills and high-technology business management paradigms, global high-technology management trends and issues; an academic and industrial background
Expert 9	Chen	New service development, service value cluster, business model innovation, technology strategy, R&D performance management and evaluation; an academic background
Expert 10	Ger	System development, technology analysis; an academic and industrial background

3.2.2. Step 2: Broaden opinion base

The purpose of Step 2 is to collect opinions regarding the issues and questions proposed in Step 1. We collaborated with the Chinese Society for the Management of Technology (CSMOT) to develop a website (http://www.activity.mot.nctu.edu.tw/) for promoting the competition and explaining the contest details. We also distributed posters and sent e-mails to all the departments of every college and university in Taiwan, informing them of this case competition. To further boost the willingness of the competition participants and the quality of the foresight proposals submitted, we also offer a monetary reward of NT$85,000 to teams that enter the final stage. Further, to expedite the competition and reduce the cost of collecting the responses, all the foresight proposals were transmitted electronically to the experts for evaluation and review.

The case competition only accepted college and graduate students as contestants. Every contestant had previously experienced the advantages and new features of the iPad and iPhone. According to a survey by Yahoo [44], people in the age range between 18 and 34 has the strongest intention to buy iPad related products. Thus, our contestants encompass an important portion in that age range. To maintain fairness and anonymity, all contestants were kept from knowing the name list of experts in this step, and the experts also did not know the name of the contestants and the universities they were from. The website provided a platform on which the contestants can upload their foresight proposals.

3.3. Step 3: Review the foresight proposals submitted

In this step, the foresight proposals submitted in Step 2 were collected, examined for completeness and then sent to our expert committee via the Internet. The experts were asked to evaluate and grade these proposals. At this stage, the experts also had chance to revise their own opinions before proposing their second converged results. After the evaluations, each of the experts collated the total scores on teams and the scores provided by other experts. The six teams with the highest scores were then invited to advance into the final stage of the contest.

It is worth noting that, at this stage, the experts were still kept from knowing the other expert committee members. Thus, through an anonymous discussion, the experts could better understand the opinions of other experts, determine whether their opinion was typical, and better express their own opinions. In the context of Delphi, Step 3 serves the function of conducting a second convergence on the various foresight proposals submitted in Step 2. While a conventional Delphi will conduct questionnaires continually until a consensus is reached, we conduct convergences only once in each step of Steps 1, 3, and 5. In other words, we use panel discussions and a case competition to replace the repetitive use of lengthy and complicated survey.

3.4. Step 4: Interaction among experts and the contestants

In step 4, the final stage of contest was conducted. Each of the six teams advanced into this stage was asked to make a formal presentation on their foresight proposal in front of expert committee. We put no limit in terms of the format of their presentations. Thus, various forms of presentations, such as video and drama play, were used extensively by most of the teams.

While a conventional Delphi facilitates interaction only between the moderator and each of the experts, we encourage interactions among the moderator, the experts, and the contestants in the final stage of the contest. Direct conversation enables the experts to better understand the viewpoints of the contestants through question asking. At this stage, the experts finally knew who the other experts were. They were able to exchange opinions with each other at this stage. After the interaction, the experts

scored the oral presentation performance and the foresight proposal of each of the six teams. The process of this stage also enabled the moderator to better understand the experts' evaluation on each of the foresight proposals submitted.

3.5. Step 5: Syntheses of the result

In the final step, Step 5, the moderator tried to resolve the divergent views among the experts and the contestants during a panel discussion with experts only. The final strategic foresight conclusion of this research was then established. While a conventional Delphi will obtain conclusions through reformulation and does not discuss those eliminated ideas and opinions further during the convergence process, we not only selected the strategic foresight proposals favored by the experts, but also allowed the moderator to participate in the last session of panel discussion that addressed those opinions eliminated earlier in the preliminary stage of contest.

