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TECHNOLOGICAL CONVERGENCE OF CONSUMER ELECTRONICS PRODUCTS A STUDY OF CONSUMER BEHAVIOR AND BUSINESS STRATEGY TOWARD VALUE CREATION

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Abstract—Technological convergence creates an evolution for different technological systems to evolve toward performing similar tasks. Those tasks were previously performed in separate devices, which now can be integrated into one integrated device. Separate technologies such as voice (and telephony features), data (includes basic office tasks and other productivity application) and video now share resources and interact with each other synergistically. Learning from case by case of three major converged products in the consumer electronics industry, it is a certain that in the 21st century is fast integrating the world's media, telecommunication and information technology and online industries under a single platform. The consumers themselves are getting more educated and aware for his condition, while they are purchasing the products not only by its price, but starting to consider the key feature and value benefit which offered by the brands for them. On the consumer choice pattern it is certain that the acceptance of the concept of technological convergence might not be applied to the entire product yet by seeing case by case among product tested, it could bring some evidences that the key convergence feature has not yet absorbed by the diverged products. However, it still indicates that there will be a time when the quality of converged features are over the diverged one, which can result that a consumer will choose to use the "multi-feature" device instead of a singlefeatured device. The stages that have led to the transformation of digital convergence have left an impact with the passing of each era of the timeline. Comparing to the last decade, in this era, software and services are become a major part required to win the competition within the converged products.

Keywords: technology, convergence, media, marketing, strategy, value

I. INTRODUCTION

The term technological convergence is often defined in a very generalized and simplified terms as a process by which telecommunications, information technology and the media, sectors that originally operated largely independent of one another, are growing together.

By its definition, technological convergence in the last few years enables different technological systems to evolve towards performing similar tasks which resulted in invention of devices that not only interact

with the media they are primarily designed to handle, but also with a number of other formats. In the past, for example, each entertainment medium had to be played on a specific device. Video was played on a television by using a video player of some sort, music was played on a tape deck or compact disc player, radio was played on an AM/FM tuner, and video games were played through a console of some sort. Similarly, different communication media used their own technologies. Voice conversation was carried on using a telephone, video communication briefly used highend video phones, facsimile copies used fax machines, and e-mail used a computer. But now, the appliances evolves to make life easier, for example, the Xbox video game console has as its primary purpose the playing of console games, but it is also able to play back video and music and to connect to the Internet. Similarly, most modern DVD players are capable of not only playing DVDs, but also of playing music CDs, displaying photos from photo CDs, playing encoded video in formats such as DIVX or VCD, and playing DVD music.

In today's world, internet is an important tool used to reach various audiences around the world. Its users have striven to create more uses for the Internet than the mere sharing of academic information. The television, radio and newspapers are the world's main mediums for accessing news and entertainment. Now, all three mediums have converged into one, and people all over the world now can read news on the Internet. They can also watch videos, television shows, listen to music, and download and upload pictures, music and videos. One doesn't have to wait until the next day to hear the latest in news, fashion, and music. The Internet is so easy to access that should anything happen, it would be displayed to the whole world within minutes. The internet is the simplest way to describe the media convergence.

Media convergence, in this case the internet advancement, has lowered barriers of entry to the market for new operators and service providers. The emergence of new market players intensifies competition, giving consumers an extensive pool of providers and services to choose from and lower communication costs. Additionally in a technological convergent environment industry boundaries become blurred, allowing service providers to offer services in multiple markets. For example, besides access to television, cable operators can also offer voice telephony and internet services. Content providers can now easily access consumers with no need to own the distribution network. As barriers to market access are significantly reduced, allowing an increased number of new players to enter the market and provide a wide variety of different service packages, established operators and services providers are required to reassess their business models and strategies not only to face these new providers, but also to upgrade their networks to integrate it into their own offering. Another challenge lies in convincing consumers of the value added by the new services for which they must

New applications have given rise to new ways of entertainment (i.e. online gaming) and socialization (i.e. chat rooms). The convergence of voice, video and data gives consumers new ways of communication as we can all talk, send text and video over one single network, using one single application at much lower costs than before.

