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Description	一般論文

## 2B08 Product Technology Strategy of Flash Memory Card in Japan's Market

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### Abstract

The intense competition of Flash Memory Card in Japan's market stimulates a new trend. SD Card market share has passed its predecessor SmartMedia, and is projected to pass the pioneer, Compact Flash by the end of this year. Its interaction with digital camera (as major utilize device) explains the trend change in Flash Memory Card's market in Japan.

### I. INTRODUCTION

Many electronics and digital devices are getting smaller, but have 'better' functions, nowadays. Especially the portable gadgets such as PDA, Pocket PC, digital camera, and also mobile phone. Following that, not only smaller microchip that is needed, memory storage device, which enable the user to transfer the data from one device to other devices (or computer) is needed as well. And it requires small, no batteries, but big capacity memory storage devices. For portable memory storage data, floppy disk or CD is the only options we have before. With small size but big memory capacity (now it reaches GB unit), Flash Memory Card becomes the ideal partner for portable devices. Compact Flash, Memory Stick, MultiMedia Card, Secure Digital (SD) Card, Smart Media, and xD Picture Card are the options of Flash Memory Card's formats in the market now. Below is the chronology of product technology innovation of Flash Memory Card.

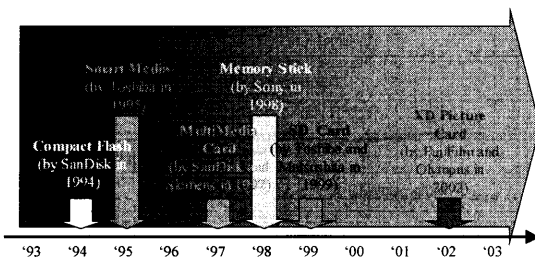


Fig.1. The Chronology of Flash Memory Card Innovation.

The objectives of this paper are: to analyze the market trend of Flash Memory Card in Japan, and investigate the main reason behind it.

### II. PRODUCT'S FEATURES AND CHARACTERISTICS

The close up features of each Flash Memory Card formats, concerning its technology, main user, advantages, and disadvantages are described as follows:

- (i) **Compact Flash** card has advantages as the pioneer in the Flash Memory Card product technology.. But its larger size makes it inappropriate for the smallest products, such as mobile phone.
- (ii) **Memory Stick** offers a reliable copyright protection environment so that users can securely record copyrighted content and at the same time, the rights of copyright holders can be protected. Memory Stick is used predominantly in Sony products. But, its over-dependency on Sony products can be boomerang for Memory Stick in the future.
- (iii) **MultiMedia** Card is used as removable memory solutions for portable devices, such as MP-3 music players, portable video games, laptop computers, personal digital assistants (PDAs), mobile telephones and digital cameras. One of the disadvantages of MultiMedia Card is it does not offer data security protection.
- (iv) **SD Memory** Card offers powerful security and copy protection (SDMI compliant).
- (v) **SmartMedia** Card's slim design limits its capacity. Other disadvantage is that SmartMedia is the only flash format with no current or planned I/O capabilities.
- (vi) **xD Picture** Card is the smallest memory card available. Since xD Picture Card is the latecomer in this industry, the use (applications) is still limited; FujiFilm and Olympus digital camera are the major users.

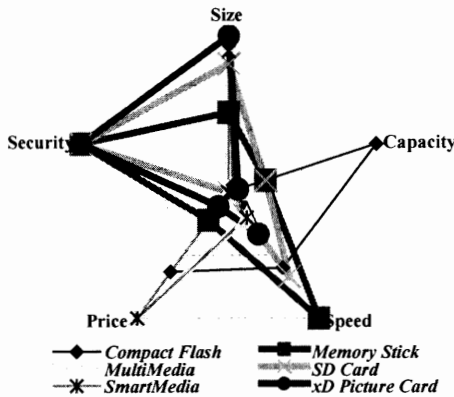
**Table 1** compares the characteristics of each format on Size, Maximum capacity, Speed, Price, and Security.

**Table 1 Flash Memory Card Format's Comparison Table**

Formats	Size	Capacity	Speed	Price	Security
	(mm)				
CF	43x36x3.3	4GB	9 mbps	2900	no
SM	45x37x0.76	128MB	3 mbps	2475	no
MS	50x21x2.8	1GB	15 mbps	3375	yes
MM	24x32x1.4	256 MB	3 mbps	2500	no
SD	24x32x2.1	1GB	10 mbps	3630	yes
xD	20x25x1.7	256MB	5 mbps	3375	yes

<sup>a</sup> CF: Compact Flash, SM: Smart Media MS: Memory Stick  
MM: MultiMedia, SD: SD Memory Card, xD: xD Picture Card

The radar chart of Flash Memory Card's characteristics is illustrated in Fig 2. The value was normalized by dividing it with the largest value for each category (except for size and price category, it was obtained by deducting the largest value with the chosen value, and then dividing it with the range value in that category).