4. Results

4.1. Results from step 1

As a result from step 1, we propose the following two sets of questions to be addressed by the EUPs, i.e., the contestants:

1. Why are Apple's products so successful? What can Taiwanese electronics companies learn from Apple? Is Apple too successful to compete against?
2. Can Taiwanese electronics companies overcome this tough challenge? What are the feasible strategies, such as outsourcing, branding, hardware, software, tangible products, or intangible services? What operating models and business strategies do you recommend?

4.2. Results from step 2

The public invitation to the contest was well received by college and graduate students in Taiwan. In total, there were 62 teams comprised of 308 college and graduate students from 22 departments of 18 universities that submitted their foresight proposals. However, it is to be noted that 90% of the participants were from management colleges, and among them, the majority were from department of international business, as shown in Fig. 4. The fact that 90% of participants were from a management background did surprise us at first. It could be suggested that students from Management College are less versed in technical aspects of information and communication technology (ICT). Thus, foresight strategies proposed by many of the teams might be vulnerable to the ignorance of technical capability or intellectual property of Taiwanese PC OEM firms.

4.3. Results from step 3

The 62 proposals submitted were reviewed and classified into 10 categories as shown in Table 2.

In the preliminary stage of the contest, there were 14 teams that focused their strategy on brand and service innovation. However, in the final stage of contest with six teams left, only one team proposed the strategy of brand and service innovation while three teams emphasized their strategies on marketing in China and the third world countries. This contrast reveals the gap of perception between the contestants and the experts. A high percent of EUPs regarded brand and service innovation as a vital strategy for Taiwanese PC firms; yet the experts generally preferred and believed that strategy focused on marketing in China and the third world countries is more crucial.
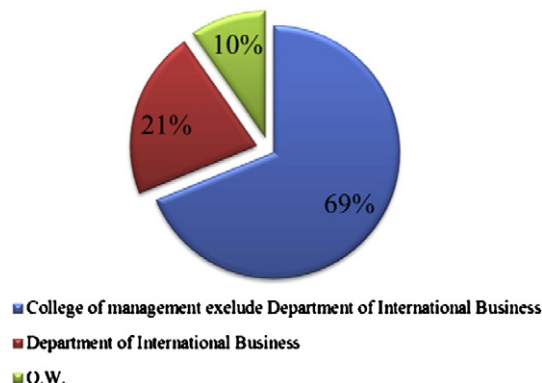

- College of management exclude Department of International Business
- Department of International Business
- O.W.

Fig. 4. Proportions of the participants' varying backgrounds.

Table 2
Number of teams with each strategy proposed.

Strategy	Explanations	Preliminary contest	Final contest
Brand and service innovation	Develop brands and relevant technologies to improve brand value.	14	1
Brand and focus on foundry	Develop brands and manufacture original equipment for relevant industries.	5	1
Focus on marketing in China and the Third World	Deploy major markets in the Third World and China.	5	3
Focus on cloud technology and related hardware/software	Focus on cloud technology and relevant hardware/software.	6	1
Focus on culture innovation and related hardware/software	Focus on cultural innovation and relevant hardware/software.	9	0
Follow government policies and intellectual property development	Follow the current industry polices implemented by the government, and improve the applications and development of intellectual property.	1	0
Transform to the green industry	Integrate green industries and diversified consumer electronics.	4	0
Cooperate with Android	Collaborate closely with Android.	2	0
Combine Taiwan's PC ecosystem with large-scale industries	Conduct vertical and horizontal integration throughout Taiwan's electronics industry.	2	0
Elimination	Includes plagiarizing documents (PowerPoint) available on the Internet or proposing content not related to the topics.	15	0

4.4. Results from Steps 4

The six teams with the highest scores were invited to advance into this final stage of the contest. Interestingly enough, after the extensive direct dialogue between the committee of experts and each of the final six teams, the experts came to a consensus and awarded the first place to the team that focus their strategy on brand and service innovation. This phenomenon vividly showed that the committee of experts had revised their opinion from the exchange of viewpoints with the young contestants.