II. BUSINESS ISSUE EXPLORATION

Nowadays, Software is becoming an ever more important part of CE products. Most embedded software is developed by the product maker or under his control by smaller companies. Operating systems are in the hands of large (U.S.) companies, in particular Microsoft for desktop PCs, or owned by (consortia of) smaller ones, like the EPOC platform for personal organisers. Applications software comes from many companies, large and small alike.

The shift from hardware functions to software on the one hand, and the changing roles between the three kinds of software (embedded software, operating systems, application software) on the other, cause fierce battles between the major competitors. These confrontations have attracted much publicity in the PC world, but similar, less visible struggles take place in mobile telephony and digital television.

"Content" is now become critical for many CE products. It comes from sources all over the world, and Europe has a good position in certain areas. Content is delivered in various ways (i.e. broadcast, on discs, online) by many companies. Likewise, services play an increasingly important role in the CE markets. Especially in this area, many new entrants are operating with considerable success.

A. Conceptual Framework

From the consumers' side, technological convergence bring benefits to make tasks become easier and faster. Beside making the life easier, the consumers at the end of the chain, enjoys the benefits of price reduction due to more efficient in terms of economies of scale from technological convergence, which enables the manufacturers to produce less kind

of products, which resulted on 'converged products'. Those converged products are manufactured in a larger number than before which creates economies of scale. Finally, the increasing popularity of CE, and the conscious efforts of the manufacturers, resulted in ever-larger production series at the level of key components as well as of final products.

Technological convergence are mainly aimed to enable the users to access all media content trough one device. As such, media business practice has been to identify the next device to invest in and provide media for. This has caused a number of problems. Firstly, as device are invented and abandoned, the individual is left with numerous devices that can perform the same task, rather than one dedicated for each task. For example, a person may own both a computer and a video games console, subsequently owning two DVD players. This is contrary to the streamlined goal of the device theory, and instead creates clutter.

Secondly, technological convergence tends to be experimental in nature. This has led to consumers owning technologies with additional functions that are harder, if not impractical, to use rather than one specific device. For example, Intel has created a surfboard with an in-built laptop. Additionally, LG has created a microwave with a television screen. Many people would only watch the TV for the duration of the meal cooking time, or whilst in the kitchen, but would not use the microwave as the household TV. These examples show that in many cases technological convergence is unnecessary or unneeded. Furthermore, although consumers primarily use a specialized media device for their needs, other device devices that perform the same task can be used to suit their current situation

Consumer behaviour theorists generally believe that consumer behaviour theories can be applied globally but consumer preferences and tastes are influenced by their cultural background (Schutte and Ciarlante, 1998). Therefore, marketers and business practitioners have to recognize that consumers attitudes and beliefs, preferences, needs and tastes towards certain products or services are greatly influenced by their culture and the society they belong to. For instance, consumers in other parts of the globe may consider price as the most important determinant in their decision to buy certain products, whereas, in others, they may consider quality, simplicity or certain feature attached to the products as the most important factor that may affect their choices. Other factor that may surface could also the place to buy for certain products. As we might acknowledged that technological convergence and transformation to digital eras has also create transformation to the retailing type of consumer electronics products which shifts the consumers attitude toward their place to buy. Years ago in Indonesia, when the technology is not so advanced as today, consumers tend to buy electronics products in traditional stores. However now, manufacturers also offered more advanced method of selling, through the penetration of modern channel, which enables potential users to have more engagement to the products they want to buy. Despite all these uncertainties, marketers or businesses still invest a lot of money in their marketing plans to indulge consumers to buy their products or services. This is an on-going process that they have to deal with in order to meet consumers specific needs and preferences. It is not enough to offer a variety of products, but the true gain in business platform is how to sustain profit and survive in the marketplace by satisfying consumers needs and wants relative to the value of the offerings.

Hence, this research will assess the question as follow regarding to the consumer choices which is there any relationship between products' key convergence features, price, and place to buy toward the purchase intention or choice pattern for consumer electronics products.

B. Method of Data Collection and Analysis

AfterThe framework of this research will be developed based on stochastic models of brand choice and purchase incidence as modified by Jones and Zufryden (1980). In their research, Jones and Zufryden used the demographic variables, i.e Household Income, and the number of children in a household) and price dimension (marketing mix) as explanatory variables, which aimed to predict the brand choice or purchase driver using logit model estimation. For this research, the framework will be based on Figure 1 below.