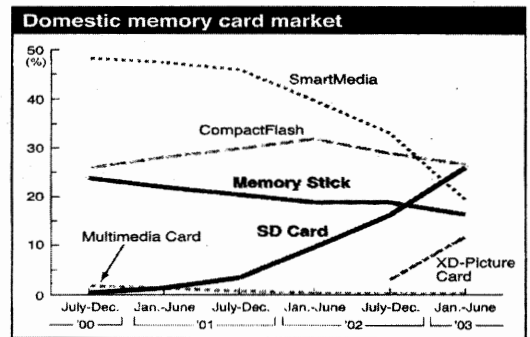
**Fig.2. Radar Chart of Flash Memory Card Characteristics.**

Since the portable devices are getting smaller as well, market demands smaller size for Flash Memory Card. In the size category, XD Picture Card is leading (With the size of 20mm x 25mm x 1.7 mm). This category is a handicap for Compact Flash Card. But with maximum 4GB memory capacity (8GB is even ready to be launched) Flash Memory Card is the leader in capacity category. With bigger capacity, more pictures or more music could be stored, and especially it will give

more advantages for digital handycam users. The new member of Sony's Memory Stick family, Memory Stick PRO media can write at speeds of 15mbps (fast enough to record DVD-quality video). Even if power is interrupted during recording due to battery depletion, data recorded up to that moment is not lost. With this media, users can efficiently and smoothly record massive volumes of data. The price of Flash Memory Card has been falling down recently. Seems the price range is not really differing for each format. Smart Media is the cheapest among the others, but it does not explain the slump of its market share in Japan (shown in chapter III). The question is whether security is needed for this technology. Hitachi spokesman says that a lot of digital content doesn't need to be secure when they launched smaller packages for MultiMedia Card in November 2002.

**III. PRODUCTS AND MARKET INTERACTION**

The concept of dominant design describes that one innovation stimulate many different products. But after a while there will be one dominant product that dominates the market. Fig.3 shows the Domestic (Japan) flash memory card market. Compact Flash Card, the pioneer in Flash Memory Card technology, is not the dominant product in the (Japanese) market now. SmartMedia was dominating the market few years ago (2000) their market share has been decline since 2001. What are quite interesting here are the stable market share of Compact Flash, and also the rapid growth of SD card. Now, SD card market share has passed its predecessors Memory Stick, and even SmartMedia, and about to pass Compact Flash (it is expected to surpass Compact Flash this year).



source: GfK Marketing Services Japan

**Fig.3. Japan Flash Memory Card Market.**

MultiMedia Card, though slightly thinner than SD cards is predicted to disappear from the market. Most manufacturers are building SD slots into their devices instead of slots for MultiMedia Cards, because the SD format offers faster read/write performance. SmartMedia has possibility to disappear too, because its slim design limits memory capacity and it is also the only flash format with no current or planned I/O capabilities, which is not favored by electronics makers to adopt the format.

#### IV. ANALYSIS

Flash Memory Card's characteristics and its interaction with the market (concept of dominant design) are discussed in the previous chapter. Flash Memory Card's characteristics seem not strong enough to explain why SmartMedia's market shares slump and the raising of SD Card. The main question is: What will determine the sales? Is it its interaction with the end user (consumer), or with the device utilizing it? The hypothesis is: Its interaction with utilizes devices will be the main factor defining its existence in the market. In case of Japan is digital camera. (The boom of digital camera in Japan market is one of the reasons as well)

Linear Regression Analysis is used to investigate the correlation between Flash Memory Card and digital camera in Japan's market. Market share of Flash Memory Card is used as the dependent variable, and the percentage of digital camera models utilizing it as the independent variable. The data is the (domestic) market share of each format Flash Memory Card from year 2000 (second semester) with six-month interval, and number digital camera models utilizing each Flash Memory Card format (from 18 makers company in Japan) in the market from year 1997 until the first semester of year 2003. In the case of MultiMedia card, the model will be neglected if it utilizing SD card (in the same slot).

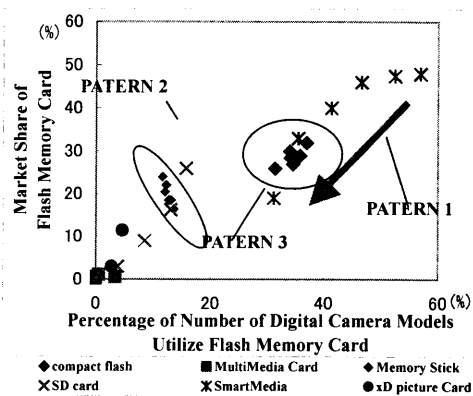
The results is illustrated in **Table 2**.