4.5. Syntheses of the results

The two groups of participants, namely the committee of experts and the student teams, proposed two possible scenarios, brand and service innovation, and focus on marketing in China and cloud technology. Because the two groups did not agree the most about the strategy of focusing on cultural and creative industry related hardware/software, the moderator had then conducted another panel discussion with the experts regarding this topic. In this paper, we report the three highest ranked strategies according to the level of agreement and present them below.

4.6. Brand and service innovation

The EUPs suggested that Taiwanese manufacturers should develop software applications and various service models, such as backup services in cloud hardware, network address book backups, mobile communication services, travel information services,

Table 3
Brand and service innovation.

Brand/ service innovation	Experts' view	EUPs' view
Unique views	• Strategies proposed by EUPs were too disjointed to be converged into one practical strategy. • Taiwanese firms should not develop brand and service innovation simultaneously because they require different core competences • Service innovation should begin with integrating with traditional energy industries, business consultation, and energy-saving verification.	• Taiwanese manufacturers should develop software applications and various service models • Asus can enter the cloud through its strong R&D capabilities in hardware • Acer can further develop its own brand by integration with mobile communication firms.
Shared views	**Forecasts of the future:** • Apple's i-products will definitely dominate the world in the future. • Taiwanese manufacturers will gradually transform from being dependent on Wintel to depending on Apple and Google. • Taiwan's PC ecosystem should apply platforms to cloud within each system • Asus's and Acer's divisions of their brands from their OEM business become a role model for others. • **Actions recommended:** • Brand marketing: Providing diverse brands to effectively design, price, set specifications, and deploy after-sales services • Channels: Using a low net-profit model that shares profits with distributors, instead of using direct sales through the company's own channels • Service innovation: Sell assembly lines to other countries, build factories for small- and medium-sized enterprises in emerging markets, introduce software, and attract more clients for Taiwan • Demand creation: Cooperate with local operators globally	

Table 4
Focus on marketing in China and cloud technology.

Marketing in China/cloud technology	Experts' views	EUPs' views
Unique views	• India and China were two different emerging markets • With limited resources and the immediate impact of iPad, short-term investment in India should not be considered.	• Focus on niche markets in emerging countries, like India, using low-priced products to circumnavigate the highly competitive Western markets • Opportunities exist to create own brands. • India is a market that firms must invest immediately
Shared views	**Forecasts of the future:** • The Western markets will be dominated by iPad. • The prosperity of the emerging countries increases the potential demand for consumer electronics. • Without close cooperation with Wintel, firms in Taiwan's PC ecosystem would not have prospered. • Taiwan's PC ecosystem has appropriate flexibility and speed to meet the change • China will become the largest single market in the world. With cloud technology, Taiwan has the advantage of sharing a common culture and ethnicity with China • **Action Recommended:** • Firms can refer to the method of Acer in obtaining the rights of using China's existing brands and distribution channels	

hospital information services, e-books, and video services. They pointed out that, in the future, tablets will be able to connect to all sorts of services, thus constructing a novel computer ecosystem. In this regard, hardware will become an end tool to connect to the cloud. Taiwan's top three PC manufacturers, Acer, Asus, and Quanta, have accounted for the largest global Notebook PC output in the past; however, they lack experience in the software market. Therefore, the EUPs believe that Asus can enter the cloud through its strong R&D capabilities in hardware, and Acer can further develop its own brand by integration with mobile communication firms.

Conversely, our invited experts believed that brands and services could not coexist, and that they should be discussed as two separate issues. Currently, Taiwan's manufacturers cannot develop brand and service innovation simultaneously because brands and services require different core competences. Acer and Asus had separate brands and services, which indicates that pursuing services and innovations simultaneously is difficult. Regarding brand and service innovation, the expert committee is of the opinion that strategies proposed by these teams were too disjointed to be converged into one practical strategy. The experts suggested that future service innovation should develop energy services that begin from the perspective of energy saving and integrate traditional energy industries, business consultation, and energy-saving verification.