Explanatory Variables Criterion

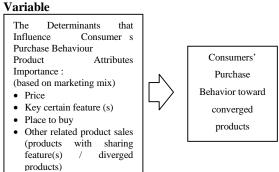


Figure 1. Research Framework

The explanatory variables were categorical data, while the criterion variable was metric data. Jones and Zufryden's model was adapted due to its flexibility, while as suggested by the authors who developed the model(Jones and Zufryden, 1980). However in this current research framework, demographic variables are omitted to this analysis, hence focused only on the product attributes, i.e price and key features, the retailer type and other products with sharing features has been added to the model. In contrast to Jones and Zufryden's model, the current research framework was tested using standard multiple or multivariate regression procedures and least square method to determine the linear relationships among all sets of variables used in the research. This was because the data used in this research were metrics for both the explanatory and the criterion variable.

Based on above argument and discussions in the literature, the hypothesis will be as follow:

- H1a: There is a relationship between price of the products to the consumer choice.
- H1b: There is a relationship between key feature(s) existence toward consumer choice.
- H1c: There is a relationship between the type of retailer (place to buy) toward consumer choice.
- H1d: There is a relationship between other products (diverged products) existence toward the consumer choice.

As this research is aimed to assess the determinants of converged products, first it is necessary to create groups to divide between converged and diverged products then define the similar feature between the products and define which products cannibalize what products. Hence the definition will be as on the table below:

below.					
			Diverged (cannibalized)	Key shared feature	
		1.	Video Games Consoles	Games	
1.	Smart-Mobile Phones	2.	Portable Media Player	Music Player	
		3.	Digital Camera	Image Capture	
		4.	Car Navigation (GPS)	Navigation	
,	Audio Home System (includes docking	Rad	lio Recorders	Music Player	
2.	station and home theatre)	DV	D Player	DVD Player	
3.	Webbooks/Tablet PC	1.	Portable Media Players	Music Player	
		2.	Video Games Consoles	Games	
		3.	Digital Camera	Video Capture	
		4.	Camcorder	Image Capture	

Continuing the steps above, Hence the empirical model for this research will be :

"Y=a+b1Price+b2Feature+b3Tradetype+b4SalesDiv+e"

While the definition of the variables are as follow:

- Y: Choice toward converged product, which are reflected by sales units of that particular converged product.
- 2. Price: Price of the product
- 3. Feature: Sales units and Price of the diverged product, which share the features with the tested converged product.
- 4. Tradetype: Place to buy, dummy variable, valued 0 for modern trade and valued 1 for traditional trade
- 5. SalesDiv Sales units of cannibalized (diverged) products which have the similar key features.
- 6. E: error terms

In this research, the author will use secondary data. However those data are divided into several kinds of data as follow:

1. Major Data

Major data is the main data that is used for this research, and become the part affecting the judgment of researcher in order to take the conclusion and recommendation. The types of data used are:

a. Retail audit data

Retail audit is Study of a selected sample of retail outlets, provided as subscription-based service by market research firms. Retail-audit service providers gather information on a brand's sales volume, sales trends, stock levels, effectiveness of in-store display and promotion efforts, and other associated aspects. In this research, researcher will use the retail audit data from GfK, which covers the five big islands in Indonesia, Java, Sumatera, Kalimantan, and Sulawesi, both urban and rural area. The retailer types covered are both modern channel and traditional channel. The usage of this data mainly to assess the significances across factors which affects the purchasing behavior.

b. Consumers' survey data

This survey is already done previously using the probability sampling method on certain numbers of respondents. The usage of this data is to support the modeling analysis and to give a quick insight toward consumer behavior in certain kind of products.

2. Minor / Supporting data

The minor / supporting data in this research are any kind of desk research data that are used for analysis, such as the penetration data and other sources of survey data that is used on this research.