**Table 2 Regression Result**

a	b	adj. $R^2$	DW
0.81	3.70	0.89	2.57
(2.76)	(15.56)		

As the result we obtain adj.  $R^2$  value = 0.89, which is mean that percentage of digital camera models utilizing it, explains 89% of the variance. Furthermore, from correlation graph of Flash Memory Card market share with respect to percentage number of digital camera models utilizing it (shown in **Fig. 4**), shows an interesting pattern. Pattern 1 shows the declining slope of the number of models utilizing SmartMedia card. It is similar with the slump of SmartMedia market share. Pattern 2 shows the increasing number of models utilizing SD Card and xD Picture Card, which is similar with the format's market share growth. While Pattern 3 shows the stagnant growth of the number of models utilizing Memory Stick and Compact Flash, which reflects the stagnant change in its market share.

Based on those points, the percentage of digital camera models utilizing Flash Memory Card will be strong enough to explain the behaviors of each Flash Memory Card in the market.



**Fig.4. Correlation between Market Shares of FMC and Percentage of Digital Camera Models Utilize FMC (2000-2003).**

From the pattern 1, SmartMedia card is projected to lose their utilizer (digital camera), due to its competition with SD card and xD picture card. Makers such as Konica-Minolta, Ricoh, and Toshiba are shifing the memory media to SD card, while FujiFilm and Olympus are to xD picture card, which then stimulated pattern 3 (illustrated in **Fig.5**). Pattern 2 reflects the stable behavior of Compact Flash and Memory Card, which are mainly influenced by Sony's brand power and Canon's strength in digital camera market.

	2001						2003					
	CF	SM	MSMM	SD	xD		CF	SM	MSMM	SD	xD	
CANON	19	0	0	0	0	0	38	0	0	0	1	0
CASIO	14	0	0	1	1	0	15	0	0	9	9	0
SONY	0	0	28	0	0	0	0	0	48	0	0	0
EPSON	7	0	0	0	0	0	8	0	0	0	4	0
FUJIFILM	0	46	0	0	0	0	0	52	0	0	0	9
HITACHI	0	0	0	0	0	0	0	0	0	0	2	0
KODAK	13	0	0	1	1	0	13	0	0	1	1	0
KONICA-MINOLTA	7	1	0	3	3	0	11	1	5	15	15	0
KYOCERA	1	0	0	1	1	0	2	0	0	1	4	0
NIKON	6	0	0	0	0	0	20	0	0	0	0	0
OLYMPUS	3	35	0	0	0	0	5	42	0	0	0	9
PANASONIC	0	0	0	2	2	0	0	0	0	7	7	0
PENTAX	0	0	0	0	0	0	9	0	0	0	2	0
POLAROID	0	1	0	0	0	0	0	1	0	0	3	0
RICOH	3	9	0	0	1	0	3	9	0	0	6	0
SANYO	6	5	0	0	0	0	9	5	0	1	1	0
SIGMA	0	0	0	0	0	0	1	0	0	0	0	0
TOSHIBA	0	11	0	0	0	0	0	11	0	1	6	0
total	79	108	28	8	9	0	134	121	53	35	61	18

Fig. 5. Comparison on Digital Camera Models Utilizing Flash Memory Card in 2001 and 2003.

<sup>a</sup> See the footnote of Table 1 abbreviation.

## V. CONCLUSION

### 1. New Findings

Note worthy findings obtained include:

- (i) The interaction between Flash Memory Card and its utilizing devices influence its existence in the market, more than its interaction with end users (consumer).
- (ii) Flash Memory Card's behavior in Japan's market is strongly depended on its interaction with the digital camera (quantity of digital camera models utilizing).
- (iii) The growth of digital camera utilizing SD card and xD picture card (quantity wise) reflects their growing market shares in the Flash Memory Card (domestic) market, while SmartMedia card is going to the opposite direction.

### 2. Implications

Above findings lead to following implications:

- (i) Matsushita's SD card and Sony's Memory Stick have rapidly gain popularity in the market. SD card is favored by digital camera makers as they produce slimmer and smaller product. Matsushita's SD card made a big step recently in strategically important mobile phones when four out of six of the latest handsets in NTT DoCoMo's 505series utilize mini-SD Card, and Sony's Memory Stick Duo only two.
- (ii) One of the keys of the growth of Matsushita's SD format is its open policy, which allows each participants of the format management body to have an equal right in determining specifics of contents application to be used for the card. It stimulates the growth number of electronics makers adopting the format.
- (iii) In the opposite, Sony keep tight control on what application can be used for Memory Stick format. Which in someway, it could discourage many potential manufacturers that hope to incorporate Memory Stick technology. But superiority of Memory Stick soon will be recognized once consumer starts to use a single memory card for multiple purposes among different products. This implies Sony's confidence on Memory Stick's product design and format management, that it has far more advantages as a bridge media for connecting a variety of devices than other formats.

Therefore, further works should be focused on the technology behavior of each format in their interaction with the utilizing devices.

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