Through a comprehensive discussion, both the EUPs and the experts agreed that Apple's i-products would definitely influence the world in the future. Taiwanese manufacturers will gradually transform from being dependent on Wintel to depending on Apple and Google. Furthermore, the EUPs and the experts agreed that Taiwan's computer ecosystem should apply platforms to cloud within each system to enable end users to use tablets for saving and accessing digital content from the cloud.

Both the EUPs and the experts believed that the experience of Asus and Acer in dividing their brands from their outsourcing business can provide a reference for manufacturers in Taiwan's PC ecosystem regarding brand innovation. Separating brands from outsourcing business can reduce customer suspicions of the profit from brand outsourcing, and can further concentrate resources on brand marketing channels. Regarding brand marketing, by providing diverse brands, companies can effectively design, price,

Table 5
Focus on cultural and creative industry and related hardware/software.

Cultural and creative industry and related hardware/software	Experts' views	EUPs' views
Unique views	• Whether traditional paper books are replaced with e-books is determined by the content of e-books and the convenience of e-book platforms. • E-book displays are not a key factor in developing the industry • The trade platform of e-book copyright is more vital than the display technology. • Cooperation with digital leisure and entertainment industry is more profitable than in other sectors in the cultural and creative industry	• Traditional paper books will gradually be replaced with e-books, and tablets will dominate the potential market of e-book displays. • Manufacturers can take this opportunity to establish new brands or constructing patent portfolio in the field of e-books manufacturing.
Shared views	**Forecasts of the future:** • The platform for cultural and creative industry could be established with government's support, but its success depends on the degree of culture access • Cultural and creative industry will be localized and customized to enhance the value added of each market. • The digital leisure and entertainment industry will grow much faster than that of other sectors in the cultural and creative industry **Action Recommended:** • Cooperating with digital leisure and entertainment industry	

set specifications, and deploy after-sales services, which is beneficial for establishing a clear target for brand marketing. Regarding the channels, a low net-profit model that shares profits with distributors is recommended instead of direct sales or sales through the company's own channels, that is, manufacturers only reserve a certain proportion of net profits and give the rest to distributors. This method is expected to facilitate cooperation and earn trust from distributors. By establishing e-platforms, suppliers are connected with distributors and can access all the information on sales in channels, stocks, cost structures, and manufacturing schedules.

Regarding service innovation, to reduce the stress of international brands slashing prices, manufacturers of original components can sell assembly lines to other countries, build factories for small- and medium-sized enterprises in emerging markets, introduce software, and attract more clients for Taiwan component suppliers; to create demand for computers, they can cooperate with local operators and integrate channels and services. For example, Quanta coordinate with Taiwan's largest telecoms operator, Chunghwa Telecom. With the operating system and the broadband network of Chunghwa Telecom, the manpower of Chunghwa Telecom Laboratories, the servers of Quanta, and their experience of manufacturing the hardware of storage systems, Quanta and Chunghwa Telecom cooperate to build cloud application services. From the infrastructure of the software platform to the application services and total solution projects, they promote software as a service (SaaS) related to ICT.

4.7. Focus on marketing in China and cloud technology

The EUPs suggested that manufacturers in Taiwan's PC ecosystem focus on niche markets in emerging countries. Although the GDP in these countries is still growing, the consumers are sensitive to prices and tend to buy low-priced products. Moreover, introducing products to India and other emerging markets can circumnavigate the highly competitive Western markets, and may present opportunities to create own brands.

The experts thought India and China were two different emerging markets based on a number of conditions. Chinese entrepreneurships are supported by the government, whereas private enterprises in India prosper without governmental assistance. China controls investment in fixed assets, whereas India suffers from insufficient capital. China welcomes foreign investment and excludes those not conforming to the power structure; India rejects foreign investment and overly protects domestic enterprise. No capital market exists in China; the Indian capital market is superior to those of other emerging countries. Thus, these two countries adopt different entry strategies. Moreover, China and India have different languages, cultures, manpower, and local partners for collaboration (which cannot be achieved rapidly).