C. Analysis of Business Situation

1. Smart and Mobile Phone

1. Smart and Woone I none					
Method Used : Three stages least squares					
Dependent Variable	Independent Variable(s)	Coefficient	Std.Error	P.Value	
	asp	-0.94391	0.540926	0.081	
Total SMB	dscsales	4.523477	2.636836	0.086	
Sales units	pmpsales	-22.778	21.79809	0.296	
Bares units	Trade	-1.03E+07	1098226	0.000*	
	vgcsales	1.066826	7.083185	0.880	
$R^2 = 0.8706$	Const	4464363	639930.5	0.000	
SMB With	asp	-0.9264	0.409218	0.024*	
Camera	dscsales	8.468094	2.884632	0.003*	
Feature Sales	trade	-8949952	992973.8	0.000*	
$R^2 = 0.9009$	Const	3543231	508192.9	0.000	
SMB with	asp	-3.20924	0.644988	0.000*	
Music	pmpsales	-92.1354	33.72594	0.006*	
Playback feature sales	trade	-1.11E+07	1309943	0.000*	
$R^2 = 0.9032$	Const	7165496	717443.7	0.000	
SMB with	asp	-1.30924	0.445968	0.000*	
GPS and	cnavasp	-0.01298	0.003638	0.002*	
navigation feature sales	cnavsales	16.00798	20.01551	0.435	
$R^2 = 0.9200$					

*) significant at 95% confidence interval

Variable information:

- 1. ASP: Average selling Price
- 2. Dscsales: Sales units of digital still camera products
- 3. Pmpsales: Sales units of portable media player products
- 4. Vgcsales: Sales units of portable video game consoles
- 5. Trade: Proportion (%) of modern trade

On the mobile phone case, based on the regression, it is founded that the technological convergence has happened in this product. However, going specifically for the key feature of camera, music player and playing games. Based on the analysis, it is founded that music player and navigation feature is going to be absorbed to the mobile phone. However, based on this model, gaming feature and photography feature or built in camera existence in the mobile phones, has not yet reach to a level when we can say it has became a significant demanded converged feature.

2. Home Theatre System

2. Home Theatre Bystem				
Method Used : OLS				
$R^2 = 0.9240$				
Depende nt Variable	Independent Variable	Coef.	Std. Err.	P. Value
	asp	0.00195	0.00351	0.582
	Rrpsales	-0.2168	0.09248 1	0.026*
Home	Rrpasp	0.01592	0.01582	0.323
Theatre Sales	dvdsales	0.07369	0.02597 6	0.008*
Sales	dvdasp	0.00263	0.05022 8	0.959
	trade	10084.9 1	7584.81 1	0.194
	_cons	17732.5 5	20327.1 7	0.39

Variable information:

- 1. ASP: Average selling Price for Home theatre system
- 2. RRPsales: Sales units of radio recorders products
- RRPASP : Average selling price of radio recorders products
- 4. DVDsales: Sales units of DVD players products
- DVDASP : Average selling price of of DVD players products
- 6. Trade: Proportion (%) of modern trade

Based on the model result, it is found that sales of the diverged products, i.e. radio recorders and DVD players are the significant determinants of Home theatre sales. In this case, we can conclude that technological convergence has started to happen in this particular product. From the price side, the consumers of this kind of products are most likely less elastic, which means that those who are in the middle to upper socio economic class, who are the main target of this kind of products. In the end, we can say that selling price is not necessarily one of the important factor for consumers to purchase home theatre system. Among the diverged products, Hence, we can see that people are making the purchase of home theatre system because they are more attracted to the convergence and quality improvements of the feature, which are not offered by their previous diverged products, which is the DVD player and radio recorders. At last, combining all of the information we had, we can conclude that the home theatre system is proven to be a successful converged product in the consumer electronics industry.

3. Webbooks / Tablet PC

Method	R ² : 0.9026				
Dependen	Independent				
t Variable	Variable	Coef.	Std. Err.	P> t	
Webbook	wbkasp	0.00793	0.00150 8	0.000	
s Sales	spsales	ı	0.01407	0.067	

		0.02754	4	
		0.02734		
	spasp		0.01651	0.006
		0.02912	2	0.096
	pmpsales	4.60245	2.09859	0.042
		4	8	*
1	pmpasp	0.01019	0.00829	
		2	5	0.236
Ì	, ,	1.18068	0.27785	0.001
	dscsales	1	3	*
	dscasp	0.00276	0.00441	
		2	2	0.54
	Netsales	1.38528	0.16673	0.010
		3	2	*
Ī		0.00276	0.00389	
	netasp	2	2	0.48
	camasp	0.00157	0.00152	
		5	2	0.315
l	camsales		1.57949	
		0.84318	9	0.6
1	vgcsales	2.60245	2.05453	0.015
		4	9	*
[vgcasp		0.00725	
		0.54528	5	0.055
[35580.3	
	_cons	66901.5	6	0.077