Although the EUPs regarded India as a market that must invest immediately, the experts suggested that the consumer behavior and infrastructure in India is different to that in China. Instead of short-term investment, potential profits should be emphasized. With limited resources and the immediate impact of iPad, short-term investment in India should not be considered.

Both the EUPs and the experts agreed that the potential Western market is occupied by iPad, whereas the emerging countries are focused on joining the specialization chain of global trade, resulting in rapidly growing GDP. The growth of the global economy depends on the economies of emerging countries. The prosperity of the emerging countries increases the potential demand for consumer electronics.

Both the EUPs and the experts believed that without close cooperation with Wintel, the high-tech industries in Taiwan would not have prospered. Although the high-tech industry is changing continuously, Taiwan's high-tech industries have appropriate flexibility and speed to meet the industry demands. Currently, the U.S. obtains everything because the U.S. market is the largest in the world. However, in the near future, China will become the largest single market in the world. With cloud technology, we have the advantage of sharing a common culture and ethnicity with China.

In summary, joining the emerging markets is feasible. From the experience of entering China's market, most Taiwanese firms have learned that entering a new market requires an understanding of local customs and culture. This study suggests that Taiwanese manufacturers refer to the method of Acer, which obtained the rights to use the brand and distribution channels of the second largest computer brand in China, the Founder Technology, through a leasing agreement in August 2010. In that model, Acer can concentrate on their strength of product research and development; while the local operators are responsible for market sales and brand development.

4.8. Focus on cultural and creative industry and related hardware/software

In the preliminary stage of contest, nine proposals about focusing on cultural and creative industry and related hardware/ software were proposed. However, all these proposals were eliminated by the expert committee. Therefore, in Step 5, the moderator brought up this topic again in a discussion with the experts to understand why these proposals were not favored by the experts despite of their popularity among the EUPs.

The EUPs believed that traditional paper books will gradually be replaced with e-books, and tablets will dominate the potential market of e-book displays. Therefore, as a market pioneer, manufacturers can establish new brands or apply for patents related to manufacturing e-books.

The experts pointed out that the opinions of the EUPs were inclined toward hardware, namely, the EUPs regarded e-books as an e-book display industry. However, whether traditional paper books are replaced with e-books is determined by the content of e-books and the convenience of e-book platforms. If all manufacturers develop their own e-book platforms, the users will be limited to using certain platforms when searching for e-books. For example, the Kindle Store of Amazon only offers Kindle e-books, and all the e-books are protected by a copyright form (.AZW).

E-book displays are not a key factor in developing the industry. The trade platform of e-book copyright is more vital than the display technology, which includes protecting digital rights management (DRM), presenting a preferable layout for users, and sharing profits with copyright owners. Numerous e-book-related enterprises consider these to be the most disturbing issues.

Because regulations and attitudes toward copyright vary across nations, copyright and e-book downloading still presents problems. China has numerous illegal e-book websites, and people can use vertical search engines to extract numerous illegal resources on the Internet. Other empirical results proved that other countries also use search engines to avoid legal risks.

Although China is a potential market, illegal copies and copyright are difficult problems to resolve. The experts suggested that investment in leisure and entertainment innovation is more beneficial than in cultural innovations because of the minimal profit return. Therefore, they believed that the market cannot mitigate the impact of tablets.

5. Conclusion and discussion

5.1. Conclusion

The emergence of tablets has threatened the prospects, if not the existence, of Taiwan's PC ecosystem. In this study, we proposed a modified Delphi model with participation from end-users to conduct a strategic foresight for the sake of Taiwanese PC related firms. To involve students with the foresight project, we hosted a foresight case competition through collaboration with the Chinese Society of Management of Technology (CSMOT). Our foresight project proceeded mostly in the spirit of a Delphi in five steps. The final conclusion was accomplished through this series of intensive interaction among two committees of experts and 62 teams of students. Three set of strategies were finally adopted by the committee of experts as most plausible for Taiwanese PC OEM firms in their effort to sustain or even to grow in the post Apple iPad's era.