*) significant at 95% confidence interval Variable Information :

- 1. Wbkasp: Sales units of webbook products
- 2. Spsales: Sales units of smart phones products
- 3. Spasp: Average selling price of smart phone products
- 4. Pmpsales : Sales units of portable media player products
- Pmpasp: Average selling price of portable media player products
- 6. Dscsales: Sales units of pocket digital camera products
- Dscasp : Average selling price of pocket digital camera products
- 8. Netsales: Sales units of netbook computers products
- Netasp: Average selling price of netbook computers products
- 10. Camsales: Sales units of camcorder

Based on the model, it is a clear view that webbooks products has been a fully converged products, as the consumers are considering the price and features that are offered. The feature of voice and text communication, as well as taking photograph, video and internet browsing has converged successfully into this product and the value has delivered to the consumers.

III. BUSINESS SOLUTION

The Convergence has lowered barriers of entry to the market for new operators and service providers. The emergence of new market players intensifies competition, giving consumers an extensive pool of providers and services to choose from and lower communication costs. Additionally in a technological convergent environment industry boundaries become blurred, allowing service providers to offer services in multiple markets. For example, besides access to television, cable operators can also offer voice telephony and internet services. Content providers can now easily access consumers with no need to own the distribution network. For example, a company may produce TV content and distributed it through cable networks without having to own it.

Learning from case by case of three major converged products in the consumer electronics industry, it is a certain that in the 21st century is fast integrating the world's media, telecommunication and information technology and online industries under a single platform. Globally the communication industry is undergoing a transformation owing to technological advancement and massive investment flows, leading to revolutionary changes in the digital eco-system. The consumers themselves are getting more educated and aware for his condition, while they are purchasing the products not only by its price, but starting to consider the key feature and value benefit which offered by the brands for them.

On the consumer choice pattern it is certain that the acceptance of the concept of technological convergence might not be applied to all of the product yet. If we go through case by case, among those three products that we discussed earlier, it could bring some evidences that the key convergence feature has not yet absorbed by the diverged products. However, it still indicates that there will be a time when the quality of converged features are over the diverged one, which can result that a consumer will choose to use the "multi-feature" device instead of a single-featured device. The stages that have led to the transformation of digital convergence have left an impact with the passing of each era of the timeline. Comparing to the last decade, in this era, software and services are become a major part required to win the competition within the converged products.

IV. CONCLUSION AND IMPLEMENTATION PLAN

Facing the converged world with more aware consumers of the value of going into the digital convergence, challenges may appeared ahead for the brand manufacturers to utilize their capability to create and develop strategy to win the tough competition ahead. As the market is also going to be more converged, in this modern world of technology, manufactures has to combine their marketing strategy with cooperation as well.

A. Bundling as an alternative

Companies build customer-experience around the product by bundling strategy as a means of selling potentially separable to customers, as integrated system or bundle usually by collaborating with their B2B partners (Porter,1985). Core product and services are a bund (example:software-hardware maintenance package). This implies, manufacturers should combine sales-leadership and deliver specialized service. For example in this case, Blackberry in its initial launch in Indonesia collaborated with network providers to create a new way of unlimited internet browsing in mobile 3G networks, which exclusively only for blackberry devices. The use of bundling strategy could also be useful to sell a diverged product which already experienced the dawn stage of its product life cycle.

B. Vertical Integration as the tool to reduce cost

In the modern converged world, everyone can get the same technology now, supported by a globalized world. However that doesn't mean that they can make an advanced product. In this case outsourcing the manufacturing will cause a high cost which resulted in reducing the competitiveness. Through controlling the manufacturing process, especially for the core component of a device, a manufacturer can reduce significant transaction cost. Learning from Samsung, through investing to component manufacturers, to reduce the transaction cost and monitor the research and development and opening several factories in China and India, the company is able to utilize the benefit for the low cost labor, especially for technology sector. In addition, Samsung is able to utilize the outsourced materials efficiently, through maximizing the combination or customization of most components to its clients. For example, they made a special order for Dell, Microsoft and Nokia with a unique specification, which resulted in they charged more to their clients and gain more from it.