5.2. Discussion

During this foresight project, we have come to three observations on the proposed method as follows:

5.2.1. Strength of the modified Delphi with EUP
This modified Delphi could reduce the possibility of personal subjectivity bias restraining strategic foresight. We published all the project titles proposed by the competing teams on the Internet to stimulate reference effects among the participants. This encouraged the participants to be ambitious and win the championship using their creativity, instead of being misled by others' opinions. We believe that the modified Delphi used in this study increases the diversity of strategic foresight opinions, dramatically simplifies the research process, and reduces the research time. During the final stage of contest, the experts discussed, scored, and made final conclusions with the six teams. During this process, the experts directly communicated with each other and explored their opinions. When the experts heard opinions from other experts, they could strengthen or adjust their opinions. This study also appointed one expert to be the convener. The convener clarified and compiled the expert opinions and conducted panel discussions regarding the strategic foresight projects proposed by the contest teams.

5.2.2. Background of participants does make a difference
It is worth noting that almost 90% of the participants were from management colleges. Among them, most were from the Department of International Trade. This indicates that students learning international trade could be more sensitive and concerned about industrial development trends and their impact. However, the six teams advanced into the final stage comprised of students from technology management-related departments (Fig. 5). This is a surprising but understandable result, which
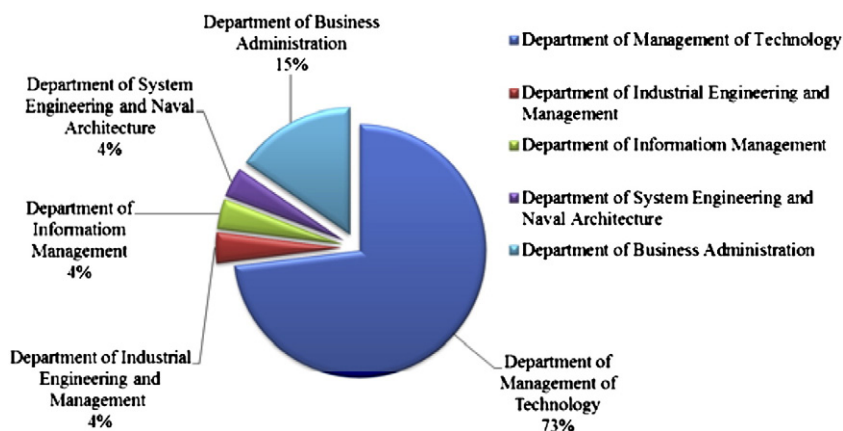
Fig. 5. Proportions of the varying backgrounds of the participants in the final contest.

could be caused by the emphasis on training in each of the departments. The focus of training in international trade seems to be international commerce and strategic marketing for enterprises; whereas the department of technology management emphasizes industrial analysis, strategic foresight and deployment, and innovation management.

5.2.3. A better approach of strategic foresight for consumer electronics or fashion products

To face an uncertain future, developing resolute judgments and responsible projects are the aim of strategic foresight. Effectively implementing strategic foresight requires experts and the effective design of procedures. To make effective decisions, experts must have professional knowledge. However, these experts may be limited by their knowledge and experiences, neglecting the new trends produced by the changing environment. Regarding procedure design, conventional Delphi emphasizes the convergence of expert opinions, which focuses on the compromise among experts and may neglect new key factors occasionally. This study expands on conventional Delphi by incorporating a group of young inexperienced experts. The modified Delphi of this study hosted two rounds of discussions between traditional experts and young people from the target consumer group. We suggest that this Delphi approach modified to include end-user participation can be superior to conventional Delphi approaches for developing strategic foresight regarding shorter life-cycle products, such as consumer electronics or fashion products.

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