C. Product Leadership Strategy

Hardware development itself has their own challenge, as the tension of the competition is increasing by the time. Product leadership through diversification are a good strategy to win the competition. As the price war usually ended with a non-profitable condition especially for new entrance or growing company. In the case of Samsung, they choose to spread their own portfolio by making entrance to several kind of sectors, while the other electronics company choose to stay focus on one sector, i.e Nokia for cell phone and Intel for processor. By entering multiple sector, Samsung is able to take advantage from the different product life cycle and gaining a sustainable advantage through it. Combining with their strategy in making hardware component, by entering multiple sector, they have the expertise and possibility to have a partnership with more companies in that particular sectors.

To ensure for success, this kind of strategy has to be supported by an effective and efficient research and development team. As the innovation is the key, creating a disctinct product which offers more advanced technology or features are good tools to take the pie on the market. Samsung done several breakthrough in product innovation, as they create a memory chip which are commonly used by many electronics manufacturers, or for consumer products, Samsung creates an innovation by introducing the cell phone with a colour screen and develop TV with a brighter contrast. A technological breakthrough done by Samsung in the LCD TV products has attracted Sony to make a partnership. Again Samsung gain advantage of sharing the cost, due to economic of scale by manufacturing a product in mass scale. This made Samsung became a product leader in LCD TV has. The other benefit of digital product innovation strategy or product leadership strategy is the ability to control a price temporarily for a certain time until the competitor reached the similar technology. A product with a new technology is able to be priced higher at the initial stage, this can resulted in a short term profit for the company

D. Marketing Strategy Implementation in Digital Convergence

If brand manufacturers are focusing its business to take a lead in the digital product, and aimed to take a digital technology leader position, the products that are manufactured has to be focused to the digital electronic products. The digital convergence itself are based on two trends, first is combining several technologies into one major product, or combining several technologies which are connected by a single network. For example, Windows Phone which are equipped with a Nokia Lumia smartphone, and an Samsung Galaxy Tab which have a capability to make a phone call.

Combining the product leadership through innovation, creates a way to create a market segmentation for mid-range and high end brand, which position the brand as a premium product in order to reach the target where all of the product lines reach the consumers in middle to upper class, as the product will be charged higher. In the last, we can conclude that in order to expand the market, a brand manufacturer has to maintain its brand and sell its innovative products with its own Brand, so the brand building is happened during the way of reaching the technology leader position.

E. Translating Consumer Engagement into Value

The idea of creating experiences that matter, rather than simply manufacturing devices, lies at the heart of competitive-ness in today's consumer electronics marketplace. It's actually not a new concept. Decades ago companies like Kodak and Polaroid understood that they were really in the business of creating memories, not just selling cameras and film. However, they were unable to truly deliver on that promise of an experience. Once past the marketing, it was still all – and only – about the product.

That context is essential when considering new ways to innovate and generate revenue. To drive smarter product and service innovation, consumer electronics companies must know as much as possible about how products and services are used and how customers integrate them into their lives. A 360-degree view of the customer on how they use a particular device as well as insight into their entire life-style is needed. For example, what other devices do they use? What are they saying about the company products? How do they use technology to interact with friends, family and colleagues? Looking beyond the offerings of a single company can paint a more complete picture of who customers truly are.

F. The Power of Market Research and Business Intelligence in Gathering the Efficient way to innovate in digital convergence era

An example of how the integration of insight into business processes can produce real gains is found in the experience of a leading telecommunications company. By monitoring social media, call records and other subscriber data in real time, then analyzing it, the company was able to predict churn and move proactively to increase customer retention. It engaged in targeted marketing that also boosted cross-selling of additional services. Now that the company have captured and optimized data to create insight, the next step is to make use of all the company've learned to transform how products and services are created and managed. The ability to achieve fast time-to-market with intuitive and – even more importantly– relevant offerings is a major factor in marketplace credibility.

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